SUBJECT REVIEW

2016 MID-YEAR EDITION

Contents

Preface

By now, you have probably ascertained that you may want to be an actuary. But what must one learn to become an actuary? A quick Google search for "actuarial science" will bring up this Wikipedia definition:

> Actuarial science is the discipline that applies mathematical and statistical methods to assess risk in insurance, finance and other industries and professions.

Perhaps this suggests a predominant study of mathematics, statistics, and finance. Nevertheless, this gives no headway as to what exactly an actuarial student may encounter in their university studies. As it turns out, the path to becoming an actuary is arduously complex, and the Actuarial Students' Society has recognised this.

This publication is the product of the society's efforts to create greater transparency regarding the subjects studied as part of an Actuarial Studies major under the *Bachelor of Commerce* degree. Through this, we hope that students hoping to graduate from the major may gain not only greater insight to the content studied in these subjects, but also general tips and advice that past students have provided from their own experience of studying the subjects. With authors coming from a range of different backgrounds, we hope to highlight the obstacles and challenges in each subject so that students may prepare themselves better in their studies.

In the 2016 mid-year edition of the *Actuarial Students' Society Subject Review*, the society expanded coverage from 31 subjects to 36 subjects. The *Actuarial Students' Society Subject Review* now contains reviews for all core subjects in the 3-year undergraduate Actuarial Studies major, as well as an overview of the *Diploma in Mathematical Sciences*. Reviews for subjects in the Honours-year program as well as common breadth and elective options for Actuarial Studies students have been included in the subject review.

Invariably, each review will be an expression of opinion — we urge readers to be conscious of this fact, as the subject experience may differ from individual from individual.

Please take note of the year and semester of each subject review. Subject content, structure, and personnel undergo continuous change, and it is important to recognise whether the reviewed curriculum has since been superseded. Such reviews will, however, still serve as a reliable reference for the general direction of the subject.

If you are interested in submitting a subject review for the next edition of this guide, please contact the Actuarial Students' Society at contact@melbourneactuary.com.

About the Actuarial Students' Society

The Actuarial Students' Society is the representative body for all Actuarial students at the University of Melbourne. Since being founded by Actuarial students in the mid-90s, the society has been an important link between students, the university, and employers. Our aim is to enhance the social and professional lives of our members. We help prospective actuaries build bridges and make connections with other students, mentors, and potential employers.

We host an array of events throughout the year and all students are welcome to attend. We provide valuable exposure to the industry at our premier event of the year, Contact Night, as well as career luncheons and workshops. Events such as Trivia Night, Poker Night, and Pool Night are great ways to make friends and have fun with fellow students and qualified actuaries in a relaxed, informal manner.

Our sponsors are industry leaders and always on the lookout for the best and brightest. We provide our members with information regarding internship and employment opportunities directly from our sponsors, along with many events where you can brush shoulders with practising actuaries.

For more information, including how to become a member, please visit our website or Facebook page:

www.melbourneactuary.com

www.facebook.com/actuarialstudentssociety

Acknowledgements

The Actuarial Students' Society would like to extend its sincere gratitude to the following people for their kind contributions to the 2016 mid-year edition of the *Actuarial Students' Society Subject Review*:

Saurav Acharya	Patrick He	Yaozhong Qiu	Mengtong Xia
Holly Briffa	Catherine Huang	William Soo	Max Yang
Jiani Chen	David Kwak	Truman Tang	Angel Yuan
Gavin Cheng	Ryan Li	Matthew Tsiglopoulos	David Zhang
David Cochrane-Davis	Yan Liu	Garvin Tso	Jack Zhang
Cuong Duong	Alexander Nguyen	Anita Voon	Bob Zhu
Christopher Ebeling	Tishan Paranahewage	Eric Wang	

Disclaimer

First-Year Subjects

ACCT10001 Accounting Reports and Analysis [SM1] (1)

Exemption status	Not an exemption subject, but is a prerequisite for ACCT10002 *Introductory Financial Accounting* (CT2 *Finance and Financial Reporting* subject).
Lecturer(s)	Mr Matt Dyki Miss Michelle Hoggan Professor Michael Davern
Weekly contact hours	1 × 2-hour lecture 1 × 1-hour tutorial
Assessments	Tutorial attendance and participation 8% 2 tutorial work submissions 2 × 1% Group assignment 20% 3-hour end-of-semester exam 70%
Textbook recommendation	Birt, J., Chalmers, K., Maloney, S., Byrne, S., Brooks, A., & Oliver, J. (2014). *Accounting: Business Reporting for Decision Making* (5th ed.). New York, US: John Wiley & Sons. The textbook is often referred to in tutorials for content and questions that appear in tutorial work, so having access to one (not necessarily purchasing) is beneficial. That being said, the textbook content is far too detailed and prescribed readings that span full chapters are generally at least 80% irrelevant. ✓ My personal advice is to purchase the e-text (only accessible through a program/app "VitalSource Bookshelf") which can be shared across two computers and two mobile devices. This will set you back $50, or $25 if shared between two ($12.50 if shared between four etc.).
Lecture capture	Full (both audio and video).
Year and semester reviewed	2015 Semester 1

Comments

This is the first accounting subject that you will encounter at university and is essentially a straightforward introduction into the field of study. The instruction and assessment of this subject both explore the ambiguity of questions and carry a heavy emphasis on **JUDGEMENT** (you'll see), as well as your ability to justify your responses.

A natural association that many made was the one between VCE Accounting and this subject. However this was a dangerous one to make, as VCE Accounting gives you close to no advantage over others and is rather more likely to make you complacent in studying this subject. The content covered in this subject is basic; however it is your ability to articulate your arguments and justify responses that will differentiate you from the cohort. This subject **can be** the easiest core subject you do in Semester 1, and I would advise you take it as an opportunity to hone your ability to answer questions effectively, which will be advantageous to the rest of your BCom studies.

This review was previously published in the 2016 start-of-year edition of the *Actuarial Students' Society Subject Review*.

Subject content

As ARA is the first accounting subject at university, the first week of lectures and tutorials covered mostly an introduction to accounting, which was boring, to say the least. However, ignoring it is not advised, as it has been made clear that an exam question such as "What is accounting?" is very much feasible and has stumped many students in the past.

Between Weeks 2 and 5, the subject systematically covers key accounting elements (assets, liabilities, equity, revenue, and expenses). It does so by going through the definition and recognition criteria of each element, discussing the methods by which to recognise, measure, and report each element, before proceeding to evaluate possible issues and **JUDGEMENT** to be made with each one through the discussion of a specific case study. The four lectures (2–5) cover the foundations of accounting and the concepts covered are recycled throughout the rest of ARA and also ACCT10002 *Introductory Financial Accounting*. Though they require some **rote**-learning, gaining an appropriate level of understanding through these weeks is strongly advised.

Lectures 6–12 cover the area of management accounting, which is where the majority of the essay writing you do in this subject comes into play. It begins with ratio analysis, which is the definition, calculation, and interpretation of various accounting ratios denoted by wonderful acronyms such as ROA, ROE, NPAT, EBITDA, NTAB, PE etc. Although these do get quite repetitive, understanding them is essential for your group assignment (to be elaborated upon later).

Lectures 7–10 cover management decisions involving accounting, namely cost analysis, pricing, and budgeting. These require a small number of calculations, and although predominantly straightforward, some do require you to pay attention to the wording of the question. The arithmetic is the easiest part of the subject (for us obviously), and in accordance with the stereotypical actuarial student, the extended responses are the hardest. Of course, nothing in this subject is impossible, and preparation for this particular section can be done through analysing as many case studies as possible, doing all the tutorial work and answering past exam questions.

The subject ends with an in-lecture share market game (Lecture 11) and a recap of the subject (Lecture 12). The former is more 'fun' than practically useful, while the latter is, well, the opposite. I would strongly advise attendance for the last revision lecture, as it is often a good indicator of what to expect on the exam.

Lectures

The lecture notes for this subject are, in my personal opinion, the best foundation upon which to base your studies. As previously mentioned, the prescribed pre-readings for this subject are much too broad; however, if you only read sections which build upon what is addressed in lectures, you will gain a deeper understanding, without wasting too much time.

Fortunately, this subject has — courtesy of the faculty — constructed its lectures such that attendance is almost discouraged. The quality of the notes, combined with the recording of **everything** covered on screen in-lecture, makes it such that missing a lecture does not disadvantage you in any way (assuming you bother to catch up). It is a common joke amongst first-years to boast about the speed at which we watch lectures on lecture capture, and I can assure you ARA lectures are quite easily a 1.8× out of a possible 2.0×.

In approaching lectures for this subject, I would advise you to use the notes and read up on the textbook when needing further clarification but to watch the sections of the lectures which cover case studies.

Tutorials

As 8% of your score will be based off your tutorials, attendance and participation are strongly recommended.

The marking criteria and distribution of this 8% are quite complex, and the best thing you can do to assure you get a high score is just to try your best in tutorials. Despite the cliché, tutorials really are quite useful in this subject, particularly the tutorial questions that are discussed each week. Depending on your tutor, the structure of a tutorial usually entails a quick recap of the covered content, followed by some curated questions and the discussion of said questions.

There are numerous tutorial questions that will be provided, and many more are suggested in the WileyPlus textbook. These will serve as extremely good revision for the exam.

Additionally, there is a weekly online quiz which is predominantly multiple-choice and accounts for a small percentage of your subject score. These are extremely easy, and it is almost impossible not to get 100% with the perk of collaboration, the ability to refer to a textbook, and the generosity of a second try.

The best thing about tutorials were the two written submissions for feedback. These were past exam/exam-style questions which were marked by tutors and for which comprehensive feedback was provided. These are worth 1% each to encourage their completion, though the feedback is worth much more than the allocated mark.

Assignments

There is one main collaborative assignment for ARA which you are allowed to form your own group to complete. This assignment is designed to examine the ability to calculate and interpret various accounting ratios, (something not easily examinable in the exam).

The assignment is divided into two parts. Part A is worth 25% of the assignment (5% of your total grade) and comprises of calculations of ratios. Part B is worth 75% of the assignment and is the primary focus of the task. In this section, your group will draw upon the results of the calculations in part A and write up an analysis of said results. This assignment is hard to score well in due to the vague instruction and room for individuality. However, time is not at all an issue and the calculations are mostly straightforward. Since the originality of your analysis is limited by the prescribed figures, the best method to create a H1-worthy assignment is to create a structured report with flowing arguments and good presentation.

End-of-semester exam

The exam is split into Part A (10 marks, multiple-choice), Part B (financial accounting), and Part C (management accounting). Part A, as with most multiple-choice sections, is quite easy to score well in.

Part B of the exam requires you to recite some definitions of accounting elements and often apply these definitions to an explanation of how and why you would record a certain item. These are often shorter questions, and the main marks come from definitions and references to qualitative characteristics of accounting elements. In some exams, there is a table which requires you to fill in entries in the correct category, which is for the most part straightforward.

Part C is where the majority of students fall over and where the good ones stand out. With management accounting, there is an abundance of the task words "identify" and "explain" in questions, as well as "Why?" and "discuss". These are all longer questions and are worth more than the part B questions. It is imperative that you discuss as many relevant points as necessary in this section to gain the maximum number of marks.

Concluding remarks

Not the most riveting of subjects in term of subject content; however, the completion of this subject will prepare you well for the upcoming IFA (which is an exemption subject). This is one of the few subjects where you can get a good score without spending all of your time on it, so don't waste the opportunity. Study hard and I wish you a H1 in this lovely introduction to accounting at university.

ACCT10001 Accounting Reports and Analysis [SM1] (2)

Exemption status	Not an exemption subject, but is a prerequisite for ACCT10002 *Introductory Financial Accounting* (CT2 *Finance and Financial Reporting* subject).
Lecturer(s)	Mr Matt Dyki Miss Michelle Hoggan Professor Michael Davern
Weekly contact hours	1 × 2-hour lecture 1 × 1-hour tutorial
Assessments	Tutorial attendance and participation 8% 2 tutorial work submissions 2 × 1% Group assignment 20% 3-hour end-of-semester exam 70%
Textbook recommendation	Birt, J., Chalmers, K., Maloney, S., Byrne, S., Brooks, A., & Oliver, J. (2014). *Accounting: Business Reporting for Decision Making* (5th ed.). New York, US: John Wiley & Sons. ✓ The textbook was necessary to complete the online tests. It is expected that textbook readings are done before each week's lecture.
Lecture capture	Full (both audio and video).
Year and semester reviewed	2015 Semester 1

Comments

Subject content

This subject is heavily focused on analysis rather than recording. It is up to you to learn the basic concepts, explored in the pre-lecture textbook readings. Multiple readings may be necessary. A big change from any high-school subject is that you cannot rely on teachers pushing you to do work; it is very important to be self-disciplined and work consistently. Personally, I felt that the subject started off more challenging and ended with some slightly easier content.

Lectures

Lectures are quite fast-paced, especially if you've never done an accounting subject before. Note-taking is very helpful for revision purposes nearing the end of semester; this may require going over the lecture recordings again.

Tutorials

Tutorials really do help for this subject. It is very important to participate in tutorial exercises; these questions are similar to exam questions and are very helpful in consolidating your understanding of the concepts. Often the questions have

This review was previously published in the 2016 start-of-year edition of the *Actuarial Students' Society Subject Review*.

multiple correct answers as long as they are justified. It is important to understand all of these answers and be able to go both ways. Also keep your tutorial sheets — they will be useful for exam revision.

Assignments

The assignment was a group assignment and separated into two parts. The first part involves calculation of ratios that will be used in the second part for analysis. A good idea is to start thinking about how you are going to do the second part or even start the second part of the assignment before the lecturers tell you to. For the first part, it is most beneficial to each individual and the group to come up with the ratios individually and double-check your answers that are different. For the second part, it will require all group members to meet up regularly. Pay extra attention on the lecture preceding the second part of the assignment. Other than that, there is little instruction on how to do the assignment.

Timed assessments

Each week there will be an online test. These are simple if you've done your textbook readings, and you will get two attempts.

End-of-semester exam

For exam revision, I would recommend first going over all of your notes, and then do the tutorial sheets again. You don't have to write the answers out. Just thinking in your brain is enough; make a note if you miss any points that are in the answers. Then do practice exams and go back to the textbook for any concepts you forgot about. In the exam there are sometimes recycled questions and questions of similar format. Also do not freak out if something doesn't make sense in the exam. Just skip the question; the exam could have mistakes on it.

ACCT10001 Accounting Reports and Analysis [SM1] (3)

Exemption status	Not an exemption subject, but is a prerequisite for ACCT10002 *Introductory Financial Accounting* (CT2 *Finance and Financial Reporting* subject).
Lecturer(s)	Mr Noel Boys Professor Michael Davern
Weekly contact hours	1 × 2-hour lecture 1 × 1-hour tutorial
Assessments	Tutorial preparation and participation 5% 5 online tests 5 × 1% Written Assignment 1, due in Week 5 10% Written Assignment 2, due in Weeks 11 and 12 10% 3-hour end-of-semester exam 70%
Textbook recommendation	Birt, J., Chalmers, K., Maloney, S., Byrne, S., Brooks, A., & Oliver, J. (2014). *Accounting: Business Reporting for Decision Making* (5th ed.). New York, US: John Wiley & Sons.
Lecture capture	Full (both audio and video).
Year and semester reviewed	2016 Semester 1

Comments

Subject content

Most lectures in this course were taken by Noel Boys. This subject assumes no prior knowledge of accounting and covers basics of financial and management accounting, including:

- conceptual framework (1 week)
- financial statements including balance sheet, income statement and cash flow statement (5 weeks)
- ratio analysis (2 weeks)
- budgeting and cost–volume–profit analysis (2 weeks)

The other two weeks included an introduction to the course, exam advice, and an overview of accounting jointly taken by both lecturers.

I believe that this subject is well structured. We spent time covering the basics of transaction worksheets and financial statements in early lessons that provided a platform for following content. Likewise, financial accounting lays a foundation for discussion of management accounting and analysis.

ARA is quite a content-heavy subject but definitely manageable. There are many definitions and principles to remember; however, thankfully most of these are logical and intuitive. Whilst I acknowledge the importance of this subject in providing an introduction and framework to accounting, I found the subject content relatively dull. I personally enjoyed ratio analysis and budgeting as it essentially tied the subject together and was a departure from the rote-learning nature of financial accounting.

I used the lecture slides as a primary source of learning. Unfortunately, the textbook (unlike the ECON10004 *Introductory Microeconomics* one) was very dull and mundane. The lecturer provided sample solutions to selected questions from the textbook which were highly detailed and over-the-top. It is not expected that students answer questions in such detail, but it is certainly useful to see the scope in which questions can be answered. I skimmed through these questions and resorted to reading the solutions due to time constraints.

Lectures

All material covered in lectures can be found in the textbook. It is important to note, however, that due to the subjective nature of accounting, there is a multiplicity of approaches to many processes in this subject. For instance, some formulae or practices that are covered in lectures may differ from those presented in the textbook. The lecturer stresses that these differences are matters of personal preference and that students may take either route.

I found several of the early lectures quite dull. This is not attributed to the lecturer's style, but more a result of the course content. Noel Boys did a remarkable job in attempting to keep students entertained, especially in the last few lectures. I missed all four lectures streams due to timetable clashes, but thankfully the lecture recordings were sufficient. The lecturer uses a PowerPoint presentation in each lecture so text is easy to read. He speaks clearly and often uses examples to explain concepts that require some audience interaction. At times, however, his demonstrations on the document camera, such as examples of illegible numbers, are not recorded. It is stressed that these are primarily for humour so there is no issue.

Slides were generally released on the Sunday or Monday of the week, which may have meant that some people in the Monday stream were unable to print notes off in time for the lectures. These generally consist of 40–50 slides, but they are very concise with some useful diagrams and flowcharts. Occasionally, these slides contain slight errors, but these are often pointed out by the lecturer. Most students print these off and annotate them; others like to take their own notes. Certain lectures also have corresponding lecture illustrations, which are essentially blank financial statements that Noel works through during lectures.

Students undertaking this subject should be warned that several actions are highly frowned upon during lectures. Noel will cease speaking until unruly attendees stop speaking. Moreover, he stipulates clearly that photography in lectures is prohibited. I personally think it is stupid that people continue to dismiss his warnings and attempt to take photos right through to the last lecture. All the material is accessible from the LMS in the recording and the slides.

Tutorials

Tutorials in this subject were predominantly based upon discussion. Tutors sometimes briefly recapped the previous week's lecture or answered any questions at the beginning of tutorials. Each week a set of slides were presented containing approximately three or four questions adapted from the textbook. Students generally worked through these questions and discussed answers one at a time. Slides to most tutorials were not uploaded to the LMS. Therefore, whilst the discussion was very useful, retention was made harder by the fact that we did not have access to all the slides.

Assignments

There were two major assignments during the semester.

Assignment 1 was an individual assignment out of 30 marks that counted for 10% of the overall grade. Students were provided with a list of economic events and had to fill in a transaction worksheet, income statement, and balance sheet for the company. It was relatively simple and should generally have taken no more than a few hours. Marks were deducted for seemingly small errors such as bad formatting.

Assignment 2 was a group assignment (groups of four) out of 40 marks that accounted for 10% of the overall grade. Groups had to be formed within tutorials. Part A was to be completed over one week. Students had to calculate a set of ratios and conduct trend/vertical analyses on a set of data provided. This was worth 12 marks. Once the deadline had passed, a set of solutions was released. These then formed the basis of Part B, which was also completed over one week. Students were required to complete a report analysing these ratios and suggesting whether or not the company was a viable investment. This was worth 28 marks.

In general, assignment grading turnover was relatively fast, taking approximately one to two weeks for Assignment 1 and Assignment 2A to be returned. However, we did not receive Assignment 2B marks until after the exam. No feedback was provided for assignment 2B either, which could have been useful for the exam.

No summary statistics were provided for the cohort's performance on the assignments.

Online tests

There were five Wiley online tests held throughout the semester. Each test contained 20 pooled multiple-choice questions to be completed within an hour. Each test was worth 1% of the overall grade. Most of these questions were pure recall from the textbook, although some required simple calculations. However, this means that some questions required processes or formulae that were slightly different to those presented in the lectures as aforementioned. Some questions were marked incorrectly, and some students who realised brought this up on the OLT. Ultimately, each question accounted for 0.05%, which is relatively insignificant.

End-of-semester exam

The exam for this subject had 100 marks to be completed over three hours. It is a hurdle for passing the subject. In preparation, the lecturer provided a sample exam cover detailing the instructions, number of questions, and corresponding marks, as well as a list of phrases that people from a non-English speaking background may not understand (no dictionary is allowed in the exam). He also provided three past exams with irrelevant questions removed. These exams were not written by Noel, so they are quite different in style. This year's exam did not contain multiple-choice questions. It consisted of nine questions which covered each major topic in order. There was a balance between qualitative and quantitative questions, and students were required to prepare financial statements and budgets from scratch. Many students found the exam challenging and failed to "balance" the balance sheet.

Concluding remarks

This subject undoubtedly provides an insight into accounting. Many students decide upon completing this subject whether they wish to pursue accounting or not. It is well coordinated and easy to do well if you understand the underlying concepts.

ACCT10002 Introductory Financial Accounting [SM2]

Exemption status	CT2 *Finance and Financial Reporting*, in conjunction with FNCE20001 *Business Finance*. An average of 73 across this subject and FNCE20001 *Business Finance* is needed, with no fails.
Lecturer(s)	Mr Warren McKeown
Weekly contact hours	1 × 2-hour lecture 1 × 1-hour tutorial
Assessments	Tutorial attendance and participation 5% Individual assignments 25% 3-hour end-of-semester exam 70%
Textbook recommendation	Carlon, S., Mladenovic, R., Loftus, J., Palm, C., Kimmel, P. D., Kieso, D. E., & Weygandt, J. J. (2010). *Financial Accounting Building Accounting Knowledge*. Milton, AU: John Wiley & Sons Australia. ✗ Note the textbook is simply a repeat of what is in the lecture slides and is definitely not required to do well. As it is quite expensive, consider purchasing the $50 online book off VitalSource if you desperately need one.
Lecture capture	Full (both audio and video).
Year and semester reviewed	2015 Semester 2

Comments

In first year, there are only two subjects that are part of the CT exemption subjects: ECON10004 *Introductory Microeconomics* and ACCT10002 Introductory Financial Accounting. This means that a score of 73% or above in these subjects should be aimed for, as this will ensure the exemption requirements are met.

Overall, this subject was met with disorder, where the content was basic (debits and credits/assets, liabilities, equity), while the exam garnered a mixed response.

Subject content

Having successfully completed the monstrous ACCT10001 *Accounting Reports and Analysis* (ARA) in Semester 1, this subject should be extremely similar, if not the same. Content-wise, this is a good sign; if you bothered trying in ARA, this means you will definitely have an advantage. If asking for a subjective benchmark against ARA, Introductory Financial Accounting is probably half, or even less, difficult theory-wise.

There is a lot of grunt work to do with journal entries and the occasional extended response question. By the end of the semester, you will be extremely familiar with the various classes of assets, liabilities, and equity, including Accounts Receivable, Accounts Payable, Share Capital, and how to journalise them. Note that this subject does cover each class in greater detail than ARA, so be expected to go into a bit more detail. However, most of the content doesn't stand out; it is

This review was previously published in the 2016 start-of-year edition of the *Actuarial Students' Society Subject Review*.

extremely repetitive, easily remembered (if time and effort is put in), and should be no challenge for most students. There is also a lot of usage of T-Accounts, especially when learning about the cash flow statement.

Also, remember ratio analysis from ARA? You're going to be doing a bit of this each week starting pretty early on, and yes, it's extremely repetitive and boring. However, it is not as extensive as the assignment given in ARA, and you only learn around two or three ratios per week.

You will end with share issues and share-related theory. This is quite straightforward; take a while to familiarise yourself with this equity account, and it should be a breeze.

Overall, the aim of the subject seems to be drilling the importance of debits/credits and the double-entry system within students.

Lectures

The lectures will seem quite monotonous and repetitive, given that what you will be learning is similar each and every week (that is, debits and credits for various accounting classes). For example, you will start off assuming little knowledge in debits and credits, and move into assets, liabilities, and equity quickly after.

Warren is also a lecturer who likes to hint at what will be on the exam during his lectures, so try to follow onto these!

While lectures are recorded (there are three repeated every week, so you can choose from whichever to download and replay), and I would personally say that skipping them is possible, I would advise you attend some of them at least, because he is an all-round great guy who actually tries to make his lectures entertaining.

The lecture notes are very comprehensive; there are examples and guides on how to process each accounting journal entry, and you will probably be swamped with information by the end of the lecture.

Warren is a lecturer who likes to include little case studies at the end of lectures, which document the importance of what you have just learnt. Most of the time, these are just interesting, but are seldom applicable to what you will be tested on.

At other times, Warren will spend the last 30 minutes of his lecture going through a full-blown example involving what you have just learnt. This is probably the most informative aspect of his lecturing. These full-blown examples are similar to what may appear on the exam, so being able to go through this with Warren is extremely useful. Whether you attend the lecture, or watch it at home, you should probably watch these examples. This is especially true for the cash flow statement construction, which appears around Weeks 10–11.

Tutorials

As 5% of your score will be based off tutorial attendance, it is highly recommended that you go to these.

Be warned, the written tutorial assessments (or assignments) are trickier than what you expect. To obtain a full score of 10/10, you were expected to elaborate in greater detail than what was taught in lectures. Personally, ARA knowledge will help you with this more than you would expect.

You will be given a lot of pre-tutorial questions to go through (more than other subjects from what I've seen), and your tutor should go through the important ones in class.

This is extremely good, as if you are receiving around 10–15 tutorial questions per week, it means you have a lot to study and revise in preparation for the exam. For my revision, I redid most of the tutorial questions, as they were extremely useful.

Generally, (for the 2015 cohort) tutors were pretty good, and as the subject isn't too hard, their explanations were usually quite simple and easy to process.

Assignments

Note that Warren did not actually give us written assignments, they were online WileyPlus assignments. Basically these are online tests that you have to complete in one sitting. These had a combined worth of 25%, which is quite a lot for some online tests. In fact, I am pretty sure Warren himself stated that **you were allowed to work together on these assessments**, and work together we did. Some of the numbers may change between different tests, so be careful of this.

1. The first test covers the first three or four weeks of content and was quite basic. So long as your internet did not crash, you could easily receive full marks. This was especially true as if you answered a question wrong, you were given a second chance.
2. The second test was met with much more negative reception. It had covered the rest of the weeks, and was significantly harder than the initial one. Furthermore, as Warren had learnt from his mistake and made it a 1-try-only test, if you got it wrong, you could not try again. It is highly advised that individuals work together, as this one will be tough.

End-of-semester exam

Warning, the exam is trickier than the content.

You are provided a cheat sheet with all the ratios on DuPont analysis (a way of breaking down return on equity). This means there are a lot of ratios that you do not have to memorise.

You are given three or four practice exams, which is plenty (compared to ARA). However, these are extremely deceptive in terms of difficulty — we'll come back to Warren's mischief soon enough.

Personally, I don't remember memorising any ratios at all. Warren is the type of lecturer who won't dog you on having to do a lot of grunt work; he'll try to make you elaborate on what you have learnt, instead of mindlessly crunching numbers.

So what did Warren do to the 2015 Semester 2 IFA exam? He made it a lot harder than the Semester 1 exam, which caught a lot of us off guard. Be prepared to face an exam that may be tougher than what you are expecting and what you have learnt, as what you learnt barely covers the detail he wants you to attain.

Breakdown There were 10 multiple-choice questions (worth 1 mark each), 40 marks on practical questions, and 50 marks on theory questions!!! Hang on a minute, if most of what we learnt was practical, why is half the exam theory? Thanks Warren, you've trolled us again!

- Some multiple-choice questions (not many, around 10).
- Short answer, where you write what you believe is your response to certain accounting scenarios, e.g. the typical: when is a gift card recorded as a sale?
- Cash flow statement reconstruction; oh no you better prepare, because this will be 10 marks that could make or break your paper. Definitely practise on this until you don't need to use T-Accounts (basically a breakdown of debits/credits) to reconstruct.
- Theory, theory, theory. ARA really comes in handy; there were questions that were literally asked in ARA.

- Final 10 mark question which was a two-page extended response on a big accounting issue.

ACTL10001 Introduction to Actuarial Studies

Exemption status	Not an exemption subject, but a great introduction subject which covers the basics of financial mathematics.
Lecturer(s)	Dr Xueyuan (Shane) Wu
Weekly contact hours	2 × 1-hour lectures 1 × 1-hour tutorial
Assessments	2 Microsoft Excel group assignments 2 × 10% 45-minute mid-semester test in Week 8 10% 2-hour end-of-semester exam 70%
Textbook recommendation	Dickson, D. C. M., & Atkinson, M. E. (2011). *An Introduction to Actuarial Studies* (2nd ed.). Cheltenham, UK: Edward Elgar Publishing. ✓ This book matches the lectures well and provides great extra exercises to solidify your knowledge of each topic. However, some of the working steps to contingencies exercises are presented in a slightly different way to that in the lectures.
Lecture capture	Full (both audio and video).
Year and semester reviewed	2014 Semester 2

Comments

Subject content

Weeks 1–4 cover financial mathematics: discounting future lump-sum payments and series of payments, valuing debt securities such as treasury bonds and bills, and analysing housing mortgages with interest.

The first assignment is out of 20 marks and tests the first three weeks, which does not include bonds and housing loans. Excel is used to value series of payments with changing payment amounts and changing interest rates more easily.

Weeks 5–7 cover demography: the different population distributions and statistics for undeveloped/emerging/developed countries, survival functions (probability that a person lives till a certain age), and life tables (number of people living in a population for all ages, death rates, survival rates, etc.).

The mid-semester test occurs in Week 8 and tests all material up to and including Week 6. It is out of 35 marks and students are given 45 minutes with no reading time.

Then, in Weeks 8–10, the first seven weeks are combined to learn how contingent payments (future payments that have a probability of not being paid) should be valued. In particular, the valuation of term insurance, whole-life insurance, and endowment insurance are covered. Some information on the specific roles of actuaries working in life insurance is also covered.

The second assignment, again out of 20 marks, is longer than the first assignment and tests everything from Week 4 to Week 10.

This review was previously published in the 2015 edition of the *Actuarial Students' Society Subject Review*.

The last two weeks do not involve any calculations and give students an idea of what actuaries do in areas of insurance other than life insurance, such as general insurance, private health insurance, and superannuation.

Other remarks

Although this subject involves a lot of number crunching, the only mathematical concept that must be learnt and applied is summing arithmetic and geometric progressions. The difficulty comes in interpreting the question correctly, as there are multiple factors like interest rates, timing of payments, and changing death rates that must be taken into account, and consequently being able to set up the correct equations. Additionally, many new symbols are introduced for each type of payment and each component of the life table, which take some time to become familiar with. Shane stresses the importance of not simply rote-learning formulas and applying them, but rather being able to derive and prove each one. He often puts one or two proof questions on the MST/exam to test this, and this helps in solving more complicated problems.

During the lectures, Shane is a bit difficult to understand at first because of his accent, but does have a nice logical approach to each exercise presented in the lectures. However, the last two weeks of lectures (which introduce the different types of insurance) are extremely boring as he simply reads blocks of text from the slides.

The tutorials were definitely the worst part of this subject. You are required to attempt the set questions beforehand, with full knowledge of everything covered in the lectures, and then discuss answers during the tutorial. From my experience, the first few weeks' questions were doable, but later on, as the concepts and questions got harder, there were often no attempts at the questions beforehand. Instead of going over the concepts again, my tutor became annoyed and told us to look at lecture slides, only providing the worked solutions for each exercise. This did not add to my understanding of the concepts and was particularly frustrating when it came to the harder topics of life distributions and contingencies.

However, the tutorial problem sets do come with past exam questions for each topic and full solutions to each problem, which when combined with the textbook provides more than enough practice material. Luckily, the exam is easier than the past exam questions given, and adequate time is given to complete the paper (60 marks in 2 hours). Only one specimen exam paper is provided, and no past exams are available.

If you want to keep on top in this subject, I would suggest reading the textbook after every week to ensure that you fully understand each concept. Otherwise, tutorial problems will become hard to do, and even worked solutions will become hard to follow.

Despite its flaws, I think this subject (particularly the last four weeks) gives prospective actuaries a very good indication of the types of traditional work done by actuaries, and is structured very well in terms of content.

ECON10003 Introductory Macroeconomics [SM2] (1)

Exemption status	Not an exemption subject, but is a prerequisite for ECON20001 *Intermediate Macroeconomics* (CT7 *Business Economics* subject).
Lecturer(s)	Dr Graham Richards
Weekly contact hours	2 × 1-hour lectures 1 × 1-hour tutorial
Assessments	Tutorial attendance and participation 10% 2 online multiple-choice tests 10% 2 assignments 2 × 10% 2-hour end-of-semester exam 60%
Textbook recommendation	Bernanke, B., Olekalns, N., & Frank, R. H. (2014). *Principles of Macroeconomics* (4th ed.). North Ryde, AU: McGraw-Hill. The textbook is very detailed and at times convoluted. ✓ It is a great resource for deepening your understanding, or in my case, learning new content when you stop attending lectures. You can probably survive without it, but I would recommend against that.
Lecture capture	Full (both audio and video).
Year and semester reviewed	2015 Semester 2

Comments

Subject content

Introductory Macroeconomics is an extremely content-heavy subject and often requires quite a lot of reading, because the lecture slides sometimes only briefly gloss over some parts of the subject or are not very clear in their explanations. That being said, it is entirely possible to complete the subject learning from only the lecture slides provided to you by Graham, because most of the questions on the final exam and second assignment (the first assignment is a research assignment) can be rote-learnt. However, I do recommend reading the book because it is a helpful resource in completely understanding the content, most of which I found very interesting because it detailed the basics behind the nationwide economy, something which I had previously not really thought about before.

Lectures

If I'm going to be brutally honest, the lectures were boring to the extent that I stopped going to them shortly after the semester started. They aren't necessary. I learnt much more from reading the slides, and if I didn't understand something, I would consult my textbook, my tutor at his consultation, or the Online Tutor who also happened to be my tutor. Graham goes on unnecessary tangents most lectures or he tries too hard to appeal to the audience, sometimes by making racist

This review was previously published in the 2016 start-of-year edition of the *Actuarial Students' Society Subject Review*.

jokes. Otherwise, I found him really dull and it was hard to find any excitement in learning about macroeconomics when I was at his lectures or listening to them at home.

Beware if your lectures are in the Melbourne School of Design. The lecture theatre has what I find to be the most comfortable lecture seats in all the lecture halls I've been to. Coupled with the fact that the projection of the lecture slides is the main light source in the hall, it creates the ideal conditions for falling asleep.

Tutorials

My tutor was my best friend throughout my studying Introductory Macroeconomics. His tutorials were well-structured and he created his own slides which I found to be much less convoluted and more useful. I did attend my friend's tutorials from time to time, because it came much earlier in the week and I wanted to study new content before the online tests which came before my tutorial in the week. Though the effort he put in paled in comparison to my tutor, the way the new content was taught was largely the same and still helpful in reinforcing the previous week's material. I believe that the tutorials are an extremely useful way to help reinforce what you've learnt and for clearing up anything you didn't understand from the previous week's content, especially if you are like me and stopped attending lectures.

Assignments

The first assignment was annoying to say the least. I found that the assignment question was at times ambiguous and most people interpreted it differently. Not only that, it was research-based, meaning I had to spend hours finding a single reference that was relevant to what I had chosen to research. Fun times.

The second assignment is based on the content from the lectures and the textbook. It's much more straightforward, and, as I said before, you can rote-learn the content required for this assignment, making it pretty easy. Where you might lose marks on is the amount of detail you put into your explanations and conclusions, so I advise caution.

Online Tutor

Coming from someone who had the Online Tutor as his tutor, I can safely say that the Online Tutor is not the same as going to consultations or your tutorial. He told me himself that the Online Tutor is only a tool for confirming your knowledge, not deepening it. The Online Tutor gave very brief answers or even told you to refer to the textbook and lecture slides. During assignments, he would say "it's your judgement call" in response to questions regarding what assignments were asking for.

ECON10003 Introductory Macroeconomics [SM2] (2)

Exemption status	Not an exemption subject, but is a prerequisite for ECON20001 *Intermediate Macroeconomics* (CT7 *Business Economics* subject).
Lecturer(s)	Dr Graham Richards
Weekly contact hours	2 × 1-hour lectures 1 × 1-hour tutorial
Assessments	Tutorial attendance and participation 10% 2 online multiple-choice tests 10% 2 assignments 2 × 10% 2-hour end-of-semester exam 60%
Textbook recommendation	Bernanke, B., Olekalns, N., & Frank, R. H. (2014). *Principles of Macroeconomics* (4th ed.). North Ryde, AU: McGraw-Hill. ✓ *Principles of Macroeconomics* is available in several editions as a PDF and I would strongly advise procuring an electronic copy of it. The textbook covers content in great detail and does not go off on tangents.
Lecture capture	Full (both audio and video).
Year and semester reviewed	2015 Semester 2

Comments

This subject is structured similarly its microeconomics counterpart; however, the content that is covered is slightly more challenging and requires much more lateral thought to perform well in.

As with all subjects where non-exam scores are given high weightings, Intro Macro is a subject where assignments should be utilised to give yourself a head start before the exam. With 2 multiple-choice tests and 2 written assignments distributed quite evenly across the 12 weeks, it is essential for you to keep up to date with the subject.

Even though ECON10003 Introductory Macroeconomics is not an exemption subject, it would be advantageous to do well in this subject as it provides a good foundation for ECON20001 *Intermediate Macroeconomics*, which is a CT7 *Business Economics* exemption.

Although the subject itself isn't very hard, the Intro Macro exam is **not** a 'crammable' assessment!! (Ask any smart Actuarial student that did the exam in 2015.)

Subject content

In comparison with ECON10004 *Introductory Microeconomics*, Intro Macro covers content that is much more applicable to real-life scenarios and everyday concepts, which makes it slightly more practical and easier to research/study.

This review was previously published in the 2016 start-of-year edition of the *Actuarial Students' Society Subject Review*.

Week 1 covers the notion of GDP as a measure of economic growth and methods of measuring and comparing nations' economic growth, subsumed under the broader classification of national income accounting.

Weeks 2–4 cover more specific topics such as inflation and its measures, the labour market, and savings. These are elaborated upon in great detail; however, they are typically not assessed as heavily as the other topics. (That's not to say they should be skimmed over, as they often serve as secondary points of discussion within broader question and are an opportunity to display comprehensive knowledge).

Week 5 covers the Keynesian model, which is the first time many are exposed to a macroeconomic model. Though very straightforward, understanding the effect of the autonomous multipliers and the ability to derive/explain said multipliers through algebraic manipulation proved problematic for some.

Week 6–7 covered fiscal and monetary policy, explaining effects of policy on inflation as well as exploring the concurrent effects on the economy. It then moves on to cover the AD/AS model, one of the main topics examined in papers.

Weeks 8–10 cover economic growth and growth models, focussing on the Solow–Swan model of economic growth, which has had a guaranteed spot in many historical papers. (Questions on the SS model are generally very standard and are easy marks so mastering the SS model is a worthy investment).

Weeks 11–12 focus on the foreign exchange market, covering the effects of fluctuations in the FX rate on the economy. While the main focus is as stated above, this topic (FX) also includes some other intricate details that might require some time and additional research to understand.

Lectures

These lectures are undoubtedly the most boring you will ever attend in your university life. The 'PowerPoint' presentations — quotation marks because they're more like essays in Microsoft Word than PowerPoint slides — are often 60+ slides of paragraphs of text, some of which are often neglected in lieu of discussions of tangential topics.

Personally, I found lecture attendance unnecessary for this subject and would advise reading through the slides at a leisurely pace, building upon key topics using the textbook and other research.

Watching the lectures on lecture capture can help as sometimes the slides, despite the large slabs of text, fail to explain concepts clearly, but Graham almost always clarifies it verbally.

Tutorials

Tutorial participation constitutes 10% of your grade for this subject, and tutorials should be attended if only for this reason. I found that tutors across the subject were generally well-equipped in terms of knowledge and were always more than happy to answer questions whether via email or in consultation hours.

Each week, the tutorials are structured to begin with a discussion of theory covered in the previous lecture before moving on to the pink sheets, which had questions to complete during the tutorial. These pink sheet questions were always of a good standard, and doing them properly is strongly advised. At the end of the tutorial, blue sheets are handed out as preparation for the next topic, and it is suggested that students complete this in their own time. I personally found that many of the blue sheet questions were exactly the same or very similar to pink sheet questions, and I would suggest possibly leaving those to the end and completing them as exam revision (you should still prepare for your tutorials by studying/making notes).

The best advice for Intro Macro tutorials is to engage in discussion as the topics discussed are often very interesting. Apart from scoring some bonus participation marks, you can further your understanding and practise articulating your answers.

Assignments

- 2 multiple-choice quizzes, worth 5% each: these are much harder than you would expect from a multiple-choice quiz, and I would not advocate 'winging' them or trying to use them as a learning experience. Study hard for these and work together with your friends.
- Written assignment 1 (10%): the first assignment is based more upon research than content and would be based upon the first week's content which is National Income Accounting. You are given the discretion to choose your own topics for discussion, so make sure you decide on ones that you are comfortable with, but also consider ones that aren't too basic.
- Written assignment 2 (10%): a tough assignment on monetary policy. My only advice is to spend as much time on it as you can.

End-of-semester exam

Warning! Time constraints.

The Intro Macro exam is notorious for its erratic selection of examinable content. To best prepare for this exam, study **everything** in the subject guide, which is a comprehensive guide to what Intro Macro covers. Past exam solutions provided by Graham have answers which are sometimes pages long. Even though answers of that amount of detail are not expected, the solutions are an indication of how much you can write and, if anything, how broadly you should think when answering a macroeconomics exam question.

The multiple-choice section is a generous concession that is provided to you and is often easy enough to complete in reading time, bar a few that involve arithmetic. The written response section typically does require you to relate your answers in some way to a prompt in the question, so do be aware of that. Also, one would be wise to attempt all the past papers under timed conditions to gauge your ability to complete a 2-hour exam.

Note for all: If you're thinking 'There's no way we need to remember this formula' you're probably wrong.

ECON10004 Introductory Microeconomics [SM1] (1)

Exemption status	CT7 *Business Economics*, in conjunction with ECON20001 *Intermediate Macroeconomics*. Satisfactory performance in both subjects' end-of-semester exams is needed.
Lecturer(s)	Mr Gareth James
Weekly contact hours	2 × 1-hour lectures 1 × 1-hour tutorial
Assessments	Tutorial attendance and participation 10% Online multiple-choice test 5% 2 assignments 25% 2-hour end-of-semester exam 60%
Textbook recommendation	Gans, J., King, S., Byford, M., & Mankiw, N. G. (2014). *Principles of Microeconomics: Australia and New Zealand Edition* (6th ed.). South Melbourne, AU: Cengage Learning Australia. Borland, J. (2013). *Microeconomics: Case Studies and Applications* (2nd ed.). South Melbourne, AU: Cengage Learning Australia. The prescribed textbooks are useful, but it is possible to do well without them as well. Any edition will do. Get them if you need full sentences to explain what is happening in the graphs and models to help your understanding.
Lecture capture	Full (both audio and video).
Year and semester reviewed	2015 Semester 1

Comments

Subject content

The subject covers the basic demand and supply model and the effects of different economic conditions on the model and the subsequent equilibrium point. It also covers the concepts of marginal revenue and marginal costs, competition, price determination, and game theory. The concepts are quite interesting, and are easy to understand and master.

Other remarks

Gareth James has a very boring monotone voice, but his slides are good and his accompanying narration is good. He is straight to the point and doesn't overcomplicate things. The textbook is good supporting material which forms the ideas discussed in lectures in full paragraphs, which is very useful if you find the information provided in the slides lacking in detail and explanation. The textbook will fill in all those gaps for you.

At the end of every single tutorial you will get a blue sheet which contains questions covering ideas and concepts that will be discussed in lectures the next week. The intended usage of these sheets assumes that you have completed textbook

This review was previously published in the 2016 start-of-year edition of the *Actuarial Students' Society Subject Review*.

readings as recommended, which would allow you to attempt these questions and give a feel of what you are going to be up against, though my personal experience says otherwise. I never really managed to derive the correct way to apply the concepts myself. I always found it more effective for me to just wait for the pink sheets that are given at the start of every tutorial, which contains questions that will be discussed immediately, and be spoon-fed the methodology. How you use these blue and pink sheets will depend heavily on your style of study.

Assignments are relatively easy — questions are straightforward, though it might be time-consuming if you don't know how to draw graphs on your computer quickly. Personally I drew all of the graphs on PowerPoint first and then copied them as images into my report. It was a relatively quick process.

The exam is relatively easy as well. It is the easiest subject in your first year, other than possibly your breadth. Try to get a H1 in this subject to pull up your WAM.

ECON10004 Introductory Microeconomics [SM1] (2)

Exemption status	CT7 *Business Economics*, in conjunction with ECON20001 *Intermediate Macroeconomics*. Satisfactory performance in both subjects' end-of-semester exams is needed.
Lecturer(s)	Professor Nisvan Erkal
Weekly contact hours	2 × 1-hour lectures 1 × 1-hour tutorial
Assessments	Tutorial attendance and participation 10% Online multiple-choice test in Week 4 5% Written Assignment 1 due in Week 6 10% Written Assignment 2 due in Week 10 15% 2-hour end-of-semester exam 60%
Textbook recommendation	Gans, J., King, S., Byford, M., & Mankiw, N. G. (2014). *Principles of Microeconomics: Australia and New Zealand Edition* (6th ed.). South Melbourne, AU: Cengage Learning Australia. Borland, J. (2013). *Microeconomics: Case Studies and Applications* (2nd ed.). South Melbourne, AU: Cengage Learning Australia. There are also some other recommended readings that are not textbooks. Harford, T. (2013). *The Undercover Economist* (2nd ed.). London, UK: Abacus. McMillan, J. (2002). *Reinventing the Bazaar: A Natural History of Markets*. New York, US: WW Norton.
Lecture capture	Full (both audio and video). The video of the recording will show the annotated slides under the document camera.
Year and semester reviewed	2016 Semester 1

Comments

Subject content

This subject assumes no prior knowledge of economics and covers three major topics:

- Markets (4 weeks): comparative statics, welfare, international trade, and market failure
- Firms (4 weeks): costs and the price/quantity decision, the effect of competition, and price discrimination
- Game theory (2 weeks): simultaneous and sequential games and their application to oligopolies

It is well structured, as many concepts introduced early on are built upon throughout the subject. While I find the interrelated nature of content in this subject conducive to my learning, it also means that students will need to have a sound understanding of the content presented in lectures to keep up with the course. However, this is generally considered an "easy" subject that relies to an extent on common sense, so this should not be an issue for many students. The most challenging topic is firm theory: in particular understanding how to draw graphs that represent costs and revenue. Personally, I found this topic interesting as it is highly applicable to real life situations. I particularly enjoyed game theory.

Initially, I reviewed lecture notes and the textbook and compiled a set of notes. However, I found that in general the lecture notes were sufficient. Whilst this subject does rely on some rote-learning, I found that it was more useful to focus on applying concepts learned to real-world situations and completing the revision questions. It would have been beneficial to read more of Jeff Borland's case studies book, as it would have given me a better informed approach to analysing and explaining economic decisions and their effects, which forms a significant part of Assignment 2.

Lectures

Most of the material covered by the lecturer can be found in the textbook. However, in a subject with many graphs and diagrams, I found the lectures highly useful as Nisvan worked through lectures and examples on the document camera. At times, however, Nisvan would spend 10–15 minutes covering announcements and summarising newspaper articles which caused lectures to fall behind. Her notes are clear and succinct, with each week's notes consisting of around 15 partial slides. Most students print these off and annotate them, but some prefer to take their own notes in notebooks or simply watch the lecture without note taking. These slides were mostly released on a weekly basis the night before the Tuesday lecture. During lectures, little audience interaction is required. If any, it is mostly just recall from previous lectures.

There are four lecture streams, which offers students flexibility when they have other commitments. Lectures are almost purely conducted through annotating slides on the document camera. The only material that cannot be found on the recordings are YouTube videos (which are not recorded due to copyright issues but links are provided on the LMS) and physical demonstrations with audience participation which arise when discussing firm bottlenecks and game theory. However, based on the lecture recordings, one can clearly ascertain the point being made. The only material presented exclusively at lectures was a printed copy of the subject guide in the first week. This can, however, also be found on the LMS. Therefore, students are not disadvantaged by watching lectures at home.

Tutorials

This subject uses a blue/pink sheet system. Each sheet consists of a few questions. Students will complete a blue sheet at home that covers the previous week's lectures (ideally before their tutorial) and then consolidate this by completing a pink sheet in class that is slightly harder. Blue and pink sheets are uploaded at the end of the week, along with answers to the blue sheet. In a way, this is an incentive for students to attend tutorials, as tutors work through the pink sheet. Tutors mark students based on participation, and if students fail to attend at least seven tutorials in the semester, they will lose one tutorial mark for each extra tutorial missed. Tutorials are mainly structured around the pink sheet. However tutors sometimes revise material presented in the previous week's lectures. Students are given time to complete each question before the tutor presents the answers. At times, due to the rushed nature of tutorials, there is little scope for discussion among peers while completing questions. It is easy to attend make-up tutorials as there is a list of all tutorials on the LMS. The temporary tutor will sign students' pink sheet for presentation to their tutor in the following week. My tutorial was on Monday morning which was before the Tuesday lectures. However, due to poor time management and failure to complete lectures on time as aforementioned, this meant that I was unable to complete some questions in both the blue and pink sheets without guidance from the tutor.

Assignments and assessments

There were two major individual assignments throughout the semester. Students were given approximately three weeks to complete each one, but that included the mid-semester break for the first assignment. Assignment 1 was out of 40 marks,

whilst Assignment 2 was split into two parts — Part A out of 40 and Part B out of 20.

Assignment 1 (covering markets and welfare) and Assignment 2A (covering welfare and firm economics) were highly similar. Four excerpts from *The Economist* articles were presented with accompanying multi-part questions, requiring students to explain economic events and their implications. There is a word limit of 1000 words for each, which requires students to be succinct. Sometimes, questions were ambiguous and had too much scope for interpretation, meaning students were unsure what assumptions they should make and therefore how to answer questions. Here, the Online Tutor was highly helpful, providing some guidance as to what was expected of us. The marking allocation also confused students, as Assignment 1 was originally allocated 10 marks (later changed to 40 when results were released), and in Assignment 2A some questions had many marks allocated for seemingly short and simple answers. It was recommended that students draw graphs on the computer; however, this became very tedious so I resorted to drawing them by hand.

Assignment 2B was a case study. Students were required to explain an economic event or activity that had appeared in the news or been observed by the student. There was a word limit of 500 for this section. This was a fulfilling assignment, as it not only allowed students to revise previous concepts, but it encouraged us to be creative and think of real-world applications of economics.

Marking was quite lenient, with half-marks awarded in some instances. The lecturer noted that she was impressed with the quality of assignments; however, there were no summary statistics for the cohort's performance. Being one of the most popular subjects at the university, it is understandable that feedback comments were sparse. There was not much transparency regarding cross-marking so I cannot comment on consistency of marking. In this semester, there was an issue with the LMS that coincided with the submission deadline for Assignment 1. This caused the deadline to be extended by a day.

There was only one test in Week 4 that covered comparative statics and concepts such as opportunity cost. It was a 40-minute multiple-choice test of 10 questions that was conducted on the LMS over two days. Being an online test, students were able to access their notes at home whilst completing the test or ask other students who had already completed the test (albeit with different values) for advice. Two written practice tests and one online test were provided, although they were much easier than the online test. In addition, there was a review session that was conducted by the head tutor. According to the lecturer, a score of 9–10 was excellent, 7–8 was good and less than 7 meant students needed to revise concepts. Once again, summary statistics were not provided.

However, even though summary statistics were not provided, the head tutor released an excel spreadsheet during SWOT-VAC with marks from each assessment and indicative tutorial grades ('Y' if greater than 4 and 'N' otherwise). These are sorted by student number.

End-of-semester exam

The exam ran for 2 hours and allowed just over one minute per mark. It is not a hurdle for passing the subject. In preparation, four past exams and corresponding solutions were provided. One of these was written by the current lecturer. The exams in this subject are relatively predictable. There are three sections; multiple-choice, "Who is right?" and traditional short-answer questions. This year, there were 10 multiple-choice questions worth four marks each, so essentially each incorrect answer to a multiple-choice question lowers the final grade by 2. Section B presents sets of two statements, which in the past have been by Alan Accountant and Edwina Economist. Wisely, they decided to use tutor names this year, as it became a trend that the economist was always correct. This section was worth 36 marks. The final section was short-answer and required several graphs. It was worth 34 marks. Overall, the exam was relatively straightforward with some challenging questions.

Necessary resources

There were two textbooks for this subject — *Principles of Microeconomics* and *Case Studies*. I bought the e-book for both of these. The textbook is normally $150, whereas the e-book is approximately half the price. Any edition is fine, as the subject guide presents page numbers corresponding to each edition. Explanations are very clear and examples including ice-cream and The Beatles are enjoyable. Some copies are available in the library; however, these are mostly High Use copies. The lecturer provided an extract from a book on game theory, as she believed that it was not covered sufficiently in the textbook.

Supplementary resources

There is a wide variety of resources that are available to students. The head tutor runs review sessions after each major topic, and there are documents containing key learning points and solutions for each topic. Tutors also have consultations and pit-stop tutorials. The Online Tutor was very friendly and helpful, responding to hundreds of questions even though many were repeats.

Concluding remarks

Ultimately, this subject requires students to be able to use graphs and diagrams as well as words to explain economic activity. Many students enjoy it because it requires "common sense". It is generally considered an "easy" H1 subject. However, students should not be overconfident as the exam is slightly harder than the assignments.

MAST10006 Calculus 2 [SM1]

Exemption status	Not an exemption subject; however, you will need either • an average of at least 75 across this subject and MAST10007 *Linear Algebra* or • a total of at least 135 across this subject and MAST10008 *Accelerated Mathematics 1* to continue the major and enrol in ACTL20001 *Financial Mathematics I*.
Lecturer(s)	Semester 1 Dr Christine Mangelsdorf Dr William Holmes Semester 2 Dr John Banks
Weekly contact hours	3 × 1-hour lectures 1 × 1-hour tutorial
Assessments	4 individual assignments 4 × 5% 3-hour end-of-semester exam 80%
Textbook recommendation	None; the lecture notes are good enough.
Lecture capture	Full (Semester 2 only; both audio and video).
Year and semester reviewed	2015 Semester 1

Comments

Subject content

The subject covers limits, sequences, hyperbolic trigonometry, integral calculus, first and second order differential equations, and functions of two variables.

Other remarks

If you are doing it in Semester 1, GO TO CHRISTINE'S LECTURES. You can enrol in a different stream, BUT GO TO HER LECTURES INSTEAD. She is an absolute gun. Listen to her and you will do fine. The other lecturers in Semester 1 aren't necessarily bad, but she's just too good. The lecturers in Semester 2 are generally not as great.

Do it in Semester 1 because well — Christine.

Expect the pace to be very fast. Every lecture you will be taught a new concept or a new method to solve a question. Follow along with the green question booklet after each lecture to make sure that the ideas are sinking in. It will take a maximum of 30 minutes. The content isn't hard, but the amount of material can overwhelm you if you don't follow along.

There are 4 assignments worth 5% each. These questions are substantially harder than the questions in the lecture notes, so expect to be challenged.

This review was previously published in the 2016 start-of-year edition of the *Actuarial Students' Society Subject Review*.

The exam is 3 hours long with 10 questions. You will be pushed for time and expect to finish with only a few minutes to spare. The difficulty of these questions vary but are generally close to assignment difficulty. Do not be deceived by how easy the questions in the green booklets are — they are only there to solidify ideas and concepts. Expect to encounter new material that would require critical thinking.

Listen to Christine, keep up with the question booklet throughout the semester, do not underestimate the exam, and you will do fine.

MAST10007 Linear Algebra [SUM]

Exemption status	Not an exemption subject; however, you will need either • an average of at least 75 across this subject and MAST10006 *Calculus 2* or • a total of at least 135 across this subject and MAST10009 *Accelerated Mathematics 2* to continue the major and enrol in ACTL20001 *Financial Mathematics I*.
Lecturer(s)	Professor Peter Forrester
Weekly contact hours	6 × 1-hour lectures 2 × 1-hour tutorial 2 × 1-hour computer lab session Contact hours occur over 2 days a week for 6 weeks. Each day consists of half of the week's contact hours.
Assessments	4 individual assignments 20% 3-hour end-of-semester exam 80%
Textbook recommendation	None; the lecture notes are sufficient. Just work through the slides as Peter goes along, and complete the homework slides once the relevant topic has been covered.
Lecture capture	None.
Year and semester reviewed	2016 Summer Semester

Comments

Subject content

This subject covers six main topics:

1. linear equations
2. matrices and determinants
3. euclidean vector spaces
4. linear transformations
5. inner product spaces
6. eigenvalues and eigenvectors

Note: The area related to cryptography is not covered as in-depth as the normal semesters.

The content matter covered in this subject isn't too challenging but a good understanding of the different terms and how they differ is very important. What is the difference between "the image" and "the basis of the image"? The kernel, rank, nullity — many of these terms can be easily mistaken as each other and need to be distinguished properly. Peter does all of this as second nature so do pay attention and find ways to help yourself remember them, i.e. some weird acronym, repetition etc.

Lectures

Peter goes through the concepts at a very fast pace which is as expected of an intensive subject. It's not that hard, but make sure you are following at all times, because once you fall behind, you fall behind.

Peter sometimes goes off on tangents to deepen understanding, but what I've realised is that you really only need to understand the general gist of what he is trying to say and rewrite what he has been ranting on for half an hour in about four lines or so. If you really have no idea what he's going on about, just look at the example questions and solutions to deduce the logic behind it. Peter's rantings is usually just a more rigorous explanation of these ideas.

Tutorials, assignments, and exam preparation

Go to tutorials! Tutorials are where you learn how to use the ideas you have been taught to answer exam-style questions, so it also doubles up as exam preparation. Same applies for assignments. Master these along with the past papers, and you will master the exam. Since this is the summer intensive they don't tend to make things too tricky. Questions should be quite similar to what you have been given throughout the semester and are quite predictable. In case of the one or two tricks which are used to distinguished the best from the good, this is where a very good understanding would help.

The lab sessions are not very useful for understanding or exam preparation, but now I've realised it's actually very good preparation for second-year MAST20004 *Probability* and MAST20005 *Statistics*, where lab sessions are so crucial to doing well in the subject.

Concluding remarks

I took this subject as my only subject during Summer Semester, so it was my only focus for 8 weeks (6 weeks of teaching followed by the exam), which probably made my life easier. Once again, I say this subject isn't hard, but a very good understanding is required to do well. Do not expect scaling to save you like in many other actuarial subjects. 75 should be your aim, and it can be deceptively harder than you think. Do not underestimate this subject.

MAST10008 Accelerated Mathematics 1 (1)

Exemption status	Not an exemption subject; however, you will need either • an average of at least 60 across this subject and MAST10009 *Accelerated Mathematics 2* or • a total of at least 135 across this subject and MAST10006 *Calculus 2* to continue the major and enrol in ACTL20001 *Financial Mathematics I*.
Lecturer(s)	Associate Professor Paul Norbury
Weekly contact hours	4 × 1-hour lectures 1 × 1-hour tutorial 1 × 1-hour MATLAB tutorial
Assessments	3 Maple online tests 6% 3 individual assignments 9% MATLAB test 5% 3-hour end-of-semester exam 80%
Textbook recommendation	✓ Get the yellow workbook on your first day of class. Anton, H., & Rorres, C. (2013). *Elementary Linear Algebra: Applications Version* (11th ed.). New York, US: John Wiley & Sons.
Lecture capture	Full (both audio and video). The video of the recording will show the annotated slides under the document camera.
Year and semester reviewed	2016 Semester 1

Comments

Subject content

This subject covers linear algebra, with topics including:

- Systems of linear equations, Gaussian elimination, matrix algebra, determinants, dot product, cross product, lines, and planes (3 weeks)
- Number systems and proof (1 week)
- Complex numbers (1/2 week)
- Vector spaces, subspaces, linear combinations, spanning sets, basis, dimension, row and column spaces, inner product, norm, and distance (3 weeks)
- Curve fitting (1/2 week)
- Linear transformations, image and kernel, matrix representation, change of basis, eigenvalues and eigenvectors, diagonalisation, orthogonal projection, Markov chains, diagonalisation of symmetric matrices and their applications to conic surfaces (3 weeks)

- Functions of two variables, level curves, linear approximation, stationary points, and double integrals (1 week)

In my opinion, the most difficult topic was linear transformation: in particular picturing and understanding change of bases and matrix representations of linear transformations. Whilst there are definitely some very formulaic aspects to this course, such as row reduction, Gram–Schmidt process and finding eigenvalues and eigenvectors, there are definitely times when a deeper understanding of the material is required. In this course, there is quite a lot of assumed knowledge. Students should remember all the formulae for differentiation and integration from VCE Specialist Mathematics, as well as compound and double angle formulae to name a few. There is no formula sheet on the exams, so students will either need to remember algorithms (such as the Gram–Schmidt process and the formula for orthogonal projection) or be able to derive them in the exam. Moreover, calculators are prohibited on the exam, so students should have quick mental arithmetic skills. I completed the workbook questions for half the semester; however, due to an increased workload, I slacked off towards the end of the semester. As tutorials are dedicated towards working on selected questions from the workbook together, this hindered my ability to contribute to discussion as it was my first time seeing the questions.

Lectures

The lectures in this subject are extremely important. With four lectures per week, it is very fast-paced. Missing more than one lecture in a row can leave you significantly far behind. Paul's lectures are highly structured. They begin with the customary "Let's begin the lecture" and a short recap of the previous lecture's content. Somewhere during the middle of the lecture, he will say, "Let's pause there," allowing students to stretch and talk for a couple of minutes. These interludes allow Paul time to ponder examples he wants to discuss, raise subject announcements, or tell us about various mathematicians and their relevance to the subject (linear algebra). Finally, he will end with "Let's finish there". Paul is highly engaging with many humorous anecdotes to share.

Lectures are conducted on partial slides on the document camera. Unfortunately, the document camera in Elisabeth Murdoch Theatre A is horrible and has issues focussing. It caused visibility issues for all students due to the blurriness of text. Lecture slides are uploaded promptly on the Friday before the week's lectures, providing students with ample time to print them off. Lectures were fully recorded on the document camera; however, at times Paul would write on the secondary document camera which was not recorded (although this mainly occurred when he was discussing extra material during his interlude). Attending the lectures and watching the recordings are both beneficial in their own ways. Attending lectures is useful as Paul often refers to the secondary document camera and occasionally makes hand gestures for explanation during lectures. On the other hand, especially for people who sit at the back of the theatre, it is often hard to decipher what Paul is writing because of the small font which is exacerbated by the issues with the document camera. He also does not provide scans of lecture slides. Therefore, it is often useful to check the lecture recording to clarify what he has written.

Sometimes, Paul makes minor arithmetic errors. However, these are offset by the speed at which he performs and writes calculations. They are usually corrected relatively swiftly. Paul sometimes uses jargon such as "trivial" and "tautology", which can be confusing. However, the meaning can usually be gleaned from the context. There is only one lecture stream; however, the lectures are recorded almost instantly.

Tutorials

Tutorials run for two hours, split evenly between question practice and MATLAB. While attendance is taken for this subject, it does not count towards your final grade. Attending make-up tutorials is relatively easy, with tutors relatively happy to accommodate extra students.

In the practice sessions, students work in groups of approximately five, doing selected questions (stipulated by the tutor at the start of the class) on the board. Students are encouraged to discuss and work together, with the tutor providing assistance as necessary. Some tutors also choose to recap material from lectures. For students who are on top of the workbook questions, these sessions are not very useful as they will just be watching other students struggle with questions.

MATLAB sessions are slightly different. Two tutorial classes will combine to join one lab session. There is a worksheet for each week with instructions on what to do and questions relating to the content of that session. These are available along with lecture slides before the week of the lab. Some sessions are useful as they enhance our understanding by allowing us to visualise planes and lines (such as the determinants and cross product labs), but others seem slightly less relevant such as the fractals lesson. Time management is also an issue. Some sessions, such as the Hamming code session can be completed relatively quickly, but others such as the fractals session are almost impossible to complete within the allotted time. When it comes to MATLAB, it is clear that there is a very broad range of abilities. Some people will struggle with understanding what to do, whilst others may not need any assistance from tutors.

Assignments

In total, there were six assignments: three online Maple assignments and three written assignments.

The Maple assignments are relatively easy. Students are given three attempts, with an unlimited time limit to complete each attempt. The best grade is taken as your final grade for that assignment. The first assignment covered row reduction, systems of linear equations, matrix algebra, and inverses. The second assignment covered cross product, dot product, lines, and planes. The final maple assignment covered dimension, basis, linear dependence, and orthonormal basis. As most of these are relatively formulaic, students generally get 100%. It is often careless mistakes or notation errors that cause students to lose marks.

The written assignments are much more challenging. There are approximately seven questions in each; however only half are marked. Each question is marked out of five. There are usually a couple of relatively formulaic and easy questions, but there will be a couple of more challenging questions that require proof or much more thought. These cover all the content in the course apart from the final sections on conic surfaces and functions of two variables. Marking is generally quite strict as notation and inclusion of sufficient explanation in proofs is required.

Summary statistics for students' performance in this course were generally not provided, besides a comment from Paul that nearly everyone scored full marks in the first couple of Maple assignments.

Assessments

The MATLAB test was the only timed assessment throughout the semester. It covered much of the material that was presented in the lab sessions. A 45-minute assessment, it consisted of short-answer questions and a programming question where students were required to show the tutor their script working. Most students struggled with this. There was a practice test available that was quite similar to the actual test. Paul remarked during a lecture that students' performance in the subject is generally very high; however it is quite the opposite in the MATLAB test.

End-of-semester exam

The exam for this subject is usually worth 100 marks and runs for 3 hours. There are about six years of past exams on the Baillieu library (and corresponding answers posted on the LMS) and three "Typical Exam Questions" sets (of which two

have full solutions and one has answers). These are relatively good indications of the level of exam questions. However, in my opinion, the standard has slowly risen throughout the years. There are relatively simple stock-standard questions including matrix "rank", orthonormal basis, or induction proof questions that appear every year; however there are also other separator questions such as proofs that are much harder to predict. The day before the exam I went to Paul's consult. Apart from achieving the world record of having the most people ever to sit on his office couch, it was a highly useful opportunity. He explained several concepts at a slightly deeper level and provided some valuable advice for the exam. This year, I found the exam to be relatively consistent with previous years. There were definitely some easy marks there but also a few questions that required deeper thinking.

Necessary resources

The recommended textbook is *Elementary Linear Algebra*. Lecture slides have references to the relevant chapters. I did not buy this textbook as I found Paul's notes sufficient; however, copies can be found in the library. It did not cover complex numbers or functions of two variables. The main resource for practice questions is the workbook which is uploaded to the LMS. There are many questions; however, all the proof questions come with the solution "Proof required". This means students are often unable to mark their proof.

Software

The main software used in this subject is MATLAB. Students are able to download this from the University's website, and it is also available on university computers. I was relatively proficient with MATLAB. From the lab sheets, I was able to ascertain what to do, even if I did not understand how or why it worked. Familiarity with MATLAB does not affect performance in this subject, apart from the MATLAB test in Week 12 of course.

Concluding remarks

Accelerated Mathematics 1 is a challenging subject, but with good basics it is relatively easy to get a decent score.

MAST10008 Accelerated Mathematics 1 (2)

Exemption status	Not an exemption subject; however, you will need either • an average of at least 60 across this subject and MAST10009 *Accelerated Mathematics 2* or • a total of at least 135 across this subject and MAST10006 *Calculus 2* to continue the major and enrol in ACTL20001 *Financial Mathematics I*.
Lecturer(s)	Associate Professor Paul Norbury
Weekly contact hours	4 × 1-hour lectures 1 × 1-hour tutorial 1 × 1-hour MATLAB tutorial
Assessments	3 Maple online tests 6% 3 individual assignments 9% MATLAB test 5% 3-hour end-of-semester exam 80%
Textbook recommendation	✓ Get the yellow workbook on your first day of class. Anton, H., & Rorres, C. (2013). *Elementary Linear Algebra: Applications Version* (11th ed.). New York, US: John Wiley & Sons. This was the recommended text. I did not have this text and found that it wasn't necessary. The lecturer will post some free material on the LMS. Free software such as MATLAB and Mathematica is downloadable from the University's website.
Lecture capture	Full (both audio and video). 100% of the material used in the lecture are recorded as all working out and examples are done on the slides. However, the reflection of light on the pages is sometimes harsh, making the writing illegible. Good for catching up or reviewing material at your own pace.
Year and semester reviewed	2016 Semester 1

Comments

Subject content

The entire subject is very matrix-oriented, so it is crucial you understand the basics of matrices in order to build your knowledge. The first few weeks will be about matrix operations, row echelon form and matrix manipulation, as well as revision from VCE Mathematical Methods and Specialist Mathematics such as vector spaces and linear transformations. Other topics in the semester consist of, in chronological order: proofs, proof by induction, lines of best fit, orthogonal projections, eigenvectors, multivariable calculus, and other subtopics.

Positive aspects

The lecturer is interesting and quite friendly. The material is mostly straightforward and there are tons of YouTube videos on just about every topic. The lecture recording is wonderful and I recommend you use it. The material is not so difficult if you can handle the speed it is delivered.

Negative aspects

The course moves at a very fast pace, and the lecturer only covers the basics of a topic before throwing students into the deep end through the workbook questions. It is hard to catch up if you fall behind a few lectures, as each lecture builds upon previously learnt knowledge. However, lecture capture and Khan Academy can help you catch up. The lecturer can be confusing at times, taking back previous statements about some parts of theory. Marking of written assignments differs depending on how harsh your tutor is, such that sometimes incorrect notation or expression will result in the deduction of many marks.

Concluding remarks

Overall, I would give this subject a difficulty of 3.5/5, as it is mainly falling behind that will put you in trouble, and the content is mainly straightforward. The tutorials are actually very helpful in areas of understanding and problem-solving, as the style is to work in groups to answer some questions with tutor assistance if needed. Parts of the lectures can also be helpful, such as the two or three worked examples explained each lecture, so it's recommended that you attend or watch them online. Tutorial attendance is recommended as it helps solidify knowledge learnt in previous lectures, and the group-based activities aid learning new methods of problem-solving. The most valuable advice I can give overall is just to not fall behind with lectures; keep up to date with workbook questions, and you should be fine!

MAST10009 Accelerated Mathematics 2

Exemption status	Not an exemption subject; however, you will need either • an average of at least 60 across this subject and MAST10008 *Accelerated Mathematics 1* or • a total of at least 135 across this subject and MAST10007 *Linear Algebra* to continue the major and enrol in ACTL20001 *Financial Mathematics I*.
Lecturer(s)	Professor Barry Hughes
Weekly contact hours	4 × 1-hour lectures 1 × 1-hour tutorial
Assessments	2 individual assignments 2 × 5% 45-minute mid-semester test 10% 3-hour end-of-semester exam 80%
Textbook recommendation	✓ I do recommend the printed lecture notes from Co-op. They are essentially the lecture slides, which aren't available anywhere else, and you **will** want copies of the things gone through in lectures.
Lecture capture	Full (both audio and video).
Year and semester reviewed	2014 Semester 2

Comments

Welcome to AM2. Prepare for the worst.

This subject is pretty much MAST10006 *Calculus 2* and MAST20026 *Real Analysis* combined, with $\frac{5}{9}$ of the contact hours, so the pace is **fast**.

Anyway, I believe AM2 is probably the best taste of pure mathematics you can get in a level 1 subject. This subject is not highly intuitive; at times it seems you are just being thrown abstract facts which together conclude another (perhaps more abstract) fact. I suppose you shouldn't expect any more though, because the results you learn are the fruits of many centuries of work by the brightest of mathematical minds.

Subject content

Real Analysis For the *Real Analysis* portion of the subject, a significant underlying concept is being rigorous — if you want to state something, you prove it from basic definitions (most of the time). Granted, doing well in assessments doesn't require being good at this, because you'll probably be reproducing familiar proofs or processes anyway.

Decimal digits... really don't appear much during the first 3 or 4 weeks of *Real Analysis* lectures. Compared to MAST10008 *Accelerated Mathematics 1* where you might have spent a while row-reducing matrices (requiring a lot of number crunching), you'll spend that time trying to get your head around logical yet abstract arguments and processes.

This review was previously published in the 2016 start-of-year edition of the *Actuarial Students' Society Subject Review*.

Impressions towards this subject generally become pretty extreme at this point in time — you'll probably either hate it to bits (most people), or absolutely love it (aliens). If you have a true appreciation for the logical framework of mathematical results, you may be an alien.

You will learn about the notion of a limit for a sequence and a real-valued function (and fusion-ha — a sequence of real-valued functions), ways to confirm the existence of a limit of a sequence, continuity of a real-valued function, and the Intermediate Value Theorem.

And the order hierarchy. Yes, you **must** know the order hierarchy.

Assessment on this part of the subject revolves around establishing whether limits of sequences or real-valued functions exist and calculating them using the definition of a limit or limit laws (and the order hierarchy). You may be thrown the odd question requiring a proof of one of the simpler limit laws.

Calculus 2 Everyone in the subject breathes a sigh of relief once we begin *Calculus 2* content, because a little of this is familiar ground that you would have trod on to bits in Mathematical Methods and Specialist Mathematics.

Essentially the *Real Analysis* parts before this teach people what a limit actually is, which in Mathematical Methods is not really expanded upon at all. Once you have this idea of what a limit is (hopefully), you can then fully appreciate the origins of differential and integral calculus.

This part of the course is itself split into 5 topics:

1. Differential calculus

   You learn the true meaning of "differentiability" (using the idea of the limit) and some vital theorems, such as the Mean Value Theorem or Taylor's Theorem with Lagrange's Remainder.

2. Integral calculus

   You learn what the integral that you used so much in Mathematical Methods and Specialist Mathematics actually means and some new techniques to integrate.

3. Differential equations

   You learn and use some new techniques to solve differential equations involving first and second derivatives. There are a few application examples which pop up a lot, such as inflow–outflow questions and electric circuits.

4. Improper integrals

   You learn what an improper integral actually is (the limit of a proper integral). In some ways this is similar to the earlier work on limits — you work heavily with confirming the existence of an improper integral using various tests.

5. Infinite series

   Again this is similar to the work on limits. You will be using various tests to see if a series (a sequence in disguise) has a limit, and, of course, you apply this not only to series of real numbers, but also to series of real-valued functions.

Any test for existence of the limit that is introduced during work on improper integrals and infinite series needs to be known **word for word**. Applies for important theorems learnt during any of the 5 topics as well (should be clear which ones are important by the end).

The hardest of the 5 topics are probably improper integrals and infinite series — the hard part being knowing which test to use and how to apply it.

Personally I found learning the *Calculus 2* content less interesting than the *Real Analysis* content, as it was a lot more process oriented in my opinion. But anyway, I'm an alien, so...

Lectures

Not much to say for lectures. Rock up 4 days a week, sit there watching and hearing Barry go through lecture slides and example problems.

AM2 lecture recordings have screen capture, but you won't be able see what's written on the whiteboard if you don't go to lectures.

Should you go to lectures? I think so, because that way you can see Barry doing examples problems in person, and actually copy what he writes from the whiteboard. You miss Barry's spoken comments if you copy them from another person, and sometimes they are quite important to what he is writing.

When Barry writes out solutions to example problems on the whiteboard, generally he is copying it from a sheet he's prepared earlier. He'll still mostly explain whatever he writes on the whiteboard as he writes it though, except in some lectures with so much content that Barry really ends up just copying the solution and slightly neglecting the explanation.

Barry has taught this subject for a number of years. You can guarantee he's the best AM2 lecturer there is, because I don't think there are any other AM2 lecturers.

Yes, Barry has his moments of rambling... Generally on things like "third-year Complex Analysis", "second-year Differential Equations" (a subject he takes), moral, ethical, and philosophical correctness in the context of maths problems, "Calculus 2 students" (lol) and so on... But otherwise Barry is pretty enthusiastic about what he teaches, so if you don't insist that the subject is a piece of crap then you'll probably find lectures bearable at the least.

Tutorials

Your tutorials involve you doing problems, just like pretty much any maths subject. The questions all come from the post-lecture exercises though (which was kind of disappointing after coming from MAST20009 *Vector Calculus* where I got fresh questions in tutorials).

If you can do all the selected questions from the tutorials, that's a pretty good indication that you are on track. The selected questions generally revolve around the core coursework, rather than some of the other questions in the post-lecture exercises which can be more about investigation of a specific part of the theory, or requiring a proof with a certain amount of innovation.

Tutorials begin in the second week.

Assignments

You have 2 assignments for this subject. The first one is purely on *Real Analysis* content, while the second one covers everything up to differential equations.

In my semester of completion, each assignment was marked out of (an astounding) 50, and then scaled to 5% each. Because there were so many marks, the marking scheme was actually quite strict, and tutors try to be more strict in the

correction of untimed assessments anyway. For example, in the second assignment, rearranging a differential equation to a certain form described in the lectures was worth 1 mark. It was literally just subtracting a term from both sides of the original equation, but if you didn't write the equation out in the rearranged form, you lost the mark.

The first assignment is noticeably harder, because real analysis requires more rigour in general, and also people take a while to get their heads around this part of the course.

Solutions to each assignment go up on the LMS after they are all corrected.

Mid-semester test

The mid-semester test covers the first 5 weeks of lectures, which is all of *Real Analysis*, and pretty much 1 week of differential calculus (definition of differentiability and the Mean Value Theorem, essentially).

There are no past mid-semester tests available, and I feel like Barry doesn't really adhere to any specific structure when he writes the test anyway.

Know all your theorems and definitions (and variations thereof) up until this point **word for word**. You will be expected to reproduce these, and then apply these.

The mid-semester test is for most people the first piece of timed assessment on something as rigorous as *Real Analysis*, so while the course content probably induces a lot of panic up until this point, the mid-semester test isn't set at a ridiculously high level of difficulty, relatively speaking. The hardest questions will be proofs of some of the more basic results you have encountered up until this point.

Solutions to the mid-semester test go up on the LMS after they are all corrected.

End-of-semester exam

Ho ho, a classic 3-hour maths exam.

The hardest parts, as I may have hinted earlier, are *Real Analysis* content, improper integrals, and infinite series. Everything can be handled quite comfortably with sufficient practice, but with these 3 areas, it will take a lot more practice and possibly some creativity (with improper integrals and infinite series).

Again, know your main theorems, definitions, and tests. You will be expected to reproduce these and then apply these.

There are plenty of past exams available, but there are no answers or solutions. If you do enough of them, you'll notice some of the questions come from post-lecture exercises almost exactly, and I'm not just talking about "evaluate the limit" questions.

Concluding remarks

As mentioned, the pace is fast. VCE mathematics is nothing compared to this (although you may have realised VCE mathematics was nothing compared to AM1 already, too). Even AM1 might be nothing compared to this. You will definitely need high levels of concentration in lectures, and it would be good to attempt the post-lecture exercises that accompany the printed lecture notes, too. Unless you've actually done the subject before, I don't envision you can motivate the proofs

or processes of absolutely everything (and most likely hardly anything). You will want the practice on questions in post-lecture exercises. There are answers to some of the post-lecture exercises at the back of the printed notes. No solutions are provided though.

The lecture slides are almost identical to your printed lecture notes, so if you need to look up something in the slides, go to your printed notes. (You'll probably be doing this **a lot**.) Anything in the slides but not in the notes is not examined.

Everything snowballs very quickly in this subject, so try to be on top of things; it is very hard to catch up when you're behind.

AM2 is compulsory for most commerce students majoring in Actuarial Studies, so apparently Actuarial students make up half the cohort. The other part of the cohort will consist mostly of science students, as all second-year maths subjects and some physics and engineering subjects have MAST10006 *Calculus 2* or AM2 as a prerequisite, I think. Don't quote me on this.

Second-Year Subjects

ACTL20001 Financial Mathematics I (1)

Exemption status	CT1 *Financial Mathematics*, in conjunction with ACTL20002 *Financial Mathematics II*. Satisfactory performance in both subjects' end-of-semester exams is needed.
Lecturer(s)	Professor Daniel Dufresne
Weekly contact hours	2 × 1-hour lectures 1 × 1-hour tutorial
Assessments	Group assignment, due start of Week 5 10% Group assignment, due start of Week 11 10% 45-minute mid-semester test in Week 7 10% 2-hour end-of-semester exam 70%
Textbook recommendation	Fitzherbert, R., & Pitt, D. (2012). *Compound Interest and its applications*. Melbourne, AU: University of Melbourne Custom Book Centre. ✓ Get it for the practice problems.
Lecture capture	None.
Year and semester reviewed	2015 Semester 1

Comments

For context, there is a series of five actuarial subjects throughout the undergraduate and Honours program under the moniker *Financial Mathematics*. This is the first one, so the content is as basic as it gets. This subject was once dubbed by Mark Joshi (another professor in the Centre) as "financial arithmetic".

Subject content

Throughout this subject, you gain a working knowledge of calculations with interest rates and valuations of cash flows. Problems are vastly of a computational nature, so Mark Joshi is not incorrect.

Various different types of interest rates appear — simple (hooray), compound, forces — in conjunction with different time periods — half-yearly, yearly, quarterly, etc. — and of course nominal or effective quotation. Discount rates (interest rates in reverse, sort of) are studied in the same format. This then leads into becoming familiar with the common actuarial symbols — annuities and accumulations. You will be applying your knowledge with these interest rates and symbols to calculate the present value of general cash flows (aka valuation) and solving equations of value (basically finding the equivalent interest rate at which you would have to invest various amounts at various times in order to produce receipts of various amounts at various times). Here you might encounter interest rates as functions of time, payments that do not happen

This review was previously published in the 2016 start-of-year edition of the *Actuarial Students' Society Subject Review*.

regularly, payments that are continuous, or payments that are functions of time. For those of you coming from ACTL10001 *Introduction to Actuarial Studies*, nothing probabilistic occurs in this subject; everything is certain.

After dabbling with the symbols, you move on to the valuation of loan contracts and business projects — an extension or application of sorts of the work you will have just done on valuing cash flows and solving equations of value. You are introduced to loan repayment schedules and flat-rate loan contracts as well as a variety of methods to evaluate business projects through their projected cash flows.

Towards the end, you will be exposed to the properties of various asset types, such as shares, property, bonds, and derivatives. The concepts are non-mathematical here; just rote-learn them. I suspect they are only here to comply with the Institute's syllabus requirements.

How "maths" is this subject? Although the subject is highly computational in nature, there are some noteworthy theoretical results, such as the convergence of the Euler sequence (should not be new, because all of you loved and enjoyed this in AM2, I know) and properties of convex functions. Taylor polynomials pop up from time to time, but it is not as if you constantly need to recall Taylor's theorem with Lagrange's form of the remainder or anything. There are also interesting derivations of results regarding equations of value and continuous cash flows in the textbook; these are not discussed in lectures, however.

At this point I should mention that if you did not study MAST10009 *Accelerated Mathematics 2* to satisfy the prerequisite requirements for this subject, then you have something extra to learn — Taylor polynomials. Now, somewhat strangely, there is nothing in the handbook which demands the prior study of MAST10009 *Accelerated Mathematics 2*, yet in my semester of completion of this subject, Taylor polynomials were quite common. As Taylor polynomials and Taylor series are not studied in MAST10006 *Calculus 2*, students thereof are left to fend for themselves when it comes to dealing with them. I believe Daniel may have posted some resources on the LMS, but that was it from him.

How "finance" is this subject? Not at all. Apart from the home stretch, where you rote-learn properties of asset types, I recall about one finance concept, i.e. something that originated outside of the mathematics and the algebra. Officially, not once do you price financial instruments — all the "pricing" is done under the guise of valuing a series of cash flows. Perhaps you may say that time value of money is an overarching finance concept throughout the whole subject, but that feels a bit tenuous to me.

I should say that the content in Financial Mathematics I caused somewhat of an awkward situation for some students due to its rather significant overlap with the financial mathematics component of ACTL10001 *Introduction to Actuarial Studies*, which most students in this subject will have completed in the preceding semester. Personally I did not feel like I was learning many completely new concepts in lectures; rather, they were somewhat of a prolonged revision session where old content was rehashed and sometimes presented in new ways.

Perhaps it would be beneficial to divert some of your attention towards discount rates — in particular, discount rates quoted nominally, as these are not covered in ACTL10001 *Introduction to Actuarial Studies*. Your investigation of them in this subject is very similar to that of interest rates, but I suppose discount rates themselves are slightly less intuitive. The other concept which is new will be continuous cash flows, but this should not prove overly problematic.

Having also completed ACTL20002 *Financial Mathematics II* (for which this is a prerequisite) at the time of writing, I do not believe I would have struggled immensely transitioning directly from ACTL10001 *Introduction to Actuarial Studies* to ACTL20002 *Financial Mathematics II* in consecutive semesters. I can foresee various logistical issues and opposing opinions with arranging something like this, however, and I shall not go into them here.

Overall, I believe the aim of the subject is to instil into students comfort in dealing with interest rates and the time value of money.

Lectures

I will admit that I did not pay close attention to the lectures due to aforementioned reasons, but the schedule follows the chapter sequence of the textbook. Reading the textbook is not essential if you attend the lectures, however. Had I been braver, I may have risked not actually attending lectures, but as lectures were not recorded at all, I attended as a safeguard.

Lectures follow the rather standard formula of teaching of theory followed by application into example. Everything is on the slides; there is nothing for you to fill in and I do not recall Daniel handwriting anything under the document camera very often, if at all. Also, many of the examples may or may not have been lifted from the textbook.

Lecture slides are made available on the LMS every few topics or so. Occasionally Daniel will expose you to the wonderful world that is LaTeX during a lecture as he corrects or makes adjustments to content on the slides in his usual wry manner. Do not fret if you have made the decision to not attend; he kindly compiles these changes in an errata document on the LMS. Naturally, there will be far fewer things to correct for these slides for future iterations of this subject.

As I have said before, those of you coming from ACTL10001 *Introduction to Actuarial Studies* may find lectures slow-moving, and unfortunately I cannot promise you that it picks up at some point during the semester. I actually remember four consecutive lectures where we discussed the definition and properties of real-valued convex functions, but I will give him some credit here; it was one of the few concepts I would consider uniquely new in this subject.

And for those who attend lectures, the other reason Daniel is slow-moving is because his age is somewhere in the centuries. Have some sympathy for a man who has seen it all. (Disclaimer: I am kidding, but he does talk about it as a running joke a lot.)

Tutorials

This. You may forgo all the lecture hours if you are [over]confident from your previous studies in ACTL10001 *Introduction to Actuarial Studies*, but do not skip these.

Perhaps I am a little biased, but, as the content in lectures was not all that fresh, the slightly more investigative turn in the tutorials was very attractive for me.

Sure, some of that computational nature persists in tutorial problem sets, but there is also some investigation and foreshadowing. The computational ones take the form of calculating rates or valuing cash flows etc., while the more entertaining ones require you to find recursive relationships or prove algebraic relationships, generally requiring some ingenuity along the way. The interesting questions only pop up here and there, but that was enough for me. Often I would find myself in a lecture noticing that some particularly result was alluded to back in some earlier tutorial. Combined with the fact that I had an absolutely amazing tutor who had an excellent grasp of many underlying or further mathematical results, I can safely say the tutorial program was the part of this subject which I enjoyed the best.

Generally the tutor will sift through the problems on the tutorial problem sets and provide solutions for you. However, as with many actuarial subjects, the other aspects of the tutorial will be somewhat dependent on the tutor. The tutorial team turns over pretty much every year, so unfortunately it is difficult to gauge the calibre of the tutorial program for future cohorts.

(For the 2016 cohort, I just took a second to glance at your timetable. MY GOODNESS. My condolences to you.)

Also, there is a tutorial in the very first week. Do not forget.

Assignments

In my semester of completion, there were two of these, and they were both conducted as group assignments, with three to five students in each group (so you can despise the assignments in good company).

I really cannot express how out of place these felt in my semester of completion. I am honestly doubtful that Daniel will maintain this style of assignment problems in future iterations of this subject. If he does, then the assignments are **full** of investigation and foreshadowing and are a colossal departure from the usual computational nature of the subject. Of course, that means some of you will not care for it. Others will hate it. Others will hate it with passion. But all of you, or at least someone in each of your groups, will end up doing them because you want those assignment marks. It is sort of weird doing what is essentially a maths assignment as a group, but you will get used to it.

As an example, there was a question which appeared on the assignments which I would consider as needing far more ingenuity than any assignment question I had encountered in MAST10009 *Accelerated Mathematics 2*. I was kicking myself at the end of it, though.

There may be some computations and graphing for which Daniel suggests the use of software, such as Microsoft Excel or SageMath. The assignments only require light use, and if you are uncomfortable graphing with software you are always welcome to draw the graphs by hand.

Each assignment had 40 marks available but was marked out of 35; any "bonus" marks you obtained could be used to compensate for the marks lost on the other assignment that had put you below 35. If you ended up obtaining more than 70 marks across the two assignments, the excess over 70 did not become insurance in the mid-semester test or end-of-semester exam.

Many of my peers labelled these assignments as "pure mathematics" assignments, and rightly so — there was very little on these assignments suggesting that the students completing them were actually trying to become actuaries. Perhaps they are a glimpse of what Daniel actually wants to focus on in this subject were it not for the fact that he must write a final exam adhering to the Institute's syllabus requirements (and hence teach accordingly).

Mid-semester test

45 minutes of writing time and 5 minutes of reading time were given.

I believe the test covers up to (and includes) the valuation of continuous cash flows and nothing further.

As with all Actuarial Studies timed assessments, be prepared. You will never know how impossibly hard or surprisingly simple it could turn out to be. In my semester of completion, the test was on the doable side, with one question described by Daniel as "requiring you to think".

The people I talked to were probably not a representative sample, so it is difficult to say whether people found the mid-semester test difficult in general. There was no question where the techniques required had not been extensively covered, i.e. nothing obscure. Unsurprisingly, convexity was examined (I mean, we did spend four consecutive lectures talking about it). Taylor polynomials were also examined but purely in the form of a computation of a Taylor polynomial followed by an approximation of the original expression using the polynomial. Other than that, I feel that the mid-semester was just confirming people's familiarity and comfort with interest rates and valuation of cash flows. (Please see comments in the exam section for more insight on preparation.)

There is a formula sheet with some of the (algebraic) definitions of actuarial symbols — annuities in arrear, annuities in advance, accumulations in arrear, accumulations in advance — and also some of the (algebraic) relationships between

interest rates, discount factors, discount rates, and forces of interest. Since you should have been using these formulas non-stop by now, they should be second nature to you, rendering this formula sheet useless.

End-of-semester exam

I can only echo my sentiments about the mid-semester test. The difficulty of the exam will be erratic. In my semester of completion, it was overly simple, and this actually resulted in downwards scaling in the end.

I believe the exam should be largely of a computational nature, again testing your ability to work with interest rates and cash flows.

There is a big gaping trap for students who have come from ACTL10001 *Introduction to Actuarial Studies*. For these students, it is reasonable to become complacent and dismiss the content in this subject as easy, as so much of it has been studied already. However, you must always remain conscious of the fact that the computational nature of the exam and the subject in general does not preclude the possibility that you will be suffocating in the examination hall. Computations may be tedious and mechanical to carry out, but the added element of time pressure in an exam introduces vulnerabilities: if the exam turns out to be excessively long, the speed and elegance of your computations, which are perhaps neglected when you practise on your own, suddenly become a decisive factor in how well you perform on the exam. Speed is generally a high priority for students and is normally addressed through continuous practice. Elegance, on the other hand, is a different matter.

It is difficult to say how one improves elegance of computations. Perhaps you make a small algebraic substitution, and the algebra suddenly becomes minimal and your work is far less prone to error. Perhaps there is a certain relationship between interest rates and discount rates which simplifies the problem immediately. Perhaps separating a series of cash flows into individual parts, each of which is simple to calculate but in union are equivalent to the original, reduces the amount of algebra needed. The ability to make such acute observations is hard to forcibly train, but some day they may prove absolutely pivotal in an exam. I can only suggest that you remain alert throughout the entire subject as you practise on your own; be aware of any little tricks or algebraic identities you may encounter along the way — even shortcuts on your calculator. Sure, the subject is computational; however, that does not mean that the only way to be efficient is to work at breakneck speeds. There is still an art to computations if you know where to look.

ACTL20001 Financial Mathematics I (2)

Exemption status	CT1 *Financial Mathematics*, in conjunction with ACTL20002 *Financial Mathematics II*. Satisfactory performance in both subjects' end-of-semester exams is needed.
Lecturer(s)	Professor Daniel Dufresne
Weekly contact hours	2 × 1-hour lectures 1 × 1-hour tutorial
Assessments	Group assignment, due start of Week 5 10% Group assignment, due start of Week 11 10% 45-minute mid-semester test in Week 7 10% 2-hour end-of-semester exam 70%
Textbook recommendation	Fitzherbert, R., & Pitt, D. (2012). *Compound Interest and its applications*. Melbourne, AU: University of Melbourne Custom Book Centre. ✓ The textbook is highly recommended, as it is a very good complement to the slides and provides a useful set of practice problems.
Lecture capture	Full (both audio and video).
Year and semester reviewed	2016 Semester 1

Comments

Subject content

- Simple and compound interest
- Effective rates, concept of present value and discounted value
- Nominal and equivalent rates of discount
- Time-varying rates, general nominal rate, accumulation factors, consistent markets
- Continuously compounded rate of interest (CCR) and relationships with accumulation factors
- Nominal rates, discounted value as a function of CCR
- Inequalities and limits of $d^{(p)}$, $i^{(p)}$ etc.
- Valuing unit payments at unit intervals
- Level continuous payments
- Calculation techniques which require adjustment
- Valuing cash flows with linear variations
- Valuing generalised cash flow, compounding under reinvestment vs payment as due
- Solving equations of value and associated conditions for a unique solution
- Loan contracts — calculating repayments
- Loan contracts — renegotiations, flat rates
- Project evaluation
- General overview of equities, securities, bonds, hybrids, and derivatives
- General overview of futures, hedging, options, forwards, and interest rate swaps

The subject is well structured and continuously builds upon the content that is taught in lectures. Daniel begins by exposing students to the various types of interest rates that appear — simple, compound, forces — in different time periods — quarterly, half-yearly, yearly etc. In addition, there are nominal and effective rates. Discount rates are then studied in a similar method. Daniel will then work through the common actuarial symbols, annuities, and accumulations which students were exposed to during the course of ACTL10001 *Introduction to Actuarial Studies*.

Using this material, students then become familiar with calculating the present values and accumulations of cash flows using different interest rates as well as solving equations of value. This is where the content becomes trickier, with interest rates becoming a function of time or perhaps payment frequency becoming irregular, continuous, or also a function of time.

Leading on from this, you move onto loan contracts and business projects, which is the application of valuing cash flows and solving equations of value. Following this, students are exposed to loan repayment schedules and flat-rate loan contracts, which is not too difficult.

Towards the end of the subject, the lectures become more theoretical with the introduction to various asset types such as property, bonds, and derivatives. It is good to understand this section, but one can get away by rote-learning. This part of the syllabus was allocated six or seven marks on the end-of-semester exam.

It is also important to mention that if you did not study MAST10009 *Accelerated Mathematics 2* to satisfy the requirements for this subject, there is some extra study to do in regards to Taylor polynomials and Taylor series. However, do not fear — as a student who studied MAST10006 *Calculus 2*, there is an abundance of resources online that can be read or videos that can be watched to understand these concepts. Furthermore, Daniel posts some useful resources on the LMS that will also help. In addition, consult your peers — this is extremely useful when trying to grasp new concepts.

Lectures

Whilst the back-to-back lectures on Monday from 3.15pm–5.15pm proved to be inconvenient at times, I thoroughly enjoyed attending lectures and listening to Daniel's explanations. It is argued that reading the textbook is not essential if lectures are attended, but it does not hurt to see concepts in another perspective. There were a few instances that lectures were not recorded due to technical difficulties, but other than that all lectures were recorded. Nonetheless, I attended all lectures.

Lectures follow the slides, where the theory is explained followed by an example. Daniel used the document camera to better explain certain concepts that were sometimes found difficult to grasp, such as discount rates. Lecture slides are made available on the LMS, and sometimes Daniel made minor changes to these slides during lectures. Again, do not worry, as these changes are made available on the LMS following the lecture.

Early on students may fall into the temptation that this subject is merely an extension of ACTL10001 *Introduction to Actuarial Studies*. Whilst this may be true for concepts such as simple interest, compound interest, and aspects of loan contracts, this subject does contain new concepts such as discount rates, cash flows with linear variations, and much more as you will see through your study of this subject, so do not become complacent!

Tutorials

Some students will argue that they could skip lectures and get by through reading the textbook. However, I do believe attending the tutorials is most beneficial in this subject.

The content in lectures wasn't always new, as mentioned earlier, due to the concepts taught in ACTL10001 *Introduction to Actuarial Studies*. However, I felt the tutorials took a more "investigative turn" where tutorial questions required me to really

think before answering questions, which was a very stimulating challenge.

There are the standard questions which involve finding the present value or accumulation given an interest rate. Nonetheless, there were often questions which required one to find recursive relationships or proving algebraic relationships, which could be done in numerous ways. This aspect of this subject really appealed to me. Whilst I found it challenging, the satisfaction of solving such problem was most rewarding.

The tutor will work through the problems on the board or ask students to work collaboratively and share solutions to the class; this really depends on the tutor. I was very fortunate to have a brilliant tutor who recapped lecture content and also taught us tips and tricks to answer questions more efficiently. Again, like lectures, I attended every tutorial and found it most useful in understanding concepts of this subject.

Assignments

In 2016 Semester 1, there were two assignments which were completed in a group of four or five students. Assignments were handed in at the end of the lecture on the due date. Our first assignment was marked out of 40 marks whilst the second was marked out of 30 marks, with each contributing 10% towards the final grade.

I personally found the assignments to be quite interesting. Some questions were straightforward, requiring one to calculate present values or perhaps a monthly loan repayment. Whilst it may sound simple, it is important to show full working out to obtain full marks, which is good practice for exam situations. Other questions required a lot more thinking such as finding simplified expressions or proving algebraic expressions. I found that these questions were generally more difficult and required a lot of group discussion before reaching an answer.

Whilst these assignments are completed as a group, I do believe that it is worthwhile for all members to individually answer the questions before discussing solutions. In doing so, this allows each member an attempt at the questions, enabling each student a learning experience from completing the assignment. Furthermore, it generally ensures that the final answer is correct if everyone in your group obtains the same answer!

Daniel does allow students to type assignment answers using TEX and to draw graphs using Excel or Mathematica, which is also good exposure to the abundance of software that exists.

Mid-semester test

5 minutes of reading time and 45 minutes of writing time are given.

In 2016 Semester 1, the mid-semester test covered up to, but not including, the valuation of continuous cash flows.

Make sure you are well prepared. One can never really know how difficult these exams can be. In 2016 Semester 1, the test was doable. However, from general consensus, students made mistakes purely due to misreading the questions; I was also guilty for this. Make sure to read questions word for word, and underline key parts if needed to ensure you understand what the question is asking of you. Other than that, our test had nothing obscure.

It is also important to improve timing. All the questions can be completed by students but the time factor in these assessments add the extra bit of pressure. The best way to combat this is by constantly practising the art of answering questions. We were given one specimen mid-semester test and a past mid-semester test as practice. Do these questions under timed conditions to see where you can improve and endeavour to double-check answers to avoid making silly mistakes.

The mid-semester test was accompanied by a formula sheet. However I do not think students will need this, because with practice the notation and formulae become second nature to you.

End-of-semester exam

The difficulty of the exam will be erratic. In 2015 Semester 1, the year before my semester, the exam was overly simple and resulted in downward scaling in the subject. On the contrary, in my semester, those I spoke with, including myself, did not find the exam as straightforward but instead found it quite difficult.

The exam is largely computational in nature with less than 10% of the marks based on the theory that is covered in the final lectures. Overall, I believe the exam tests one's ability and comfort with interest rates and cash flows.

As I mentioned earlier, without time constraints these questions are doable. However, time pressure can cause the inability to finish the exam on time, while exam stress can really throw students off track to make small errors that lead to incorrect final answers.

Again, as mentioned earlier, my tip to combat the stress and to improve timing is by practice. Complete the textbook questions, and complete the tutorial questions. Then complete the specimen exam and past exam that is provided under timed conditions. If you have time, search online, and there will be abundance of questions related to this subject. In doing so, one exposes themselves to the wide variety of questions that could be asked and the style in which they could be asked.

Improving one's timing is vital in this subject. This isn't about writing your answers quickly; it is about being able to find little tricks to simplify a problem or recognising algebraic identities that make the computations that less time-consuming. For example, it might be recognising the relationship between discount rates and interest rates that simplifies the problem immediately. These little tips and techniques are crucial in successfully completing this subject. You will come across many of these during tutorials, lectures, and your private study. I do believe that these observations will one day become useful under the time constraints of an exam, so always practise and be alert.

Wishing you all the very best!

ACTL20002 Financial Mathematics II

Exemption status	CT1 *Financial Mathematics*, in conjunction with ACTL20001 *Financial Mathematics I*. Satisfactory performance in both subjects' end-of-semester exams is needed.
Lecturer(s)	Professor Mark Joshi
Weekly contact hours	2 × 1-hour lectures 1 × 1-hour tutorial
Assessments	Microsoft Excel individual assignment, due around Week 6/7 — 10% Microsoft Excel individual assignment, due around Week 10/11 — 10% 45-minute mid-semester test in Week 7 — 10% 2-hour end-of-semester exam — 70%
Textbook recommendation	Fitzherbert, R., & Pitt, D. (2012). *Compound Interest and its applications*. Melbourne, AU: University of Melbourne Custom Book Centre. This is available from Co-op as course notes and covers everything up until Week 9. Course notes for Weeks 10–12 are made available on the LMS.
Lecture capture	Full (both audio and video).
Year and semester reviewed	2015 Semester 2

Comments

Overall, I found this subject more challenging but much more enjoyable and rewarding to complete than ACTL20001 *Financial Mathematics I*.

Subject content

- Pricing financial instruments such as treasury notes, coupon bonds, floating rate notes, and growing dividend streams
- Measures of investment performance
- Duration, volatility, convexity of future cash flows, and their application to immunization of liabilities
- Yield curves
- Different ways to quote rates of interest used in financial markets
- Arbitrage and its use in calculating the value/forward price of forward contracts (including foreign exchange contracts), and put–call parity
- Probability in present value (expected present value) with interest rates, death and default as random variables
- Theoretical and simulation work on series of payments with independently and identically distributed interest rates
- Lognormals and their use in modelling independent and dependent unknown interest rates, both analytically and by simulation
- Time series: white noise process, random walk, auto-regressive and moving-average models, and their applications to the force of interest, both analytically and by simulation

This review was previously published in the 2016 start-of-year edition of the *Actuarial Students' Society Subject Review*.

Lectures

Mark Joshi is a switched-on, upfront lecturer who explains concepts logically and concisely whilst always trying to link course content to real-life scenarios, which I personally liked as it made it easier to see how different concepts are linked. The lecture structure is simple: a concept is explained then applied to an example problem. However, these examples are usually of the simplest level; Mark intends for students to understand how the concepts are applied in those examples rather than memorise the steps to solving that particular problem, and tests this by setting original (and often harder) questions in assessments. Hence, it is important to understand definitions of parameters/variables as they are explained in lectures or in the textbook, instead of attempting to determine their definitions from worked examples.

Absorbing all the information discussed in lectures is extremely important, so I highly recommend attending lectures in person and/or watching them attentively in your own time. The whiteboard is rarely used, but completed lecture slides are never distributed so you will need to copy down the algebraic working out for each lecture example.

Tutorials

As with all actuarial subjects, each week has a set of questions which are reviewed in tutorials in the following week. There were two tutors in 2015 Semester 2 with slightly different teaching styles. My tutor spent most of the class reviewing lecture content to reinforce our understanding, often only going through tutorial questions very briefly towards the end. This echoed Mark's emphasis on understanding, especially as some tutorial questions simply involved plugging numbers into formulas derived in the lectures. However, it also meant that harder tutorial problems were not explained in enough detail.

Assignments

My favourite part about this subject was the involvement with Excel. Walkthroughs of bootstrapping and Monte Carlo simulation were done in lectures to test the accuracy of analytical results, and many tutorial problems encouraged the use of Excel. Furthermore, there were two Excel assignments, presented as projects for an analyst working in investments, where students are required to form their own steps to create a working financial model. These assignments present an opportunity for you to independently learn Excel commands such as `VLOOKUP`, `IF`, and `RAND` and gain experience in structuring workbooks.

Mid-semester test

Other assessments include the mid-semester and end-of-semester exams, which were initially daunting due to Mark Joshi's reputation for setting very hard exams. Since all the questions set are original, the exams are harder to study for compared to some other subjects, but Mark usually sets fair exams that are possible to complete in the given time. With that said, some questions require intuitive thinking to solve — using a standard method may be too difficult or take too much time, meaning that if you are not able to see the best method, you are likely to leave the exam unfinished. A specimen exam and the previous year's exam are posted to the LMS, but should only be used to familiarize yourself with exam conditions or to identify gaps in your knowledge; they should not be used as indicators of the actual assessments.

In 2015 Semester 2, the mid-semester consisted of 10 marks and was fairly straightforward, with a median score of 7.5/10. The end-of-semester exam consisted of 70 marks, all requiring numerical answers except for two worded answer questions

worth 7 marks each: one being a regurgitation of theory written on lecture slides, the other involved explaining the steps to simulating with Excel.

Tips

In my opinion, lecture content, lecture examples, and tutorial questions are the most important things to revise before exams. If you are struggling to grasp a concept as explained in lectures, the textbook provides an alternate view on some concepts, which I found helpful when studying arbitrage. Furthermore, understanding and remembering concepts learnt in MAST20004 *Probability*, particularly conditional expectation and moment generating functions, will help greatly with the material covered in Weeks 7 to 10.

ECON20001 Intermediate Macroeconomics

Exemption status	CT7 *Business Economics*, in conjunction with ECON10004 *Introductory Microeconomics*. Satisfactory performance in both subjects' end-of-semester exams is needed.
Lecturer(s)	Dr Mei Dong
Weekly contact hours	2 × 1-hour lectures 1 × 1-hour tutorial
Assessments	Tutorial attendance and participation 10% Online multiple-choice test 5% Group assignment, due in Week 7/8 12.5% Group assignment, due in Week 10/11 12.5% 2-hour end-of-semester exam 60%
Textbook recommendation	Blanchard, O., & Sheen, J. R. (2013). *Macroeconomics Australasian Edition*. Frenchs Forest, AU: Pearson Education Australia. Available from Co-op. A few copies are in the library.
Lecture capture	Yes (both audio and video) and is a very good alternative to the actual lecture but is not a substitute.
Year and semester reviewed	2015 Semester 2

Comments

This is a fairly easy subject for Actuarial students. Most students should be able to obtain the exemption for this subject.

Subject content

1. Short-run macroeconomics
   - Output, investment, and savings
   - Financial markets; background on the financial crisis
   - IS–LM model
2. Labour markets and unemployment
   - Labour markets, part one: tour of the labour market
   - Labour markets, part two: labour market dynamics and the natural rate of unemployment
3. Macroeconomic adjustment
   - Aggregate demand and aggregate supply
   - Inflation, unemployment, and the Phillips curve
   - Dynamic AS–AD model
   - Macroeconomic policy applications
   - Rules versus discretion in macroeconomic policy making
4. Long-run macroeconomics

This review was previously published in the 2016 start-of-year edition of the *Actuarial Students' Society Subject Review*.

- Economic growth facts
- Growth theory, part one: Solow[–Swan] model
- Growth theory, part two: convergence and conditional convergence
- Growth theory, part three: endogenous growth
- Productivity and institutions
- Productivity, wages, and inequality

5. Open-economy macroeconomics
    - Openness in goods and financial markets
    - Interest rates, exchange rates, and output
    - Exchange rate regimes

Lectures

Mei is a very responsible lecturer. She prepares detailed lecture slides and she likes to use the projector a lot to help her explain the different models. She explains each concept very clearly and she gives very useful example questions and detailed solutions to help students understand the concepts. She also makes sure to link each concept so that students can follow easily.

Students are expected to explain the short-term and long-term effects when there is a change in the economy and understand how the graphs for each model works. Therefore it is extremely important that students pay attention when Mei uses the projector and talks about the shifts in different curves.

Each lecture has a repeated session, so if you've missed a lecture you can always go to the repeated session. Otherwise the online recordings are fantastic in terms of picking up every single detail Mei talks about.

Tutorials

Like all the other economics subjects, you will be given a blue sheet and a pink sheet for your tutorials. You are expected to complete or at least attempt the blue sheet before coming to the tutorial. Most tutors will check that you have written something for the blue sheet. With the pink sheet, this is something that tutors will go through after reviewing last week's lectures. Tutors will usually spend the first 15–20 minutes or so reviewing lecture contents and explaining the important formulas and graphs again to ensure students understand the concepts. It is also a good chance for you to ask any questions if you are too shy to ask in lectures. Afterwards, tutors will let you try the pink sheet and also go through the questions on the pink sheet. The pink sheets are a great indication of the difficulty level of the exam. If you are confident with all the questions on the pink sheets, you should be fine. Also, only the solutions for the blue sheets will be posted on the LMS, so it is important to attend tutorials and copy down the solutions for the pink sheets.

Assignments

The online test is a fairly easy multiple-choice test and I would expect most students to get 100% for the test.

The two assignments are done as group assignments. Each group should have no more than three students and all members must belong to the same tutorial. Each group will only submit one single assignment and each member will receive the same mark. The assignment questions will also be practice exam questions and students are expected to use

calculations and graphs to explain each question. Students may also be asked to provide spreadsheet as references to the answers.

End-of-semester exam

The final exam consists of three sections each worth 20 marks which gives a full mark of 60. Section A has 12 multiple-choice questions. Sections B and C both have three questions and students can choose two questions out of the three to answer for each section. Each question covers a different topic from the course. If students choose to answer all three questions for one section, only the first two questions will be marked.

The exam for 2015 was definitely on the easy side. Most students found Sections B and C fairly easy, but Section A was a little bit more challenging. Practice exams are available on the LMS a few weeks before SWOTVAC and are very helpful. I would suggest you try all the practice exams and make sure that you understand each question. When I say try all the practice exams, I mean to try all three questions from Sections B and C, because you will never know if the topic you decide to do does not show up on the exam or is harder than you think. It is always better to be overprepared than underprepared.

Tips

With the lectures, make sure you attend all the lectures or at least watch the recordings and never fall behind. You should understand all the lecture contents and ask questions or go to consultations if you are unsure of anything. Attend all tutorials if you can, because it does count towards your final result for the course and it is the only way you can get solutions for the pink sheets. As for studying for the exam, I can't stress enough that you understand all the questions on the blue and pink sheets and practice exams. The final exam will not be harder than these questions. If you are confident with these questions then you will be fine. Good luck!

FNCE20001 Business Finance [SM2]

Exemption status

CT2 *Finance and Financial Reporting*, in conjunction with ACCT10002 *Introductory Financial Accounting*. An average of 73 across this subject and ACCT10002 *Introductory Financial Accounting* is needed, with no fails.

Lecturer(s)

Varies. In 2014, the lecturers were

Summer Semester	Professor Rob Brown
Semester 1	Dr Joshua Shemesh
Semester 2	Dr Vincent Gregoire Dr Sturla Fjesme

Weekly contact hours

Summer Semester	2 × 2-hour lectures 2 × 1-hour lectures 2 × 1.5-hour tutorials
Semester 1 and 2	2 × 1-hour lectures 1 × 1-hour tutorial

Assessments

Summer Semester	1-hour mid-semester test, after 2 weeks of class	20%
	3-hour end-of-semester exam	80%
Semester 1 and 2	Tutorial assignments	15%
	1-hour mid-semester test	25%
	2-hour end-of-semester exam	60%

Textbook recommendation

Peirson, G., Brown, R., Easton, S., Howard, P., & Pinder, S. (2012). *Business Finance* (11th ed.). North Ryde, AU: McGraw-Hill.

Quite an expensive buy ($144.95). ✗ The course does not strictly follow the textbook, and hence, in my opinion, the textbook is not a necessary purchase to do well in this subject. Although, it does provide in-depth explanations of the concepts explored (plus other ideas not covered in the course) which are more detailed than lecture content. Overall, it is a good read to complement your studies, particularly if questions requiring explanations are not your strength.
I'd recommend grabbing a cheap second-hand copy (or an earlier edition) if you can, otherwise, don't stress.

Lecture capture

In 2014, lectures were recorded in Semester 1, but not in Semester 2.

Year and semester reviewed

2014 Semester 2

Comments

Subject content

Broadly, the subject matter covered in the course includes:

This review was previously published in the 2015 edition of the *Actuarial Students' Society Subject Review*.

- an introduction to financial mathematics,
- valuing debt and equity securities,
- modern portfolio theory,
- asset pricing models,
- capital market efficiency,
- capital budgeting,
- debt, dividends, and taxes, and
- an introduction to derivative securities.

Other remarks

I really enjoyed Business Finance. Depending on when you complete this subject, Actuarial students are often at an advantage, as many topics — such as the introduction to financial mathematics and derivative securities — are covered in other subjects within our major. Business Finance has "less maths" than most of the other subjects in the Actuarial major, and is a nice change of pace. This is not a particularly difficult subject, but students are often caught off guard by the amount of explanation-type questions in the final exam.

Commonly, the highlight of the course is the lecture presented by an industry guest speaker. This is an opportunity to get an insight into how financial concepts are applied in the business world, which contextualizes the theory covered during the semester. Past guest speakers have represented organisations such as Bank of America Merrill Lynch and Goldman Sachs.

It is common for Actuarial students to take this subject in the summer semester after their first year. While I studied this subject in the second semester of my second year, I did do an elective in the preceding summer semester (ECON20002 *Intermediate Microeconomics*), and I highly recommend completing a summer semester if it fits into your degree. Generally, in a summer semester, you will only be taking one subject, which makes balancing your studies, part-time work and social life really manageable. After completing a summer semester, you will most likely be able to underload in one of the later semesters in your degree, which is particularly useful as the subjects get more difficult and internships/part-time opportunities begin to arise. In the summer semester, Business Finance is taught over a six week period, with four weeks of classes, a one week mid-semester break, and a one week SWOTVAC period.

Actuarial students tend to cope well with the workload in this subject. Weekly tutorial work can be completed in less than an hour, and the assignments can generally be finished in a single sitting. However, it is important not to become complacent while studying Business Finance — it is not enough to only know how to do the calculations. It is important to be able to explain and apply the theory behind the models used, even though this often isn't emphasised in assessment pieces completed early in the semester.

MAST20004 Probability (1)

Exemption status	CT3 *Probability and Mathematical Statistics*, in conjunction with MAST20005 *Statistics*. An average of 73 across this subject and MAST20005 *Statistics* is needed, with no fails.
Lecturer(s)	Dr Nathan Ross
Weekly contact hours	3 × 1-hour lectures 1 × 1-hour tutorial 1 × 1-hour computer lab session
Assessments	4 individual assignments 4 × 5% 3-hour end-of-semester exam 80%
Textbook recommendation	Ghahramani, S. (2005). *Fundamentals of Probability, with Stochastic Processes* (3rd ed.). Upper Saddle River, US: Pearson Education. ✗ Generally not needed. I never looked over it. The lecture notes are comprehensive.
Lecture capture	Yes (audio and video capture of the document camera).
Year and semester reviewed	2014 Semester 1

Comments

A great comprehensive introduction to probability and its applications. You begin the course working through probability from the grassroots up with axiomatic definitions and proofs. This helps to give an intuitive sense of the course later on when things begin to get slightly mind bending and tricky.

After the first few weeks of basic analysis, Dr Nathan Ross then introduces various popular pdfs (random variable functions) used in probability, working through their applications to real-life scenarios (albeit at a fairly basic level so nobody gets too lost) and also their general properties. After this, the subject introduces how to transform these random variables to make them slightly more useful, and also how you can combine various random variable models which makes for a difficult yet rewarding few lectures. After this, you work through ideas involving probability generating functions and moment generating functions with approximations grounded by (you guessed it) Taylor series!

You learn how to work with sums and convolution integrals as a result and how you can apply these strange things. On top of learning about all these odd concepts and long words, you end the course by learning about stochastic processes/Markov chains which are, put simply, processes with more than one step. Without boring anyone by going into pointless detail, I will say the course is dense with approximately 500 lecture slides. It covers an array of topics, which thus requires consistent study (something I didn't do). While there is a lot of ground covered, generally the exam tends to be similar from year to year and easier than assignments (our year was an exception) and thus attaining an exemption mark is well within reach for a student who puts in a decent amount of work. Overall while most of the content was quite interesting, Dr Nathan Ross tried to make light of some fairly dry topics to help keep us awake during lectures and provide great intuition and insight to help ground some fairly abstract ideas. The tutorials and computer labs are well organised and work in harmony together with the lectures, with the labs helping to consolidate knowledge learnt from tutorials through computer applications of probabilistic concepts. This was a challenging yet entertaining subject and was very well organised.

This review was previously published in the 2015 edition of the *Actuarial Students' Society Subject Review*.

MAST20004 Probability (2)

Exemption status	CT3 *Probability and Mathematical Statistics*, in conjunction with MAST20005 *Statistics*. An average of 73 across this subject and MAST20005 *Statistics* is needed, with no fails.
Lecturer(s)	Dr Nathan Ross Dr Mark Fackrell
Weekly contact hours	3 × 1-hour lectures 1 × 1-hour tutorial 1 × 1-hour computer lab session
Assessments	4 individual assignments 4 × 5% 3-hour end-of-semester exam 80% The individual assignments are given in Weeks 2, 5, 8, and 11 and are due in the following week.
Textbook recommendation	Ghahramani, S. (2005). *Fundamentals of Probability, with Stochastic Processes* (3rd ed.). Upper Saddle River, US: Pearson Education. Each week, there will be supplementary problems selected from Ghahramani chapters, and these will very often be the most pertinent questions. Excerpts will be provided on the LMS, so you don't have to find them in the text yourself. That being said, the textbook will be a virtually inexhaustible resource with copious amounts of challenging questions to broaden your knowledge and exposure to questions (more on that later), so, in short, ✓ GET IT.
Lecture capture	Full (both audio and video). However, being a maths subject, only the document camera will be captured. While this IS the more important screen, watching lectures at home without the slides for reference makes it unnecessarily challenging to follow. I would recommend attending in person whenever possible.
Year and semester reviewed	2016 Semester 1

Comments

Disclaimer: I watched Nathan Ross' lectures (for the pleasant American accent) but will note differences wherever relevant.

In terms of structure and content, this is in many aspects a classic maths department subject. In it, you will get off to an easy start, with content getting challenging around Weeks 4 and 5 and potentially spiralling out of control if you let yourself get behind. Don't let the straightforward first assignment fool you, as it is not representative of the difficulty of this subject (IT'S A TRAP!).

History of MAST20004 Probability (2009–present era)

This subject used to be much less frightening due to the fact that each cohort would notice the 'similarities' between the preceding exams, essentially being able to prepare for a certain set of questions that they knew would be examined.

However, it was not only students that picked up on this, and recently it changed such that this is no longer possible (c. 2015). Hence, you will note that the 2014–16 exams are exponentially[1] more challenging.

Subject content (learn EVERYTHING)

- Axioms of probability — defining probability, set theory, De Morgan's laws
- Conditional probability, Bayes' theorem, independence, and the law of total probability
- Random variables and their distributions (discrete and continuous), properties of the distribution, mass, and density functions
- Special probability distributions
- Expectation and variance
- Transformations of univariate random variables
- Bivariate random variables, joint and marginal distributions, transformations, and the bivariate bormal distribution
- Mean and variance of sums and products of random variables
- Covariance and correlation
- Conditional expectation and variance (feat. the rather beautiful formula)
- Generating functions: probability-generating functions and moment-generating functions
- Limiting distributions: the law of large numbers and the central limit theorem
- Branching processes, stochastic processes, and Markov chains

This subject, while taught at different speeds depending on the lecturer (Dr Fackrell proceeds faster than Dr Ross), is taught well overall. It covers all the material at a reasonable pace while going into sufficient detail most of the time. However, once again, both lecturers do occasionally go off on tangents, proving certain theories in great detail. These proof are often complicated and not at all intuitive and do not always add value to your learning. It is more important to try and understand the techniques that are used in proofs rather than memorising the proofs themselves. Many recurring techniques, such as using the relationship between $1/(1-x)$ and its Taylor series expansion or factorising sums to pull out a factor such that you are left with a binomial expansion that sums to 1, are extremely 'neat' tricks that will help you immensely when working on your own proofs or questions.

Generally, each new topic will be started on a slide with its corresponding Ghahramani chapter. If you are finding the topic hard to understand, reading the chapter in the text will almost always help, as it often approaches the topic from a different perspective.

Lectures (attend them)

Nathan Ross' lectures are relatively slow compared to the pace of Mark Fackrell's. You should consider your own aptitude and preference when deciding which stream of lectures you wish to attend. As I am a slow learner, I chose Dr Ross.

As with all maths subjects, if you are finding it hard to keep up with the pace of the working out during the lecture, put your pen down and listen, and let those neurons form their connections, rather than mindlessly copying down working. There will be plenty of time to copy somebody else's notes or re-watch the lecture online.

Both lecturers essentially follow the printed slides provided. However, Ross is known to digress more often than Fackrell. This is not necessarily bad, as you will note that he still finishes on time. The digressions often provide value in another form, be it an interesting proof or an interesting example.

[1] Not really, maybe geometrically.

Overall, the lectures for this subject should not be skipped at all.

Tutorials (use them well)

Maths tutorials are maths tutorials. They are only as good as you want them to be. If you put in the effort, do all the assigned (and more) questions, and ask the tutors for help when necessary, you will learn incredibly more than other students. It is only too easy to skip the tutorials with the excuse of "but there are solutions though".

The assigned questions for this subject are not nearly as challenging as problem sets in MAST10009 *Accelerated Mathematics 2* but are a good test to make sure that you at least understand the theory. Whenever possible, endeavour to complete the Ghahramani questions as well, and ask your tutor or consult the solutions manual if necessary. It is strongly advised that you cover as broad a range of questions as humanly possible.

The computer labs give a practical application of the theory learnt in the exam and, while not exactly crucial, are a valuable resource. There have been years where the lecturer has said that there will be a question on theory covered in the labs on the exam, though it rarely ever happens (touch wood). After all, they are most often straight after the tutorial, so don't be lazy.

Assignments (have fun!)

The assignments (bar the first one) are wonderful. They are extremely interesting, challenging, and just overall great fun to do. The questions in assignments are more "out of the box" than usual and will often require a lot of thinking or trial and error to find the method to solve them. After that, the arithmetic will follow without a problem. These are the best types of problems you will do in that they are satisfying to complete.

After completion of each assignment, the past years' assignments will become accessible. You should use these as refreshers, as they are very often the same standard as questions you will encounter on the exam.

End-of-semester exam (do questions from everywhere)

The end-of-semester exam will be a mess. It will be a random variable with mean difficulty 70 and variance 10000 which is positively skewed. As I said before, the past few years have had exams which were increasing in difficulty, culminating in the disaster that was 2016 Semester 1.

Why was it difficult? The exam covered a vast range of content, barely adhering to the structure that was provided to us for preparation, and did not in any way resemble any of the past exams. The topics examined included some obscure ones, and solutions were not immediately obvious. Thus, it was easy to become scared and lose focus. Though the exam was almost impossible to finish, it was a test of how well you performed under pressure and how well you tackled questions you hadn't seen before. It is important in exams like these to get as many easy marks as you can, and I would advise you to ALWAYS start on Questions 1 and 2. These will be free marks, and you can then move on to complete whatever you are most comfortable with. Usually, the question on Markov chains or branching processes will be fairly straightforward. Getting as many marks down while not worrying about not being able to complete questions will ensure you get a decent mark.

Scaling for this subject was unfortunate. If you are hoping to scrape an exemption by riding on the scaling wave, you are in for disappointment. The brightest of mathematical minds could leave two questions unanswered on the exam and score

above 90, but for the many that only answered about 60% of the exam, you will find that your score will approximately equal that of which you answered. This is the maths department, and they do not care whether you get your exemptions.

MAST20005 Statistics

Exemption status	CT3 *Probability and Mathematical Statistics*, in conjunction with MAST20004 *Probability*. An average of 73 across this subject and MAST20004 *Probability* is needed, with no fails.
Lecturer(s)	Dr Davide Ferrari
Weekly contact hours	3 × 1-hour lectures 1 × 1-hour tutorial 1 × 1-hour computer lab session
Assessments	3 individual assignments 20% 45-minute computer laboratory test 10% 3-hour end-of-semester exam 70%
Textbook recommendation	Hogg, R. V., & Tanis, E. A. (2010). *Probability and Statistical Inference* (8th ed.). Boston, US: Prentice Hall. Lecture notes will suffice, but I recommend purchasing the textbook if you want more practice questions.
Lecture capture	Full (both audio and video).
Year and semester reviewed	2014 Semester 2

Comments

Subject content

This subject is an introduction to statistics. Topics include point estimation, sufficiency, interval estimation, order statistics, regression, Bayesian methods, hypothesis testing and various other tests. The first half of this subject will require you to generate your own estimates whilst the second half will ask you to test statistical hypothesis. Statistics covers a lot of techniques and it is important that you don't just memorise them but understand the ideas and concepts behind them.

Other remarks

Davide is a great lecturer; he pays a lot of attention to feedback and tries to cater his lectures to suit his students. During the exam period he also held a 3-hour exam revision lecture where he thoroughly went through past papers and gave students the opportunity to ask any questions. He is also quite witty at times, cracking statistics-related jokes which were quite funny.

What I enjoyed most about the subject was the computer labs. It showed us how to use modern statistical software (R and Maple16) to solve real-life applications. The laboratory test was held in Week 9. The questions were very similar to the ones given in previous weeks' computer lab worksheets, so as long as you know how to do them you'll be fine. We were also allowed to bring in our lab worksheets and 5 pages of formulas so there is no need to memorise computer code.

This review was previously published in the 2015 edition of the *Actuarial Students' Society Subject Review*.

The assignments were not difficult and Davide encourages discussion with fellow students. Another reason to purchase the textbook is that some assignment questions were extracted from the textbook. The exam was also not too difficult and similar to previous ones. We were given 3 past exam papers with solutions. Davide also went through them in the last few lectures.

The only negative aspect of this subject was that I felt it was a bit rushed towards the end. It would have helped the students' understanding if the final topics were discussed more in-depth.

This subject is very content-heavy and hard work is required to not fall behind. I recommend doing at least some of the tutorial questions beforehand, as we never finished all the questions in tutorials. There are also a lot of formulas. Please do not only memorise them; try to understand the ideas behind them also.

MGMT20001 Organisational Behaviour [SUM]

Exemption status	None.
Lecturer(s)	Ms Victoria Roberts
Weekly contact hours	2 × 1-hour lectures 2 × 1-hour tutorials 2 × 1-hour online tutorials
Assessments	Tutorial attendance and participation 10% Individual assignment, due in Week 3 10% Group assignment, due in Week 5 30% 2-hour end-of-semester exam 50%
Textbook recommendation	Department of Management and Marketing. (2011). *Organisational Behaviour* (5th ed.). Sydney, AU: Pearson Choices. The lecture notes are sufficient. The textbook for the subject is available from the university bookshop. It is a custom compiled edition by Pearson Education and contains readings from a range of textbooks which have been specially selected for this subject. The textbook is not essential and can be borrowed from the high-use section of the Giblin Eunson library, so you can have a look if you wish. The textbook was useful for filling in gaps of information and extending knowledge for the first half of the course — for the second half, it began to lose relevance.
Lecture capture	Full (both audio and video). Yes, since there is no writing or live editing in this subject, it is possible to watch them online. However if you don't go, you probably won't watch them online anyway, so you might as well go and experience OB. It really depends on how much effort you want to put in the subject, and how well you want to do, as it is not an exemption subject.
Year and semester reviewed	2016 Summer Semester

Comments

For many, this subject will be where one's WAM drops. However, this correlates entirely with how much effort you put in and how you redirect your energy to study efficiently and effectively. As a hardcore writing subject for many Actuarial students, you may initially find it daunting.

Don't be put off by the naysayers of this subject — it is a lot of fun if you try and enjoy it.

Subject content

The subject is broken down into a micro and macro section of management. Each week in Summer Semester, you will cover two new topics, so content builds up quite fast.

The first section, micro, consists of:

1. Perception, Attribution, and Decision-Making

   Actually interesting and fun if you see how they relate to you personally. You will find yourself realising you can relate to a lot of these perceptual biases.

2. Values, Attitudes, and Behaviour

   Difficult subsection; it is easy to understand the basics of this topic, as it is simply following a process of how values lead to attitudes, resulting in behaviour. The second aspect of this topic is where things begin to get confusing.

3. Leadership and Teams

   Fun subsection. If you really get into it, you will start joking with your friends about what stages of team development you are currently in. The teamwork aspect I found more enjoyable personally compared to the leadership aspect.

4. Motivation

   Not a hard topic, but definitely need to get your head around how it works.

5. Conflict and Negotiation

   Probably the most difficult and content-heavy topic of the micro section.

Note that the macro topics generally have a lot more content in them than the micro topics, as it comprises of 75% of the exam.

The second section, macro, consists of combinations of a topic and a case study on a company:

1. Organisational Change/Sanrizz

   Fun and easy to apply; hope that you get this for the exam.

2. Organisational Communication/Enron

   This was difficult to write about, and while the content isn't hard, try writing 1500 words on it in an exam.

3. Organisational Culture/Solaris and Supernova

   Fun topic. A lot of content, but not difficult.

4. Organisational Power/Automakers Australia

   Easy topic to apply. There are three dimensions of power, and once you know them, things are smooth sailing from there.

5. Organisational Strategy and Structure/Apple

   If this appears on the exam, writing about everything will probably mean you will run out of time. This has the most content and the most information to process.

Note that while these are the combinations you will learn in class, these combinations will not appear on the exam. You will have to learn how to apply each topic to each different case study.

Lectures

As I did it in the Summer Semester, I can only speak about it for that course. However, I assume the content will be similar in normal semesters.

In terms of the lecturer, Victoria was great, and I believe it was her first time lecturing. She was enthusiastic and excited — very passionate about what she was doing. Sometimes she would give her own examples of how the management topics were applicable, which was very insightful. Overall, she was a very fun lecturer and really tried to make sure her lectures were simply crammed with content. I remember watching *The Simpsons* and *Big Bang Theory* in her lectures — great times!

As Summer Semester was twice as fast as normal semesters, we had two lectures a week. This meant the lecture content did build up quite quickly. Management concepts are quite straightforward to understand but take some thought and preparation to apply; as long as you understand it and give it some creative thinking, you will be on the right track.

The micro lectures were definitely more fun than the macro lectures, as it was more personalised and you could apply a lot of the concepts to yourself and your friends. Trust me — you're going to be cracking OB jokes early in the semester.

Online tutorials

Online tutorials basically involve doing the online pre-tutorial work before you come into the following week's tutorial. It's quite straightforward; there are online questions to answer. Make sure you save a copy before you finish up; otherwise you have to redo the entire set of questions again.

The questions are simply based on whatever you covered in the lectures that week, and they don't take very long. I tried to put a lot of effort into it and made sure I had at least three lines of writing per answer, but I know some people just came in with dot points, and that was fine too.

Readings

There is a lot of reading to do in OB. There is no hiding from this. I know individuals who did well who read the readings, and I know individuals who did well who didn't read the readings. Do whatever you want, but personally, I read the readings, and I found them very interesting.

Basically, the micro readings are journal articles, which some people may find quite dry, but I found reading them really helped with understanding how OB as a subject works.

The macro readings are a must-read as they are examinable and consist of case studies which you may have to analyse on the exam.

Tutorials

Tutorials are a lot of fun if you put your heart and soul into it. You pretty much get to discuss what you wrote in the online tutorials in your group assignment groups.

If you answer a lot of questions creatively with pre-thought, you will definitely score highly on the tutorial participation side of things.

My advice: do the online tutes and actively participate in class.

However, don't breathe a sigh of relief even if you obtain full marks for your tutorial participation marks. This is only just the beginning...

Individual assignment

How's your writing? Good? Well it turns out OB markers can be quite harsh, so you have to lift your writing game. No, there's no shortcut to writing well, so you will need consistent practice on your end, and generally consulting your tutor will be a benefit to ensure that you're on track and that you won't lose marks for being off-topic.

The assignment is generally based off a micro topic and is a 1000-word academic essay, which means using academic references and citations! Yay! The best place for this is Google Scholar; you have to do something with linking it to your university account, but that isn't hard.

My trick to finding references was... there is no trick. You have to put in the hard yards — don't expect that the first search on Google Scholar will give you enough to last you the entire essay.

Trawl through Google Scholar, and ensure your references are properly cited and sourced. You don't want to lose marks on citations, because you're already going to lose enough marks...

Group assignment

Everyone's favourite part of OB. It brings students from different backgrounds and degrees together and creates long-lasting friendships and strong bonds. It is 5000 words of goodness and excitement.

What? You think I'm joking? Well, to be fair, that was actually my personal experience with our group. We all put in effort, had regular meet-ups, and really gave it an all-round effort. We ended up with a great score and had a lot of fun in the process (such as playing board games as a reward).

Teams are generally 4–5 people and are formed based on tutorial groups as well as through an 'online group test'. It is currently not known how the 'online group test' functions, so trying to put false information or trying to get friends to have different personalities may or may not work. Proceed at your own risk!

No, but seriously, not everyone will have a group as successful as this. It is a hit-or-miss draw, and it really depends on how much work you put in. Sometimes, you just don't get along with the people in your group. My advice? Get on with it; complaining doesn't get you marks. If you really believe things have escalated to a point of no return, you might actually have to solo the assignment (if your writing is good enough)!

I've heard nightmarish stories about OB groups, where things fall out so badly that no one talks to each other by the end of it, but then you have stories like mine. Is there a way to avoid it? Well, there is, but it doesn't guarantee you a good mark either. As the selection of groups is based on the individuals in your tutorial, you can try and get a group of individuals that are friends and register for the same tutorial. However, I haven't seen a lot of groups that perform well using this strategy. Your friends may be your friends, but that doesn't mean they love writing either, especially when everyone is an aspiring actuary.

Usually, the group assignment is also based on a micro topic, is 5000 words (with 10% leeway), and is supposed to be evenly divided between the group. From personal experience, while this sounds fair logically and ethically, having different

people write different sections will result in a mess of different writing styles and will probably detract from the overall consistency of your assignment. Have the best writer either do the final write-up or a thorough edit at the very end.

The group assignment will basically be a case analysis where you are given a scenario and you must analyse it with your group by using the specific topic of micro you are asked to use. The split is 3000 words towards the analysis section, and 2000 words towards the recommendations section. Don't forget: your recommendations aren't perfect, so do highlight the weaknesses in your recommendation, but not to the point of humiliating yourself.

You will need to divide up the workload into finding academic journals online, compiling these into useful examples, and actually writing the essay. You will find the latter part the hardest in a team environment.

Also, doing well in the group assignment does not guarantee a great subject score, so don't sigh a breath of relief either, as it only gets worse…

End-of-semester exam

The make or break of OB, where even getting 90+ in the group assignment does not make you immune towards getting H2A or less.

The exam is 2 hours long and contains four extended response questions: three of them on a single case and macro topic combination and the other on a micro topic. As such, micro is worth 25% and macro is worth 75%.

The micro section focusses on applying a single micro topic on your group assignment experience. This can rapidly turn into a 30-minute rant about why your group assignment team didn't get along well and why you guys did badly. While it may make an amusing read for the examiners, just remember that good writing seldom mixes well with extreme emotions about how your team worked. Also make sure that you don't spend too long on the micro section, as it is definitely not the most important part of the exam.

The macro section consists of writing extended responses to three questions based on a single case and topic combination. The case–topic combination will definitely not be one that was covered in tutorials or asked in previous exams. While this does narrow down the number of combinations, you should still practise all the combinations, rather than study a few and hope for the best.

My advice is to [hand]write a lot of practice essays in order to get accustomed to the format. Also, if you want to get a good score, just remember that memorising notes and ideas will not get you very far, especially as it is probable other individuals will memorise the same ideas, meaning that you can't stand out from the crowd for your essay. You also don't know the questions that will appear, and it is therefore impossible to prepare or memorise applicable ideas beforehand.

Really, the best way to tackle the exam is to be creative in your approach; by having a thorough understanding of each topic and case and being able to come up with your own unique ideas, you will be able to increase your chances of doing well.

The practice exams given are pretty useless, as you know those topic–case combinations will definitely not appear on the exam. It really comes down to how much effort you want to put into self-study — this is not a subject for memorising ideas and taking them in.

However, no matter the topic, the last macro question will always ask for recommendations, which requires you to think outside the box and apply the topic to the case in order to make improvements.

Concluding remarks

Prepare to see your WAM drop (or barely stay level). There's no secret to success in this subject. There's no way you're going to get through it like a bludge subject, but at least if you try, you might actually enjoy it and have a lot of fun while you go through possibly the last writing subject in your life!

MGMT20001 Organisational Behaviour [SM2]

Exemption status	None.
Lecturer(s)	Professor Graham Sewell Dr Angela McCabe
Weekly contact hours	1 × 1-hour lecture 1 × 1-hour tutorial 1 × (approximately) 1-hour online tutorial
Assessments	Tutorial attendance and participation 10% Individual assignment of 1000 words, due in Week 4 10% Group assignment of 5000 words, due in Week 9 30% 2-hour end-of-semester exam 50%
Textbook recommendation	Department of Management and Marketing. (2011). *Organisational Behaviour* (5th ed.). Sydney, AU: Pearson Choices. All of the assessable material in this unit will be covered in lectures and tutorials, so the textbook serves mainly as an enrichment tool.
Lecture capture	Full (both audio and video).
Year and semester reviewed	2015 Semester 2

Comments

Subject content

- Weeks 1–6: Micro Theories

  We look at studies on the impact of individuals and small groups on the behaviour within organisations, taking a psychological perspective on analyses.

  The theories covered in the first six weeks are

  - principles of management;
  - perception, attribution, and decision-making;
  - group dynamics, teams, and team leadership;
  - values, attitudes, and work behaviour;
  - motivation in organisations; and
  - understanding conflict in organisations.

- Weeks 7–12: Macro Theories

  These theories take a more sociological, political, and cultural perspective on organisational structures as a whole and how they affect the behaviour within organisations.

This review was previously published in the 2016 start-of-year edition of the *Actuarial Students' Society Subject Review*.

The theories covered in the latter six weeks are

- Change
- Communication
- Culture
- Power
- Strategy
- Structure

Lectures

The OB staff ran 1-hour lectures in 2015 Semester 2 instead of their usual 2-hour lectures (as in Semester 1) for the first time. As a result, lectures were easier to sit through but were very content-dense and rushed. A few slides had to be skipped here and there in order to finish on time. Regardless of the drawbacks, the lectures were well delivered by Graham and Angela.

Tutorials

The online pre-tutorial work is great for applying the ideas you have learnt in lectures and allow you to partake in richer and more involved discussions in class.

Tutorials are very helpful for learning and understanding the unit material. You're given a brief review of the previous week's lecture before going into either class or small group discussions about the pre-tutorial and tutorial work. The in-class exercises enable very detailed and comprehensive discussions to take place and are a great opportunity to fill in any gaps in understanding you may have had and also to deepen your OB proficiency.

You will form your groups for the group assignment early on from the students in your tutorial class. Subsequent tutorials offer you ample opportunity to get to know your team and smooth out any rough patches you may have, which will prove to be vital, should you desire to be a part of a high functioning and collaborative team. Tutors give out handy assignment and exam tips in class but, however, do not provide any answers to the answers you must answer in your assignments. Both online pre-tutorial work and in-class tutorial participation are graded. Tutors will consider your attendance as well as the quantity and quality of your answers provided online and in-class.

Assignments

The individual assignment is a 1000-word essay that tests your knowledge of a micro topic (has generally been scientific management vs human relations) and requires you to apply it to a case study through analysing the scenario and then providing recommendations on improvements.

This is a fairly easy assignment, since very little content is required for its completion. The task requires you to support your answers with reference to peer-reviewed journals, which seems like a daunting task; however you will be guided through the referencing requirements and be given advice by the OB teaching team in a workshop. If you're unable to attend the workshop, a comprehensive set of slides will be uploaded to the LMS for you to download.

The group assignment is a 5000-word essay that requires you to analyse a case study using models within the micro topics. Your team is selected by a program that aims to diversify your team as much as possible. The assignment requires a lot

of time to be invested into researching peer-reviewed articles to support your arguments. The key to a successful result is to maintain a flow of communication between team members and to manage your time well in order to avoid pulling late nights come submission due date.

End-of-semester exam

The end-of-semester 2-hour exam is worth half your final grade. The exam marks are divided uniformly between four questions. You will not be allowed to bring in any extra materials into the exam; however, you are allowed to annotate the question booklet during reading time.

The first question will require you to reflect on your group work experiences from your tutorials and team assignments and analyse them using one of the micro topics. Your reflection journal will come in handy here. The following three questions will be based on a combination of one case study and one macro topic, which will not be a pair you have already studied in your tutorial classes.

Overall, it will be a straightforward exam, provided that you put in the time and effort to study your topics and cases properly. You will have less to cram during SWOTVAC if you read the cases during the teaching period of the semester.

Third-Year Subjects

ACTL30001 Actuarial Modelling I (1)

Exemption status	CT4 *Models*, in conjunction with ACTL30002 *Actuarial Modelling II*. Satisfactory performance in both subjects' end-of-semester exams is needed.
Lecturer(s)	Professor David Dickson
Weekly contact hours	2 × 1-hour lectures 1 × 1-hour tutorial There is an additional lecture scheduled every three weeks. However this was only used one or two times during 2016 Semester 1.
Assessments	Group assignment, due in Week 6 10% Group assignment, due in Week 10 10% 2-hour end-of-semester exam 80%
Textbook recommendation	Dickson, D. C. M., Hardy, M. R., & Waters, H. R. (2013). *Actuarial Mathematics for Life Contingent Risks* (2nd ed.). Cambridge, UK: Cambridge University Press. Apparently three chapters of this is used, ✗ but the book is not necessary at all. All required content is provided in lecture slides. The book is, however, used for ACTL30003 *Contingencies*.
Lecture capture	Full (both audio and video).
Year and semester reviewed	2016 Semester 1

Comments

Subject content

Actuarial work in life insurance involves calibrating models to estimate the probability that policyholders die or become terminally sick. ACTL30001 Actuarial Modelling I covers, **rigorously**, the mathematical underpinnings of different types of models. The course is split into six main sections, each one building on (in one way or another) concepts learnt in previous sections.

1. Introduction to basic concepts in mortality models such as: survival functions, force of mortality, life tables, and their associated notation. Mainly work with known probability functions.
2. Building non-parametric models for mortality using Kaplan–Meier, Nelson–Aalen, and Cox proportional hazards estimates. Involves maximum likelihood estimation.
3. Deriving two-state (alive–dead) models under various assumptions. Involves parameter estimation by method of moments and maximum likelihood estimation.
4. Deriving multiple-state models as continuous-time stochastic processes. Using models with more than 2 states (e.g. healthy–sick–dead) to estimate transition probabilities. Involves solving linear ordinary differential equations

(first-rder and sometimes second-order).

5. Deriving the mathematical properties of a Poisson process (a continuous-time counting process) and solving simple problems using this model.
6. Theory behind simulation of all models taught in the course, including compound models.

Lectures

Notes for each of the six sections are provided progressively, and lectures follow these notes exactly. The lectures are one of the strong points of this subject: David Dickson speaks clearly and slowly, covering every single step of a proof or sample exercise, and draws diagrams (timelines) that help with the interpretation of loaded mathematical results. Despite this, the content of the lectures can become somewhat boring, so it is easy to lose concentration during long proofs, which could lead to missing key steps or ideas. As proofs are an emphasized and regularly assessed part of this subject, do make sure to reproduce each proof in your own time. My word of advice is to not leave all of them until SWOTVAC, because the exercises you will have to revise on top of the proofs will make this task overwhelming.

After finishing the section notes, David Dickson will use the last few lectures as exam revision lectures, going through (possibly new) exam-style problems as well as exam techniques. However, he will not record these lectures, so attendance is highly recommended. Also, it is likely that at least one concept/question covered in these lectures will be on the exam! (Don't make my mistake and find this out the hard way).

Tutorials

Overall, I found the tutorials to be very worthwhile. Questions aiming to build on concepts learnt in lectures come in two forms — problem sheets and tutorial sheets. Problem sheets are for personal revision, with solutions released every two weeks, whilst tutorial sheets are provided and completed (in groups) in the tutorials.

To help students improve their teamwork and communication skills, David Dickson requires groups to present their solutions to the class. This involves explaining your methodology for solving the question in words, which will most likely be very beneficial to your understanding of key concepts. Nevertheless, if you are struggling, the tutors (in 2016 Semester 1 at least) are always willing to help.

Apart from collecting tutorial question sheets, another reason to attend tutorials is the extra insight you will obtain from your tutor, whether it be intuitive explanations for mathematical results or mathematical proofs for given results that seem to come out of the blue. Also, the steps to solving each question are explained in much more detail by the tutors compared to what is given in the uploaded tutorial solutions.

Assignments

Unlike the end-of-semester exam, there seems to be no set style or structure to either of the two group assignments, and David Dickson does not appear to re-use past assignments. Assignments can vary from extremely open-ended tasks such as "Create an exam question" (2015 Assignment 1), open-ended tasks requiring mathematical judgement such as "Create an approximation to the density of the mortality function using this data set" (2016 Assignment 1), or purely computational questions that only require usage of results derived in lectures, e.g. "Calculate this estimate given this model and the following data" (2016 Assignment 2). One thing that is certain about assignments is that they will be marked harshly, to the

point where you could lose marks for having too many decimal places in your answers, even though the required number of decimal places is never specified. If you wish to avoid this (although most people do not mind because they are only worth 20% of your final score), carefully study the formatting of David Dickson's lecture slides, tutorial solutions, and Excel spreadsheets, and replicate that for your assignment.

On a more serious note, my tip for tackling open-ended assignment tasks is to not be afraid to think outside the "box" of the subject and be able to fully justify your method and results. A technique you've learnt in a past subject and/or one that was briefly mentioned in tutorial questions may be much more justifiable compared to another concept recently covered in lectures.

Usually, assignment submissions will include a written explanation along with an Excel file. The explanation is restricted to a page (or even less) most of the time, so being clear and concise is extremely important.

End-of-semester exam

You are given one specimen exam and the mid-semester test used for the graduate equivalent of this subject, ACTL90006 *Life Insurance Models I*, as revision material. The actual exam is of a similar difficulty and length to these two papers.

The style of questions in the actual exam follows that of lecture examples (some of which are from past CT4 papers from the Institute and Faculty of Actuaries) and/or tutorial problems. There may also be a few difficult questions you haven't seen before, but completing the sample exams and revising all tutorial sheets, problem sheets, and the ideas behind the important proofs will ensure that the majority of the exam is manageable. The revision itself is a lot of work, so you should, as mentioned before, be diligent and spread this work across the semester. If you are able to do this, you should be confident in scoring above the exemption threshold for the exam.

If you also want to score highly in this subject, you will still need to be careful in the exam as it is only out of 60 marks but is worth 80% — each mark lost will have quite a big impact on your final score.

Concluding remarks

This subject is one of the more mathematical/analytical subjects in third-year. If you enjoy rigour and proving everything mathematically, even the most intuitive results, you will probably love this subject. On the other hand, the knowledge gained from this subject will most likely be redundant when one is in the workforce, making the subject a bore for those keen to see the practicality of actuarial models. My final suggestion to make the mathematics in this subject easier to follow is to revise the concepts of moment-generating functions, inferential statistics, and important calculus results (all of which are needed to complete Problem Sheet 0).

ACTL30001 Actuarial Modelling I (2)

Exemption status	CT4 *Models*, in conjunction with ACTL30002 *Actuarial Modelling II*. Satisfactory performance in both subjects' end-of-semester exams is needed.
Lecturer(s)	Professor David Dickson
Weekly contact hours	2 × 1-hour lectures 1 × 1-hour tutorial There is an additional lecture scheduled every three weeks. However this was only used one or two times during 2016 Semester 1.
Assessments	Group assignment, due in Week 6 10% Group assignment, due in Week 10 10% 2-hour end-of-semester exam 80%
Textbook recommendation	Dickson, D. C. M., Hardy, M. R., & Waters, H. R. (2013). *Actuarial Mathematics for Life Contingent Risks* (2nd ed.). Cambridge, UK: Cambridge University Press. This is recommended ✗ but not necessary at all. However, it is recommended to purchase the textbook as it will be used for ACTL30003 *Contingencies*.
Lecture capture	Full (both audio and video).
Year and semester reviewed	2016 Semester 1

Comments

Subject content

This subject covers different models that may be used in actuarial work to estimate the chances that policyholders will die or become permanently/temporarily disabled or ill. This is a very important part of life insurance. The course has six units, and each unit is linked to each other.

1. Explain the concept of a survival model;
2. Describe estimation procedures for future lifetimes;
3. Define a Markov process, and apply Markov models in actuarial problems;
4. Describe models of transfer between multiple states, including processes with single or multiple decrements, and derive relationships between probabilities of transfer and transition intensities;
5. Derive maximum likelihood estimators for the transition intensities in models of transfers between states with piece-wise constant transition intensities;
6. Describe the binomial model of mortality, a maximum likelihood estimator for the probability of death and compare the binomial model with the multiple state models.

Lectures

David Dickson provides detailed lecture notes, and the lecture notes are released on the LMS progressively. David Dickson uses the projector to deliver lectures. He always writes notes and draws timelines to explain the concepts. For each topic, he will go through examples (either a past university exam question or a CT4 exam question) in detailed steps. It is very important to fully understand the examples in order to understand the concepts. Apart from applying models and formulae, another important area of the subject is proofs. There could be questions on the exam that ask you to prove a theorem or derive an equation. Some proofs can be long, tedious, and hard to understand the first time. Therefore you should read it over a few more times after the lecture to really understand it. Lecture attendance is highly recommended.

The last few lectures are used as exam revision lectures and are not recorded. David Dickson will go over more exam-style questions and any questions that are asked by the students.

Lastly, David Dickson is very strict on using mobile phones in lectures, so switch them OFF.

Tutorials

Problem sheets are posted on the LMS, and students are expected to attempt them before each tutorial. You will also be given the tutorial question sheet for that week in tutorials. Students will usually be asked to attempt them in groups and to present your answers afterwards as a group. Tutors will also go through each question and help you out with the questions.

It is a very good chance to ask any questions you may have. Some tutors will go over lecture concepts again in the tutorials. They may also give other intuitive explanations that will help you understand the concepts. Solutions will be provided on the LMS; however, solutions given in the tutorials are more detailed.

Assignments

Assignments are done in groups as assigned by the lecturer. Assignments are very different each year. For Assignment 1 in 2016, we were asked to create an approximation to the density of a lifetime distribution using the data provided. For Assignment 2, we were asked to calculate estimates using the model and data given. The assignments are supposed to be open-ended questions, and so they can be difficult to answer. Students are expected to submit a spreadsheet that contains all the working and a PDF file that explains the techniques used and the results obtained.

End-of-semester exam

You will be given one specimen exam and the mid-semester test for ACTL90006 *Life Insurance Models I* for exam revision. However, solutions will not be provided. The specimen exam is a good indication of the length and difficulty of the actual exam. However, the questions can be quite different.

To study for the exam, I recommend first going through all the exam-style examples and making sure you comprehend them. Then, go through all the problem sheets and tutorial questions. Again, it is essential to understand the proofs and derivations presented in lectures. I recommend leaving the specimen exams to the end of your revision and studying everything else first. It is also a good idea to study with friends and compare your answers for the specimen exams with your friends as solutions are not provided. However, revision is a very long process so don't leave everything until SWOTVAC.

As the exam is only 2 hours long, some students may find it difficult to finish all the questions. Therefore it is recommended that you practise your efficiency and maybe time yourself when doing the specimen exam to make sure you at least complete the exam within time constraints.

Tips

This subject focusses more on mathematics and less on theory. This is neither good nor bad. It also uses some knowledge that you've gained in past studies in first-year and second-year maths subjects. Make sure you understand the lectures thoroughly. Do not just memorise the proofs and derivations, but actually understand the logic behind each proof and derivation. If problem sheets and tutorial questions are not enough, you can find more practice questions in the textbook to help you prepare for the exam.

ACTL30002 Actuarial Modelling II (1)

Exemption status	CT4 *Models*, in conjunction with ACTL30001 *Actuarial Modelling I*. Satisfactory performance in both subjects' end-of-semester exams is needed.
Lecturer(s)	Dr Enrique Calderin
Weekly contact hours	2 × 1-hour lectures 1 × 1-hour tutorial There was occasionally an additional lecture during the rotational lecture time.
Assessments	Group assignment, due start of Week 7 10% Group assignment, due start of Week 12 10% 2-hour end-of-semester exam 80%
Textbook recommendation	Enrique compiles a workbook that is also the lecture slides. This is available for purchase at Co-op.
Lecture capture	Full (both audio and video).
Year and semester reviewed	2016 Semester 1

Comments

This subject and ACTL30001 *Actuarial Modelling I* both focus on modelling mortality and together form the exemption for CT4 *Models*.

Subject content

Subject content in this subject is split into four units:

- Unit 1 — Exposed to Risk Methods
- Unit 2 — Hypothesis Testing
- Unit 3 — Methods of Graduation
- Unit 4 — Markov Chains

Unit 1, for many people, was hard to understand and very confusing initially. The unit focusses on how to count the exposure of lives based on different rate intervals (or ways to classify a person's age) in order to calculate mortality rates. However, while it is quite confusing, there is ample time to master this section as Unit 2 and Unit 3 are relatively simpler. Unit 2 is similar to the hypothesis testing topic in MAST20005 *Statistics*, with a few new tests. It is important that students understand how the tests work and are able to apply the ideas to new, slightly modified tests. Unit 3 is about graduation, that is, how we can smooth out data but still ensure sufficient adherence to the original data. As with Unit 2, the material in this unit is quite methodical and routine. The difficulty of the subject returns in Unit 4 of the subject, as questions are mostly of a problem-solving nature. However, the lecturer provides lots of worked examples, so, with practice, the unit is definitely understandable.

Lectures

During lectures, the lecturer goes through the subject content. The lecture slides are not uploaded until after the lecture, and the order of the material presented may differ at times to the official subject workbook. There is space in the subject workbook to fill in the worked examples, and while the examples are usually recorded, the lecturer sometimes writes on the whiteboard.

There is also a class test during one of the lectures. It is not formal assessment, but it is recommended that students attempt the test before attending the lecture, where Enrique will discuss the solutions to the questions.

Tutorials

Tutorial attendance is not compulsory but highly recommended. During tutorials, the tutor discusses the answers to the tutorial questions (which are included in the subject workbook). It is a good idea to attempt the tutorial questions before going to the tutorial (especially for Units 1 and 4); otherwise it can be difficult to follow the questions discussed, as these units are relatively more confusing.

NB: Answers to the tutorial questions are not released on the LMS, so that is another incentive to go to your tutorials.

Assignments

There are two assignments in the subject and both require students to work at a high level. The first assignment was on Unit 1 and Unit 2, and students were able to put into practice the principle of correspondence as well as some of the hypothesis testing procedures. The second assignment was on Unit 2 and Unit 3. The assignments are generally quite long, as they test material that is unsuitable to test in an exam due to time constraints. My advice on the assignment would be to include everything: for example, reasons for the choice of graduation formulae, diagrams, and assumptions made. Usually the assignments are expected to be written as if it were a formal report.

End-of-semester exam

The exam is generally quite long, with some students (including myself) finding it difficult to complete in the 2 hours of writing time. One specimen exam is included in the subject workbook and is quite indicative of the style and difficulty of the actual exam. For other exam practice, reworking through the lecture examples and tutorial questions is very helpful. Questions are fairly routine, so understanding the lecture material and practising the available questions throughout semester will guarantee success. For Unit 1 questions, it is imperative that assumptions are clearly stated. If no assumptions are required, this should also be stated. During the exam, work through the questions you are comfortable with first. The first question could be to count days, and with exam panic it is surprisingly easy to miscount the number of days in a period of time!

ACTL30002 Actuarial Modelling II (2)

Exemption status	CT4 *Models*, in conjunction with ACTL30001 *Actuarial Modelling I*. Satisfactory performance in both subjects' end-of-semester exams is needed.
Lecturer(s)	Dr Enrique Calderin
Weekly contact hours	2 × 1-hour lectures 1 × 1-hour tutorial There was occasionally an additional lecture during the rotational lecture time.
Assessments	Group assignment, due start of Week 7 10% Group assignment, due start of Week 12 10% 2-hour end-of-semester exam 80%
Textbook recommendation	ACTL30002 Actuarial Modelling II workbook ✓ It is essential that you get the workbook. Lectures are taught through the workbook — you are not given the lecture slides prior to each lecture. Additionally, all tutorial problems and a specimen exam are located in your workbook. The workbook is also available on the LMS should you choose to print it instead of purchasing it from Co-op.
Lecture capture	Full (both audio and video).
Year and semester reviewed	2016 Semester 1

Comments

This subject, along with ACTL30001 *Actuarial Modelling I*, will be your first subjects that deal with mortality (along with other topics). This subject covers content that is a bit more practical than its sibling.

Subject content

This subject is about the estimation of mortality rates and the process of making them appropriate for use (e.g. pricing insurance instruments). The subject's content is categorised as follows:

- Unit 1 — Exposed to Risk Methods

  This unit sets the foundation for Units 2 and 3. Given a set of people's lifetimes, as well as their times of death (if it occurred), how do we estimate the probability of death for specific ages (i.e. the crude death rates)? How do we go about defining their ages? It's not as simple as their "age last birthday". Homogeneity/heterogeneity, central and initial exposed to risks, rate intervals, and the principle of correspondence are covered here. This is without a doubt the hardest part of the course.

- Unit 2 — Hypothesis Testing

  Suppose we have our crude rates, how closely do they adhere to some other set of rates (e.g. those in a standard table)? We use hypothesis testing to answer this question.

- Unit 3 — Methods of Graduation

Using crude mortality rates leaves an insurance company open to sampling errors. Additionally, there is evidence to suggest that mortality rates have to have a number of features (most notably smoothness). How can we alter our crude rates to fix this?

- Unit 4 — Markov Chains

  We then take a step away from mortality rates to explore a subset of stochastic processes: Markov chains — a stochastic process where, given the present, the past and future are independent of each other.

You will want to briefly revise row reduction (for Unit 4) as well as content covered in your second-year mathematics subjects (for Units 2 and 3).

In addition to the content covered in lectures, you will also be required to memorise conventions that apply in many of these topics (e.g. adjustments for tests to a set of graduated rates or the conventions that apply to counting days). These are common pitfalls for students come exam time, so you should become familiar with them as soon as possible.

Lectures

Lecture slides for this subject are unavailable before the lecture — students are expected to follow along with Enrique in their workbooks (that they either printed or bought from Co-op). This is not much of an issue, as the lecture slides are really just a re-formatted version of the workbook. That said, sometimes it is hard to follow along with Enrique, as we were (occasionally) required to jump to different sections of the workbook with no indication. Completed lecture slides were provided after the lecture, providing solutions to lecture exercises. Feel free to use either these slides or your workbook for revision during SWOTVAC.

Enrique regularly utilised diagrams to help us absorb some of the more challenging concepts in the subject (in particular, rate intervals and the principle of correspondence). These helped immensely with absorbing the challenging content of the course.

Occasionally, there would be an extra lecture in the week (during the rotational lecture slot) to either catch up on content or go through some advanced exercises. The exercises presented in these lectures were a very good indication of what would be on the exam, so I would highly recommend attempting the problems beforehand (under timed conditions) and attending these lectures.

Tutorials

Tutorials generally consisted of a brief recap of the content covered in the previous week followed by time to work on the problems set for that tutorial.

The problems for the tutorial are provided in the workbook. Given the nature of the content in this course, a few of the problems required the use of software (mostly Excel). Solutions for the tutorials are unavailable outside of tutorials, so I highly recommend you attend them, especially for the first unit.

Your tutorial experience will ultimately depend on your tutor. Tutorials start in Week 2.

Assessments

You will be placed into groups of four (or three for those leftover). In 2016 these groups were the same as the groups in ACTL30001 *Actuarial Modelling I*.

Both assignments require students to produce a report. The first assignment covered Units 1 and 2, while the second assignment covered Units 2 and 3 (Unit 4 was not assessed outside of the exam). Tasks included applying the principle of correspondence and estimating the age at which a mortality rate applies to, testing and/or graduating a set of crude rates, and even conducting a new hypothesis test that is not covered in lecture slides.

Marking for the assignments was strict — no marking criteria was provided, but students were expected to be incredibly thorough with their report. If you think you have to do something in the assignment, you probably have to do it. Sometimes, the requirements were not so obvious. As an example, students were required to (numerically) find parameters a and b such that some function of a and b was minimised. This was done using software in Excel. However, students were expected to show that the solution found was indeed a minimum and not another type of critical point (i.e. a saddle or a maximum), which required the use of the Hessian matrix.

Enrique loves when groups use LaTeX for their report. The average for the cohort hovered at around 34 out of 40 for both assignments.

As the content may not be as technically challenging as the other subjects taken at the same time, it is quite easy to become complacent with the end-of-semester exam. Many were surprised when the exam was more challenging than expected. The specimen exam provided in the workbook, whilst providing good practice for the actual exam, was not very indicative of its length. My advice (which is not exclusive to this subject and, in all honesty, is fairly obvious) is to have a solid understanding of the content to allow you to deal with unfamiliar scenarios. Given the limited number of practice problems available to students, this is essential for success in the end-of-semester exam. Tutorial problems were generally much easier in difficulty than the exam.

A list of expectations is presented in the back of the workbook. This checklist provides a good summary of the subject and will be an excellent guide for your studies. Also, if you look online, you may find professional exams for CT4. These questions may provide extra practice for both this subject and ACTL30001 *Actuarial Modelling I*. If you have time left to kill before your exam and you are desperate for more practice material, it might help to look at these.

The final exam was tough but fair (despite a bit of clumsy wording for one of the questions).

Tips for success

Whilst it may be easy to become complacent with this subject after Unit 1, don't. Some of the more challenging questions on the exam related to Unit 3.

MAST20004 *Probability* and MAST20005 *Statistics* are arguably the most important subjects in your second year of Actuarial Studies. Having a strong foundation in these subjects will be a boon for you in (pretty much) every subject from third year onwards. This is especially the case in this subject, where Units 2 and 3 of the course is pretty much content covered in MAST20005 *Statistics*, but applied in an actuarial context. Part of 2016's exam required students to derive the formula for a 95% confidence interval, something which is covered in your second-year mathematics subjects.

Also, learn LaTeX. Your lecturers will thank you for it.

ACTL30003 Contingencies

Exemption status	CT5 *Contingencies*. Satisfactory performance in this subject's end-of-semester exam is needed.
Lecturer(s)	Dr Ping Chen
Weekly contact hours	2 × 2-hour lectures 2 × 1-hour tutorials There are 2 extra hours of lectures in the first week.
Assessments	Group assignment 30% 3-hour end-of-semester exam 70%
Textbook recommendation	Dickson, D. C. M., Hardy, M. R., & Waters, H. R. (2013). *Actuarial Mathematics for Life Contingent Risks* (2nd ed.). Cambridge, UK: Cambridge University Press. ✗ The textbook won't be necessary. ✓ However, the course notes, which are available at the Co-op bookshop, will come in handy.
Lecture capture	None.
Year and semester reviewed	2014 Semester 2

Comments

This is a life insurance subject which essentially combines EPV and survival probabilities. Most calculations relate to calculating premiums and reserves.

Positive aspects

This subject has almost no theory; basically all questions are calculations. This may be a positive or negative aspect. It can make the subject repetitive but simpler to study for.

Combining EPV and survival probabilities gives the subject a more realistic feel, providing more of a purpose to the questions. It is also rewarding to combine your previous knowledge.

Negative aspects

The subject is very formulaic. Almost every question could be done with a formula. This can make the subject a bit dry and tedious at times.

The questions can be frustrating due to their length and the need for attention to detail. One simple mistake or oversight in lines of working can make your answer completely wrong. It is important to make sure every aspect of the question is addressed.

This review was previously published in the 2015 edition of the *Actuarial Students' Society Subject Review*.

Difficulty

This is definitely not an easy subject, as to be expected in third year. However, the categorisation as a double subject and overload of information in the first couple of weeks should not overwhelm you. There are probably a hundred or so formulas, but many of these are variations of the others and can be derived quite logically with little working. The trick is to think through the formulas and not simply memorise them all. If you have understood the previous actuarial subjects (mainly ACTL20001 *Financial Mathematics I*, ACTL20002 *Financial Mathematics II*, and ACTL30001 *Actuarial Modelling I*) and work hard then you will be fine.

The project is similar. It is difficult and you must work well with your group but it is not that hard to do well. Try to be on top of this as soon as it comes out. It does not take that long to answer but writing up the report will. Note that there are no lectures in the last two weeks for this subject so you should be able to organise yourself to have enough time.

Workload

As this is a double subject, the workload is quite high. Each tutorial is long and will take 2–3 hours to complete. It would be ideal to go over each tutorial after and continually revise the material as well. There is a lot of material to cover, so staying up to date is very important as the semester progresses.

ACTL30004 Actuarial Statistics

Exemption status	CT6 *Statistical Methods*, in conjunction with ACTL40002 *Risk Theory I*. Satisfactory performance in this subject's end-of-semester exam and a satisfactory final grade in ACTL40002 *Risk Theory I* are required.
Lecturer(s)	Dr Enrique Calderin
Weekly contact hours	2 × 1-hour lectures 1 × 1-hour tutorial
Assessments	2 group assignments 2 × 10% 2-hour end-of-semester exam 80% An additional 1-hour optional class test is held approximately four times during the semester.
Textbook recommendation	A workbook is available from the bookshop. This includes lecture notes, tutorial questions, progress check questions and a specimen exam. ✓ This workbook is inexpensive to purchase and is essential for the subject.
Lecture capture	None.
Year and semester reviewed	2014 Semester 2

Comments

Subject content

This subject covers the actuarial application of statistical models, particularly in a general insurance context. The course covers maximum likelihood estimation, generalised linear models, simulation, outstanding claims provisions, no-claim discount systems, and time series analysis. Use of R and Microsoft Excel is required for tutorial work and assignments.

Other remarks

This subject built upon knowledge from ACTL30002 *Actuarial Modelling II* and MAST20005 *Statistics* and also introduced a number of interesting actuarial techniques, mainly applicable in a general insurance context.

Tutorials were very helpful in consolidating our understanding of key concepts. There was also a good variety of tutorial problems to work through. Progress check questions included in the subject workbook and the additional class tests (held approximately four times during the semester) are useful self-assessment tools.

Assignments are in a group format; groups will be allocated by the lecturer. Questions will tend to include components that require the use of R and Excel.

Tutorial problems, progress check questions, class tests, and the specimen exam provided in the workbook cover a wide range of questions and are highly useful revision tools for the final examination.

This review was previously published in the 2015 edition of the *Actuarial Students' Society Subject Review*.

ACTL30005 Models for Insurance and Finance

Exemption status	Not an exemption subject, but is a prerequisite for ACTL40004 *Advanced Financial Mathematics I* and prepares students for ACTL40002 *Risk Theory I* (CT8 *Financial Economics* and CT6 *Statistical Methods* subjects respectively).
Lecturer(s)	Professor Daniel Dufresne
Weekly contact hours	3 × 1-hour lectures The final lecture is run like a tutorial where exercises are solved with the entire class.
Assessments	2 group assignments 2 × 10% 2-hour end-of-semester exam 80%
Textbook recommendation	There is no prescribed text for this subject. Lecture notes and exercises are provided weekly.
Lecture capture	None.
Year and semester reviewed	2014 Semester 2

Comments

Subject content

This subject aims to provide an introduction to the concepts that will be essential to understanding risk theory and derivative pricing. It covers some probability theory as well as an introduction to Brownian motion and stochastic calculus. Topics covered during the semester were:

- probability spaces, random variables, simulation, and expectations
- conditional expectations
- convergence in distribution and in probability
- random walks and mean reversion
- Brownian motion
- stochastic calculus
- martingales

Other remarks

This subject is one of the most conceptually demanding subjects in the Actuarial course. The lecturer, Daniel, is quite engaging which helps because the content is quite difficult. The lecture notes are presented in a manner which is quite unlike many other actuarial subjects because there is quite a bit of text included. The language and definitions are extremely important to grasp and understand from a very early stage.

The key to this subject is a thorough understanding of the material. You cannot simply rote-learn techniques as is the case with many other actuarial/maths subjects but you must have a deep understanding of the concepts. Once this happens,

This review was previously published in the 2015 edition of the *Actuarial Students' Society Subject Review*.

the problems become quite easy to solve but without this deep understanding it can be quite a difficult subject.

One issue with this subject is the lack of available questions to practise. There are not a lot of tutorial problems and in some weeks there are no tutorial problems at all because the lecture/tutorial is used to go through the assignment. Another issue is that the tutorial problems are not very similar to the exam questions; hence the practice exams are vital in terms of exam preparation.

Assignments are conducted in group format, where students can decide the groups. These assignments are similar to tutorials in the level of difficulty and are harder than the questions presented on the exam.

I would highly recommend forming a group to study together for this subject. Generally, Actuarial students don't prefer this, but it is highly beneficial to discuss the abstract concepts covered in this subject with someone else. This will be particularly necessary when preparing for the exam, because the lecturer doesn't make the practice exam solutions available for some reason.

ACTL30006 Financial Mathematics III (1)

Exemption status	CT8 *Financial Economics*, in conjunction with ACTL40004 *Advanced Financial Mathematics I*. Satisfactory performance in the end-of-semester exam of this subject and satisfactory performance in the mid-semester test and end-of-semester exam of ACTL40004 *Advanced Financial Mathematics I* are required.
Lecturer(s)	Dr Jane Paterson
Weekly contact hours	2 × 1-hour lectures 1 × 1-hour tutorial There is a rotational lecture every third week (i.e. Weeks 3, 6, 9, 12).
Assessments	Individual assignment, due in the mid-semester break 10% Individual assignment, due in Week 9 10% 2-hour end-of-semester exam 80%
Textbook recommendation	Joshi, M. S., & Paterson, J. M. (2013). *Introduction to Mathematical Portfolio Theory*. Cambridge, UK: Cambridge University Press. While the lectures follow the content in the book (almost exactly), it explains some of the concepts in different ways, which may help with your understanding. Additionally, almost all the tutorial problems are from the textbook, ✓ so it is essential that you own a copy (or have access to one).
Lecture capture	Full (both audio and video).
Year and semester reviewed	2016 Semester 1

Comments

True to its name, this subject has a lot of mathematics. That said, it arguably has the most theory out of all the third-year subjects. ACTL30006 Financial Mathematics III is one of the more challenging, but also rewarding, subjects of third year.

Subject content

This subject is all about different models for comparing investments. The course covers the derivations and/or motivations of each model through to their limitations. The topics can loosely be categorised as follows.

1. Modern Portfolio Theory (MPT) (Mean–Variance Analysis) — Lectures 1–9

   MPT from FNCE20001 *Business Finance* makes its return, but now with linear algebra. Given a covariance matrix of returns and the expected return vector, how would we find an efficient portfolio in the market? How about if we add a risk-free bond? These are the types of questions you will be expected to answer. This topic finishes with single- and multi-factor models as well as the Gram–Schmidt algorithm (which you may remember from your past studies).

2. Utility Theory — Lectures 10–15

This is familiar territory for those who have studied ECON20002 *Intermediate Microeconomics*. Mean–variance analysis only tells us which portfolios are worth investing in, not which ones we should invest in. Utility theory attempts to address that issue. You will cover risk aversion, quadratic utility, and the rational expectations theorem. Geometric mean and stochastic dominance closes the topic out, both of which are applications of utility theory.

3. CAPM — Lectures 16–17

   The capital asset pricing model says that the expected return of an asset is determined by its covariance with the market. Two-factor CAPM is covered shortly afterwards — a form of CAPM where there is no risk-free asset.

4. Arbitrage Pricing Theory — Lectures 18–19

   This portion of the subject attempts to price assets based on the principle of no arbitrage — the idea that there is no opportunity to make riskless profits.

5. Market Efficiency and Rationality — Lecture 20

   Up until now, assets have been assumed to be priced correctly (i.e. the market is efficient), but are they actually? This topic explores this idea.

6. VAR,and Stochastic Models for Stock Prices — Lectures 21–23

   The risk measure VAR (Value-at-Risk) is covered in the final part of the semester. The subject goes into its uses as well as some of its limitations. The subject concludes by jumping into some stochastic processes. A log-normal model for stock prices is touched upon before moving into AR(1), ARCH(1) and GARCH(1) processes, all of which contribute to the Wilkie model for investment returns.

It is important that you keep up each week, as the content in ACTL30006 Financial Mathematics III is immense.

Lectures

Jane delivers the content in an easy-to-understand way. The lectures follow the textbook almost exactly, though some topics are omitted. Slides are available in 3-week chunks (similar to its predecessor ACTL20002 *Financial Mathematics II*) throughout the semester. Whilst the slides do have some typos (especially towards the end), it is nothing too detrimental to your studies.

Every third week there was an additional lecture, which was used to address questions sent in to Jane or to cover some topics on a deeper level. For that reason, I recommend you attend these lectures. For example, Jane's notes and diagrams for weight spaces in particular was the turning point where everything about MPT clicked and made sense (to me at least), but your experience may vary.

The final lecture is used to go through exam problems. Additionally, Jane held a Q&A lecture during SWOTVAC, addressing any questions students had about the subject content. Some exam problems and explanations of challenging concepts were covered.

Tutorials

Tutorials covered select questions in the textbook. Your tutorial experience will ultimately depend on your tutor.

Occasionally, some additional exam-style problems are released, giving you a taste for the difficulty of the end-of-semester exam. These additional exam style problems were a leap above most questions in the book and really tested understanding rather than performing computations. Solutions for the additional problems are only provided in tutorials, so I highly recommend attending them.

Tutorials start in Week 2.

Assessments

The two individual assignments in this subject are very similar in style to those of ACTL20002 *Financial Mathematics II* — you are given a scenario in a firm and you are asked to produce an Excel model for said scenario. These assignments are one of the more practical assignments you will receive in the course and really help you develop your Excel skills. You are also given a second chance if you did not receive full marks for the assignment. However, your mark is then capped at 8 instead of 10 so you will still want to do well on your first attempt.

The exam is quite daunting, especially when listening to war stories from seniors. Jane likes to repeat that the questions on the exam will be very different to those in lectures and tutorials. This stresses the importance of understanding the concepts rather than relying on rote memorisation of formulae, as breaking one or two assumptions may make the standard algorithm fall apart. Generally, the exam consists of eight questions worth 10 marks each, regardless of how long they would take (i.e. one question might take 5 minutes with some clever thinking, while another question might take 20 minutes even though they are both worth 10 marks). You are given a myriad of past exams, but the style of each exam varies (only two of the four provided exams follow the eight-question format).

The 2016 paper was extremely long — no student (to my knowledge) finished all eight questions. Additionally, the exam was extremely computational in nature, requiring us to find the inverse of many matrices and compute tedious integrals. You may find that the questions cover cases you likely have not dealt with before (e.g. 2015 — finding the minimum-variance portfolio for a singular covariance matrix — or 2016 — choosing from a set of investments with a decreasing utility function). You should expect roughly 25% of the exam to be theory questions (e.g. explain the concept of such and such). You may or may not be expected to write an essay during your exam.

Tips for success

Before stepping into the subject, it will definitely be worth your time going through your notes for linear algebra from first-year mathematics. That way, you can focus more on applying those concepts rather than relearning them during the semester. Try to come up with ways to shorten your calculations through matrix multiplication instead (e.g. finding the returns and covariances of assets in a multi-factor model).

Overall, the subject is incredibly rewarding, albeit extremely tough and stressful. Just try to ignore the incredibly daunting exam (scaling also helps alleviate your worries).

ACTL30006 Financial Mathematics III (2)

Exemption status	CT8 *Financial Economics*, in conjunction with ACTL40004 *Advanced Financial Mathematics I*. Satisfactory performance in the end-of-semester exam of this subject and satisfactory performance in the mid-semester test and end-of-semester exam of ACTL40004 *Advanced Financial Mathematics I* are required.
Lecturer(s)	Dr Jane Paterson
Weekly contact hours	2 × 1-hour lectures 1 × 1-hour tutorial There is an additional lecture scheduled every three weeks.
Assessments	Individual assignment, due in the mid-semester break 10% Individual assignment, due in Week 9 10% 2-hour end-of-semester exam 80%
Textbook recommendation	Joshi, M. S., & Paterson, J. M. (2013). *Introduction to Mathematical Portfolio Theory*. Cambridge, UK: Cambridge University Press. This is very useful as it contains a healthy amount of exercises, some of which will be set as tutorial exercises. ✓ This textbook also contains useful derivations and explanations of mathematical concepts covered in lectures and is highly recommended.
Lecture capture	Full (both audio and video).
Year and semester reviewed	2016 Semester 1

Comments

Subject content

The main focus of this subject is modern portfolio theory: exploring different models, their assumptions, how they can describe how investors make their decisions, as well as critically evaluating the models. Some of the topics covered in this unit include the derivation and critique of the capital asset pricing model, expected utility theory, and using arbitrage pricing theory to find expected returns of portfolios, just to name a few. A full list of learning outcomes can be found in the University of Melbourne subject handbook entry for ACTL30006 Financial Mathematics III.

Lectures

Lecture slides are released in blocks of six lectures, which is a plus for those who want to have a quick read ahead just to have an idea of what topic is upcoming. Similar to the structure of ACTL20002 *Financial Mathematics II*, the slides themselves are skeletal, as the lectures are interactive by design. All of the missing proofs, derivations, and example exercises will be filled out in the lectures, with Dr Paterson providing very insightful and meticulous explanations with each step, as well as passing comments which can potentially be very helpful for the assignments and exams — so pay attention!

The content of FM3 is quite vast, with strong focus on both the theory and the computations, so it is important not to miss too many classes. Otherwise, catching up will be quite the challenge with so much to take in.

The extra lecture every three weeks is reserved for re-visiting topics which students are having trouble with. Make sure to request a topic to be covered via email if you are having any troubles, as Dr Paterson provides extremely good explanations and this is an opportunity you do not want to miss.

Some exam questions from past exams are thoroughly covered in the final lecture, providing students with invaluable exam skills and tips on how to perform well, so attendance is highly recommended, even if you do not want your practice exams to be spoiler-free.

Tutorials

Often set problems can be very computational and not mathematically challenging. However, the additional problems and the exploration of boundary conditions will certainly raise the difficulty and challenge of tutorials. Furthermore, tutorials are a great way to consolidate your understanding of the content you learnt in lectures, and they are the only time you will be able to get solutions to the challenging additional problems.

Assignments

Both assignments were individual spreadsheet projects which really test your understanding of the topics at an in-depth level. The topics covered in 2016 Semester 1 were the efficient frontier and expected utility theory. They are of a similar style to FM2 assignments, focussing on creating functional spreadsheets that can produce correct output for any acceptable inputs. These assignments combine the understanding of the content with application and are quite straightforward. However, you are usually required to also consider boundary conditions for full marks.

End-of-semester exam

A quarter of the exam will be theoretical, so it is important to take in everything during lectures and tutorials. One of the factors that contribute to FM3's difficulty is the vast amount of content that has to be learnt, as anything could appear in the two-hour exam. For two hours, it is generally considered a very lengthy exam too. However, with the right level of understanding, there is normally a succinct solution for each question, so it is by no means unfinishable.

Concluding remarks

Overall, FM3 provides a challenging but satisfying experience. Retaining knowledge from MAST10008 *Accelerated Mathematics 1*, MAST10009 *Accelerated Mathematics 2*, MAST20004 *Probability*, and MAST20005 *Statistics* will certainly be a big help. For a third-year actuarial subject, FM3 might seem relatively more theory-oriented, but despite this, it can still be just as, if not more difficult.

Honours-Year Subjects

ACTL40002 Risk Theory I

Exemption status	Completion of this subject and ACTL30004 *Actuarial Statistics* with satisfactory performance across both will lead to exemption from professional exam CT6 *Statistical Methods*. **NB:** Unlike previously, the mid-semester exam for ACTL40002 Risk Theory I will form part of the contribution to the exemption.
Lecturer(s)	Weeks 1–6 Professor David Dickson Weeks 7–12 Associate Professor Shuanming Li
Weekly contact hours	3 × 1-hour lectures
Assessments	50-minute mid-semester exam 20% 2-hour end-of-semester exam 80%
Textbook recommendation	Dickson, D. C. M. (2005). *Insurance Risk and Ruin*. Cambridge, UK: Cambridge University Press. Offers, alongside six tutorials and eleven problem sets, additional practice problems for the first three topics.
Lecture capture	None.
Year and semester reviewed	2015 Semester 1

Comments

Colloquially referred to as RT1, this subject will in almost every instance form part of the standard course of an Actuarial student. In essence, most, if not all, of RT1 focusses on applications of probability and statistics to actuarial science: in particular, claim distributions and claim frequencies. Previous success in the second-year mathematics subjects will be an advantage I think but the overall strength of one's mathematical ability might dictate how one performs here. It isn't spectacularly mathematical, in the sense that the concepts are not astronomically difficult to grasp, but it might be commonly regarded as such. An observation supporting this view is that proofs are, quite literally, scattered everywhere throughout the course.

Subject content

Six main topics are studied in RT1, to varying degrees of length. David will take the first two in the first six weeks and Shuanming will take the final four in the final six weeks.

- Probability distributions
- Collective risk model
- Individual risk model

This review was previously published in the 2016 start-of-year edition of the *Actuarial Students' Society Subject Review*.

- Bayesian statistics
- Credibility theory
- Ruin theory

Probability distributions First topic of the subject is essentially revision of basic probability. We revisit moment generating functions, probability generating functions, expectations, as well as important discrete and continuous distributions (all but the Weibull will be familiar). Overall, the new material really begins with the convolution distribution of identically distributed random variables, where we study (pardon the incoming jargon) the recursive method of deriving the probability mass function of the n-fold convolution of a discrete random variable with support on the non-negative integers with itself. Perhaps more important than the result itself is the proof; it will make **numerous** appearances in the subject (taking various forms) and it is crucial that you learn and become familiar with the reasoning behind the proof (it could be said that it amounts somewhat to algebraic manipulation of products of infinite sums). Methods of estimation are then briefly covered, adding a statistical element, but I would still argue that the majority of the topic is dedicated to the convolution recursion.

Collective risk model Following an extension of the above, we look at compound distributions; the n-fold convolution is the sum of n independent and identically distributed (IID in the sequel) random variables. In the case of compound distributions, n is not a fixed integer but is in itself also a random variable, usually denoted by N; this generalisation serves as a mathematical abstraction of general insurance where the number of claims over a period (say, a year) is a random variable and the size of each claim are IID copies of some random variable. (Strictly speaking, the n-fold convolution is a compound distribution, with the counting distribution, that is N, being the degenerate random variable at n, also known as the Dirac mass concentrated at n, but this is the trivial case.)

Having made that introduction into the basic idea at hand, I'll continue. Basic results of general compound distributions with arbitrary counting distributions are shown before we study the compound Poisson distribution, i.e. one in which the counting distribution is Poisson. It is studied rather heavily because it possesses some nice properties (e.g. convolutions of compound Poisson distributions are compound Poisson also). Moreover, recursion makes another appearance here (called the Panjer recursion), giving the probability mass function by way of recursion and allowing higher moments (you might have realised immediately that the first two moments are trivial by way of the law of iterated expectations and law of total variance) to be written down.

In the next and final subtopic, we look at certain classes of probability distributions with particular properties. Proofs dominate, and the number you will have to digest and memorise will be, I think, overwhelming. Recursions for these specific classes also exist and will be examined deeply; they all rely on the same concept, simply applied differently. From memory, you will be examined on material covered up to here for the mid-semester exam, but don't quote me on this! Next will be a brief discussion on approximations and parameter variability, the latter of which might be described as an application of the law of iterated expectations and law of total variance, conditioned on the (Poisson) parameter (hence its namesake). Overall, this topic is very interesting, in that it is somewhat surprising that such neat results exist for such a complex random variable.

Individual risk model It is possible to regard this as an extension of the previous topic, as it examines in detail the convolution of compound Bernoulli (not Binomial) distributions. Its namesake is therefore derived from the fact that the compound Bernoulli distribution can be thought of as the claim amount, if any, arising from an individual risk (with the Bernoulli distribution being an indicator random variable for the claim arising or not; different to the collective risk model where an individual risk may make multiple claims). Our formulation will therefore look at properties of this convolution (namely its expectation, variance, and moment generating function, which is trivial) as well as a rather involved recursion

(with its associated proof). Thankfully, the coverage on the individual risk model is rather short-lived with the majority being dedicated to the development of the recursion and the final part being a brief discussion of approximation methods.

Bayesian statistics Conditional probability is obviously the focus here, as Bayesian statistics should have already been covered (from memory, if the syllabus has not changed) in one or both of the second-year mathematics subjects or ACTL30004 *Actuarial Statistics*. We review some of the basic concepts and introduce numerous definitions, some of which may be familiar already. I think personally this topic serves as a reasonably in-depth review of Bayesian statistics, as it cites several examples throughout the topic and overall prepares you well for the upcoming topic. Something that would help here is understanding well the fundamental definitions, as the notation used in conditional probability and statistical estimation might be somewhat foreign after an extended break. Loss functions round up this topic, but it is comparatively gentle content — all it really says is that the point estimate using Bayesian statistics can vary depending on the loss function. That is to say, it is not always $\mathbb{E}[\theta|x]$, with θ the parameter.

Credibility theory Fifth in the semester, this topic is perhaps the second 'large' topic, after the collective risk model. In short, we learn to adjust a future premium or a parameter based on the claim experience. From this definition, the reasoning behind a review into the underlying principles of Bayesian statistics should be obvious. Personally, I think that in approaching this topic, one should be aware of the overlapping terminology; the word 'credibility' is thrown around a lot and it appears in a number of definitions, so you should be critically aware of how to identify the differences in the definitions (for instance, of the Bayesian and credibility premiums, or of the Bayesian premium and the Bayesian estimate). I would imagine that, for most, the algebra behind the mathematics is reasonably doable and should not be too onerous; however, the same cannot be said for the notation and the definitions. Before the topic delves into a serious exploration of what is known as the Empirical Bayesian Credibility Theory (referred to as EBCT hereafter) models, it looks at a particular application of the initial development of the theory and gives some propositions and theorems, but this should not prove too difficult to grasp.

Perhaps the most frustrating topic in the second half of the semester is the first EBCT model; it has numerous assumptions and the notation can be really quite complex (some definitions are expectations and variances of particular functions of or conditional on some unknown parameter. Such issues are complicated by the fact that the notation plays an important role in the first EBCT model and it will be crucial in order to manipulate the algebra coherently and to perform computations for your own practice and the end-of-semester exam. Essentially, the EBCT models are a formulation that generates a credibility premium (as distinct from the Bayesian premium) given a sequence of random variables representing past claims. Several results are presented including the main result — the credibility premium itself — with their accompanying proofs (which should be memorised if not for the off-chance it appears in the exam but at the very least to understand methods of proof in this topic). More results are presented that I cannot possibly begin to list, but hopefully the practice problems that will be given to you should help consolidate some of the concepts encountered.

Unfortunately, the onslaught does not stop here. Occasionally you will be given a model and therefore be able to determine several important quantities analytically, but in the cases where such information is unavailable, you will be tasked with estimating these quantities. I think, however, the cases in which one or the other method is required is quite obvious from the information presented, so there should not be too much sleep lost over that. However, just as estimation of the variance of a sequence of Gaussian observations requires memorising the appropriate formula, the estimation here also is accompanied not only by notation, but formulae that are derived using the notation. Two of the estimators will be 'obvious', but one will require making a slight bias correction. Be prepared to perform computations, in memorising proof or otherwise. For instance, some of the proofs are reminiscent of proving that the previously mentioned variance estimator with denominator N is biased, albeit of higher difficulty.

Finally, the topic looks at a second and thankfully final EBCT model, which relaxes a few assumptions but introduces a

weighting system and it is a generalisation of the first EBCT model. I think by now, while the proof will still be difficult to initially digest, the basic underlying theory of the second EBCT model should be very familiar, especially after immediately studying the first EBCT model. Indeed, most of the results are obvious analogues that have been adjusted for the weighting system, although I will admit that the way in which they change might not be regarded as obvious. I will not go into too much depth here because much of what needs to be discussed has already been said in examining the first EBCT model, but I will mention that you should be prepared to memorise more formulae and that the application of the model is slightly different due to the implementation of a weighting system. I will give my concluding thoughts; while the numerical complexity of the second EBCT model is far greater than that which could be reasonably expected in an end-of-semester exam, I think that this does not preclude the possible appearance of a question either demanding a certain proof or application of the model given summary quantities (by this, I mean for example being given the sum of a finite sequence so that you do not bear the time-consuming and tedious burden of manually computing the sum yourself) that can be used to answer questions.

Ruin theory Concluding the subject is a brief overview of ruin theory. I note that the discussion here is rather brief; at least in my year ruin theory only managed 3 or 4 lectures of discussion (actually, we might have been behind since a review lecture was scrapped). It takes a stochastic approach to the collective risk model; rather than have a counting random variable that counts the number of claims over a given period of time, say N, we have instead a counting **process**, say $N(t)$, that counts the number of claims over the time period $[0, t]$. Naturally, this extension allows us to generalise the collective risk model to be a stochastic process. Risk theory then takes the following approach: if this stochastic process, call it the aggregate claims process, is the total amount claimed over some time period, then we can introduce a surplus process, which describes the surplus of an insurer (with some initial surplus) as it evolves throughout time with the injection of premiums (theoretically a stochastic process per se, but usually simplified to be a constant rate per unit time) and the ejection of aggregate claims. Ultimately we are interested in, as the name suggests, the probability of ruin — i.e. the probability of the surplus of the insurer becoming negative.

From memory, there is a brief introduction into the (homogeneous) Poisson process, which should have been studied already in ACTL30001 *Actuarial Modelling I*; the enthusiastic might already remember all three constructions of the Poisson process and their associated proofs of mutual equivalence. We then formalise some definitions mentioned in the paragraph above in a general fashion, and in particular we give the ruin probability as well as numerous other interesting quantities. Possibly because ruin theory in academic circles is almost certainly more sophisticated than it is presented to us here, much of the material here will be definitions, remarks, and properties of the model.

Notably, there are two proofs: the first is an inequality relating the ruin probability to the initial surplus and some constant and the second is the existence of said constant as the unique positive solution to a particular equation. It is not all too complex (it involves induction, by the way), and the foray into ruin theory is overall quite brief and sparse. (Caveat: this may or may not depend on the amount of time that is available to this final topic; lecture slides beyond this proof existed but were not covered, ostensibly due to time constraints.)

Overall For those uninterested in reading the nitty gritty, I will give some summarising thoughts on the content covered in RT1 here. For most, this subject might give you the most trouble in your honours or masters year due to the mathematical nature of the problems. Multitudes of definitions and, more annoyingly, proofs are thrust upon you and for the most part you will necessarily remember these, as techniques present in the proofs occasionally recur throughout the subject (most noticeable in the proofs). Being comfortable with algebraic manipulation of certain expressions will be extremely helpful in this subject I think, since a number of proofs essentially amount to this. I think that, while the material will initially seem very dense, you should find respite in the fact that a comparatively large proportion of the material is dedicated to proofs.

From experience, the review (first and fourth) topics should not pose too much problems. However, the material present in the second and third topics is very closely interrelated and this lends itself to a vast variety of questions you might face,

while the material in the fifth and sixth topics is a bit more insular. I would imagine for most that there is a lot of memory work involved in the revision of this subject, and indeed there needs to not only be understanding of the preliminary and main results but also of their assumptions and proofs. As a caveat, the assumptions are important because you might be faced with a situation where you are unsure of the result(s) to draw upon. Some of the material should be familiar, which is why I mentioned earlier that strong foundations in the second-year mathematics subjects would be helpful (for instance, in the computation of integrals or point estimates). Nevertheless, the sheer amount of content covered in this subject should not be too daunting, given that it is an fourth-year exemption subject.

Lectures

Every week, there are 3 $\times$ 60-minute lectures with no tutorials, as per usual for a fourth-year actuarial subject. However, from memory, every second week will be dedicated to the giving of solutions to a tutorial set (there are 6 tutorials in all, with 11 additional problem sets that are not covered in class). From memory (again), said solutions to both tutorial sets and problem sets are posted on the LMS after some delay, so these classes are strictly speaking, unnecessary. If, however, you enjoy the structure of tutorials, then it obviously might be of benefit to you. As a precaution however, be prepared for a possibly abhorrent timetable for your fourth year; not only will you probably see obligatory 5–6-hour breaks due to RT1 and ACTL40004 *Advanced Financial Mathematics I* lectures usually scheduled before noon and ACTL40006 *Actuarial Practice and Control I* being scheduled on Tuesdays and Thursdays from 4:15–6:15pm, but you might also find yourself with a single RT1 class on some random day in between. I mention this only because while you might endeavour to attend every class, the possibility of your lecture being scheduled poorly (ahem, Wednesday 9am with nothing else) might be a significant deterrent.

Expect a reasonably small class size, ranging from 20–50 students, roughly speaking. From experience, you will probably become close with your classmates (and I strongly urge you to do so as it makes fourth year all that more tolerable), but this might not happen quickly enough for lectures to be a bit more interactive and for the atmosphere to soften. Nevertheless, you might find yourself more confident in responding to lecturer's prompts and asking questions during tutorial time, which you should do. I have the faint suspicion that, as an exemption subject and as by fourth year you are probably cognizant of mark scaling, people are more reserved in class, since they view others as competition which may affect the mark scaling. I hope for the most part that this does not deter people, because quite frankly the material is difficult enough and the burdens borne are so great in the first semester (subject revisions, projects, assignments, graduate program applications/interviews, and whatever social life you've managed to preserve up to now) that being able to mutually help one another is usually in your best interest (as they say, teaching is the best way of learning).

NB: the absence of lecture capture means that you should skip class at your own peril. While you might be able to mitigate some of the problems with truancy by relying on your friend's or friends' notes, this obviously is no substitute for actually being in class and, say, writing down the proof line by line with the lecturer guiding you and describing the rationale behind each step. I'm personally a bit biased on this issue because I think that you should practise attendance whenever possible, but in this particular case I recommend it highly simply because lecture capture is unavailable and you will not as easily understand the logic behind the results, proofs, nor examples, without the assistance of the lecturer.

Mid-semester exam

In 2015, the mid-semester exam covered material up to and including the fifth week and its date fell in the first class of the seventh week. While it is not overly difficult, as per most mid-semester exams, it will be stressful revision because of all the other responsibilities you will inevitably have. Use the available material — the recommended text, tutorial and problem sets — to your advantage, but do not rely on the mid-semester exam being similar. Indeed, while the questions that the

2015 cohort faced were not strictly speaking all that difficult, the variation in the style of questions was sufficient to pave way for an average below 40% and marks ranging from barely being above 0 to barely being a H1.

In defence of the mid-semester exam, there were a few textbook questions and it was for the most part quite accessible to the diligent student. Calculators played a minor role in that there was, I think, one question that mandated a numerical answer, which therefore implies that the majority of the exam demanded answers in analytic and symbolic form. Being familiar with the techniques you encounter in class will be **extremely helpful**; at least it was the case for the 2015 mid-semester exam. That said, I do not want to pigeonhole expectations of the mid-semester too much, as the vastness and richness of the content covered in the first five weeks lends itself to a wide variety of plausible questions.

End-of-semester exam

I will make a brief note of the scaling in 2015; it was upwards by a moderate amount, suggesting the exam was more difficult than average. If I recall, the calculator was used somewhat often, although thankfully analytic expressions dominated the exam. As with all exams, the scope of the exam was parallel to the coverage of the content throughout the semester. By this, I mean that all topics were covered to an extent proportional to the amount of time dedicated to their study.

To begin, there is a reasonable amount of proof throughout the exam (for instance, one question consisted entirely of proofs, although they were textbook) but overall with an emphasis (I feel) on analytic results. Overall, the exam performance was apparently poor (that's an understatement). Truthfully, however, I feel that six of the seven questions that appeared in the 2015 paper were slight variations of practice problems appearing elsewhere which, with proper thought and care, any well-prepared student could answer. If I may give any sentiments on the exam, the questions, except perhaps one, were **doable**. It might be own taste, but any question which is doable is, by my personal standards, fair game in the exam. Indeed, looking back, the questions — which covered pretty much everything from the second topic onwards — were not all that straightforward, but by no stretch of the imagination could one say that they were unreasonably hard. I would think that as an exemption and fourth-year subject, the questions were rightfully testing. I personally think, however, that there was a single question which should never see the light of day in another exam for posterity, only because the algebra was incredibly tedious. Going home and attempting it on Mathematica, I found that the problem involved a seventh order polynomial with two roots, one with multiplicity six and the other being the unique positive solution (assuming I did it right). I do not know what will become of the question in the future and whether my sentiments are objectively correct (i.e. whether the lecturer(s) agree that it was algebraically frustrating), but if anything I think it serves as a potent reminder for just how computational this subject can be. While I do not think it is the intention of the lecturers to test our understanding by asking us to sift through and manipulate lines upon lines of algebra or use the calculator excessively, it is inevitable that algebra and numerical computation appear in this exam. I think it is therefore prudent to prepare for both, whether the question is seeking for a result, a proof, a number, a verification, et cetera.

NB: In defence of the cohort, while the question which I felt was unreasonable could have been left to last with prudent use of reading time (which is obviously important), the methodology that would have been used to solve the question was comparatively simple and I do not think it possible for the typical student to have the foresight to see that the algebra would be devastatingly time-consuming.

Concluding thoughts

Despite the challenges that I personally faced in this subject, I certainly enjoyed it. Sure, there is increased pressure because it is an exemption subject, but it is also an exemplar of the mathematics that probably attracted many students

to the course. I think that the results are rather deep given that it is intended to serve as a foray into the applications of probability and statistics in insurance.

Admittedly, the material and the exams can be quite daunting. However, take comfort in the fact that you have great lecturers and a comparatively large number of practice problems to develop your skills and cement your understandings. Even though there is a large amount of memorisation that you should be prepared for, this is not advisable without the requisite understanding. After all, I would imagine it would be a godsend for questions in the exam to be carbon copies of those encountered in practice problems or request exact replicas of the proofs that appear in the lecture slides. Thus, if you are prepared for some variation in the questions you will encounter in your examinations and adapt your understanding to the problem appropriately, I think you should do fine.

Finally, I hope you enjoy this subject — it might be one of the last quantitative actuarial subject you study as you might find yourself in a second semester with, for better or worse, little to no mathematics. It is also a good time to make some friendships with the cohort whittled down to a smaller size; certainly this was the case for me. I think that, while it will be a difficult road to finish the final two exemptions, it will be a satisfying challenge. Good luck — for this fourth year and thereafter.

ACTL40004 Advanced Financial Mathematics I (1)

Exemption status	CT8 *Financial Economics*, in conjunction with ACTL30006 *Financial Mathematics III*. Satisfactory performance in the mid-semester test and end-of-semester exam of this subject and satisfactory performance in the end-of-semester exam of ACTL30006 *Financial Mathematics III* are required.
Lecturer(s)	Dr Zhuo Jin
Weekly contact hours	2 × 1.5-hour lectures
Assessments	Individual assignment 10% 1-hour mid-semester test 20% 2-hour end-of-semester exam 70%
Textbook recommendation	✓ The subject notes are the only essential textbook. Joshi, M. S. (2008). *The Concepts and Practice of Mathematical Finance* (2nd ed.). Cambridge, UK: Cambridge University Press. ✗ This is not essential at all. It is needed for ACTL40008 *Advanced Financial Mathematics II*, so if you know you will do AFM2 then buy it.
Lecture capture	None.
Year and semester reviewed	2015 Semester 1

Comments

Subject content

Largely consists of derivative calculations and related proofs and derivations. Major areas include European and American call and put options, forward contracts, binomial trees, interest rate derivatives, arbitrage pricing, Black–Scholes formula, and Itô calculus.

Other remarks

Overall, AFM1 is a challenging subject and one where some concepts will take time and effort to understand to a satisfactory level. It is more challenging for some students than others, and this will depend on your preference to different types of maths. The underlying concepts are largely related to what was learnt in ACTL30005 *Models for Insurance and Finance*, so a solid understanding of this material will give a good base. If you enjoyed Brownian Motion then this subject will likely be more to your liking. The real challenge is the last half of the course (and particularly the last few weeks), so try to stay on top of things as the semester rolls on.

The subject is delivered similarly to previous FM subjects, going relatively quickly through slides each lecture. This can be hard to follow at times, but just try to take in as much as possible and review the material after to gain a proper

This review was previously published in the 2016 start-of-year edition of the *Actuarial Students' Society Subject Review*.

understanding. One difference is there are no longer tutorials. There are still weekly questions, but these are instead gone through by the lecturer each week at the end of the second lecture. This works well; try to at least attempt the questions before class as this will increase the effectiveness greatly.

My main piece of advice would be to properly learn the material. By this I mean actually learn how everything works and understand it instead of simply being able to reproduce the tutorial questions. The exam will likely have questions that are different to those you have seen throughout the subject and which will require a deeper level of understanding than most tutorial questions. Try not to just rote-learn things.

ACTL40004 Advanced Financial Mathematics I (2)

Exemption status	CT8 *Financial Economics*, in conjunction with ACTL30006 *Financial Mathematics III*. Satisfactory performance in the mid-semester test and end-of-semester exam of this subject and satisfactory performance in the end-of-semester exam of ACTL30006 *Financial Mathematics III* are required.
Lecturer(s)	Dr Zhuo Jin
Weekly contact hours	2 × 1.5-hour lectures
Assessments	Individual assignment, due around Week 11 10% 1-hour mid-semester test in Week 7 20% 2-hour end-of-semester exam 70%
Textbook recommendation	The lecture notes are sufficient. Joshi, M. S. (2008). *The Concepts and Practice of Mathematical Finance* (2nd ed.). Cambridge, UK: Cambridge University Press. ✗ This is not essential at all. The lectures don't really follow the textbook exactly so it can be hard to match up the textbook with lecture content. However, if you really like financial maths and want some extra fun bedtime readings then feel free to buy. It is needed for ACTL40008 *Advanced Financial Mathematics II*, so if you know you will do AFM2 then buy it.
Lecture capture	Full (both audio and video). However, tutorial problems are often done on the whiteboards in class so don't get captured.
Year and semester reviewed	2016 Semester 1

Comments

Subject content

This subject focusses on the pricing of derivative securities and is very theoretical. The topics covered are roughly:

- binomial model (4 lectures)
- martingales, Brownian motion, and stochastic calculus (6 lectures)
- Black–Scholes model (6 lectures)
- interest rate and credit models (5 lectures)

Do not fear if you have not done FNCE30007 *Derivative Securities* for that subject is only really relevant for the first two lectures, the two easiest lectures of this subject. It would be better to pay greater attention to ACTL30005 *Models for Insurance and Finance*, for what is covered in MIF is essentially covered in six lectures in AFM1 in a lot less detail, so a solid prior understanding of the content will make AFM1 a lot less of a hectic experience (which it was for *Master of Actuarial Science* students who unfortunately do not get to take MIF).

Lectures

The lecture slides in this subject tend to be long and dense, and lectures can often leave you very confused. However, personally, I find that every time I read the lecture slides, I pick up on something new that I didn't notice or fully understand the first time around, and I think a lot of the subject is like that. Everything always seems like just a blur to begin with, and you feel overwhelmed by the theoretical nature of most lectures, but when you start to revise your notes and slides, things gradually fall into place. AFM1 is really just a subject that takes a lot of time and patience.

The content of the subject tends to be very well ordered. The first few weeks shouldn't be too bad, but the subject content does tend to get more and more difficult as the semester progresses. The last few lectures on interest rate and credit models are quite long and difficult. Maybe it was because I was already tired by then, but the content in the last few lectures seemed to be a lot harder to process than the rest of the semester.

Tutorials

There are no more tutorials when you reach Honours. Instead, occasionally when some of the lectures aren't that long, some time at the end of a lecture will be dedicated towards working through tutorial problems.

At the end of each set of lecture slides, there is a slide for theory problems as well as usually two or three slides of more exam-like general problems.

The theory questions include things like "Define geometric Brownian motion" or "What does it mean for a model to be complete?" Personally, I found the theory problems quite useful in testing whether or not I had fully understood the content of the lecture, and for those who like to make notes, they give good prompts for key points to have in your notes.

The general problems vary greatly in difficulty. Some are nice and easy number-crunching exercises, which can be tedious but generally shouldn't present any major issues. On the other hand, there are some problems that really test your understanding of the subject and, as is always the case in actuarial subjects, the answer is always a lot simpler than you expect but you constantly question how anyone would be able to think of such a solution in an exam situation. Solutions to the problems are provided at the end of each week. However, the solutions for some questions can be quite brief and skip a lot of intermediate steps, so if you have any doubts about a solution, make sure you ask the lecturer or a friend.

Assignments

There was just one assignment for this subject and, as with all financial maths subjects, it was completed using Excel. For our assignment, we had to use Excel (and we were allowed to use VBA for once) to price European options, American options, and barrier options using both tree methods and the Black–Scholes equation.

If you aren't familiar with VBA, it might take a while to get familiar with how the coding works within Excel. However, overall, the assignment isn't overly difficult and most students scored well for the assignment.

Mid-semester test

The mid-semester test was held during the second lecture of Week 7 in 2016. It covered all content up until the end of Lecture 10 (binomial trees, martingales, Brownian motion, and stochastic calculus). In 2016, it happened to be in the same week as the ACTL40002 *Risk Theory I* mid-semester test as well as the due date of the draft report for ACTL40006

Actuarial Practice and Control I. Therefore, it was a very busy period and starting your preparations for the mid-semester test well in advance is definitely a good idea.

One specimen mid-semester test was provided in preparation for the mid-semester test, but looking at some CT8 papers may also be helpful for preparation. In general, CT8 papers and AFM1 papers are not very similar, the latter being far less predictable. However, for additional practice on some of the basic concepts like binomial tree pricing, then the CT8 papers can be quite a good resource.

Overall, the mid-semester exam in 2016 wasn't too bad, with the average mark being 15.8/20 and the median mark being 17/20. Questions ranged from pricing a barrier option, solving a stochastic differential equation using integrating factors, computing probabilities involving Brownian motion, and definition questions.

End-of-semester exam

In preparation for the final exam, two specimen exams were provided in 2016. However, as with all actuarial subjects, what you will end up getting in your final exam can be very unpredictable. Don't expect it to resemble the tutorial problems very much.

There was one nice straightforward question of pricing an American put in the 2016 exam, which you should be very familiar with. Otherwise, most of the other questions would be ones you have not seen asked in the exact same way at any point during the semester. This does not mean you should freak out. Whilst they may not seem familiar, they will obviously be questions that can be answered using the content you have studied during the semester. My personal advice for tackling seemingly unfamiliar problems is to think about what information they have given to you. For example, if they have given you volatility then that would suggest that Black's formula may need to come into play. Indeed, there was a question in the 2016 paper that involved the pricing of an option on a bond which was quite challenging, largely because you would never have seen a question like that during the semester.

Concluding remarks

People tend to say that AFM1 is the hardest of all the actuarial subjects and, indeed, I would probably agree with those people. The calculations themselves are usually not as tedious and difficult as they might be in subjects like *Risk Theory I*. However, fully grasping a theoretical understanding of the subject is definitely the biggest challenge in AFM1. Nevertheless, it is again another subject that nicely highlights how all the mathematical tools you have learnt along your actuarial journey can be applied in a practical sense.

ACTL40006 Actuarial Practice and Control I (1)

Exemption status	Part IIA *The Actuarial Control Cycle* and Part IIB *Investment and Asset Modelling*, in conjunction with ACTL40007 *Actuarial Practice and Control II* and ACTL40009 *Actuarial Practice and Control III*. Satisfactory performance in all three subjects' end-of-semester exams will lead to exemption from both Part IIA and Part IIB.
Lecturer(s)	Mr David Heath Mr Andrew Brown Mr Donald Campbell
Weekly contact hours	2 × 2-hour lectures
Assessments	Group assignment 30% 3-hour open-book end-of-semester exam 70%
Textbook recommendation	Bellis, C., Lyon, R., Klugman, S., & Shepherd, J. (Eds.). (2010). *Understanding Actuarial Management: the actuarial control cycle* (2nd ed.). Sydney, AU: The Institute of Actuaries of Australia. If you want, you can purchase the subject textbook (used for ACTL40007 *Actuarial Practice and Control II* as well), ✗ but it is unnecessary, and I would suggest not buying it.
Lecture capture	Full (both audio and video).
Year and semester reviewed	2015 Semester 1

Comments

Subject content

There are three main areas of study — general insurance, life insurance, and superannuation. There are also two additional lectures about investments. A broad range of topics are covered — some specific to one of the three areas and others not. These include pricing products, reinsurance, control cycle, professionalism, and risk framework and modelling.

Other remarks

You will be told multiple times that this subject is completely different to any other actuarial subject you have done. This is correct and the most challenging aspect for many students. You basically do not need a calculator; the subject is not about maths but rather about theory and the thought process behind decision-making. However, this shouldn't discourage students. It simply requires an adjustment in perspective and study strategy.

This is a subject where rote-learning will definitely not work or, at the very least, be highly inefficient and waste a lot of time.

The subject is delivered entirely in lectures — no tutorials. There is also a rotation of lecturers, the three main ones focussing on general insurance, life insurance, and superannuation respectively. This adds some variety, which is good. They are all quite good lecturers and are experts in the industry so are very knowledgeable. The creates the perspective

This review was previously published in the 2016 start-of-year edition of the *Actuarial Students' Society Subject Review*.

in the subject of working in the industry, which is a nice change and good, considering most in attendance will soon be working.

Approach the subject with an open mind and try to see the new type of subject as a challenge. Throughout the semester it will be difficult to know how to study. I would recommend attending lectures and answering/asking questions as much as possible. The lecturers will answer anything and would rather you ask a bad question than stay silent; don't be shy. Discussion during lectures will help you learn the material. At the start of the semester you should go through the "fundamentals" documents, which outline the industries and their various products. Knowing how the products work goes a long way to understanding the concepts studied throughout the subject.

At the end of the semester (or throughout), it is a good idea to make notes for the entire subject. I would recommend trying to make them organised and relatively concise. Don't just copy down the lecture slides. This is useful as a form of revision and also to take into the exam, which is open book. However, try not to be too reliant on notes during the exam.

Overall, I found this subject enjoyable and interesting, largely due to the new material not previously covered. While a lot of students find the theoretical aspect quite difficult, it is not an inherently difficult subject. The material itself is quite manageable.

ACTL40006 Actuarial Practice and Control I (2)

Exemption status	Part IIA *The Actuarial Control Cycle* and Part IIB *Investment and Asset Modelling*, in conjunction with ACTL40007 *Actuarial Practice and Control II* and ACTL40009 *Actuarial Practice and Control III*. Satisfactory performance in all three subjects' end-of-semester exams will lead to exemption from both Part IIA and Part IIB.
Lecturer(s)	Mr David Heath — Subject coordinator; general insurance Mr Andrew Brown — Life Insurance Mr Donald Campbell — Superannuation Mr Daniel Craine — Investments
Weekly contact hours	2 × 2-hour lectures
Assessments	Group assignment — 30% 3-hour open-book end-of-semester exam — 70%
Textbook recommendation	Bellis, C., Lyon, R., Klugman, S., & Shepherd, J. (Eds.). (2010). *Understanding Actuarial Management: the actuarial control cycle* (2nd ed.). Sydney, AU: The Institute of Actuaries of Australia. The textbook is used for ACTL40007 *Actuarial Practice and Control II* as well but ✗ is not really necessary.
Lecture capture	Full (both audio and video). It has to be recorded, because there are distance education students. However, often the lectures go over time, so the ends of some lectures get cut off.
Year and semester reviewed	2016 Semester 1

Comments

Subject content

Just in case you somehow haven't heard of it yet, ACTL40006 Actuarial Practice and Control I is very different to any other actuarial subject you have done. You can pretty much say farewell to your calculator, and Google will become your new best friend.

The topics covered can roughly be summarised as:

- the actuarial control cycle,
- professionalism,
- the need and impact of regulation,
- the impact of environment on commercial decisions,
- risks of financial products,
- enterprise risk management and risk assessment frameworks,
- product features and design, and
- appropriateness of models.

Each of these topics will be considered in relation to general insurance, life insurance, and superannuation. In addition, there are two lectures that cover some of the basics of investments.

Lectures

The three main lecturers (David Heath, Andrew Brown, and Donald Campbell) rotate throughout the semester according to their own availabilities, so you will find that the order of the content will jump around quite a lot. However, each lecturer is a practising actuary, and together they bring a wealth of commercial knowledge and know all the nitty gritty details of the industry they work in.

Lectures are aimed to be discussion-like in nature, and certainly some of the lecturers encourage discussion a lot more than others. Therefore, it is a subject where question-asking is most welcomed. I think the risk of being picked on to answer a question during class scared some students away from attending lectures and lecture sizes did become very small (around seven students) at some point during the semester.

However, I would really encourage participation in lectures. The lecturers are all really friendly. Also, although the lecturers aim to repeat the comments and questions that students at the lecture make into the microphone so that people listening at home can hear them, there are inevitably still times when they forget to do so and you may miss out on some useful information if you don't rock up.

At the start of semester, David Heath will also emphasise repeatedly the importance of going through the information posted in the fundamentals documents that he uploads. As the semester progresses, you will come to realise just how little you actually do know about the insurance and superannuation industries, so I would recommend doing what he says. Also, at any point when the lecturer brings up some term or some concept you have never heard of, make a note somewhere to Google it or ask the lecturer directly. Knowing how the insurance and superannuation industries operate will greatly assist your understanding of the content in this subject.

Tutorials

There aren't really many tutorials in this subject. I think we had about two or three lectures where we went through some tutorial problems. However, these lectures are probably the most useful, especially if doing well in the exam is your main aim. In these tutorials, the lecturers often give a lot of exam tips and insight into how they mark exams and what sorts of answers are actually worth marks in the exam.

Indeed, for much of the semester, you will find yourself wondering how any of this content will ever be examined, because a lot of it will seem like common sense. The tutorials are very useful in giving you an idea of what sorts of questions you may be asked in the exam as well as what sorts of answers are appropriate. The lecturers usually upload brief outlines of solutions to these tutorial problems, but they are usually very sketchy and not in very much detail, so I would recommend making your own notes too.

Assignments

There is one large assignment for this subject. However, it will be submitted in three parts — a scope letter, a draft report, and a final report. The groups will be assigned and usually consist of around four or five people.

The aim of the assignment is to demonstrate the way that real consulting projects are carried out; that being first confirming the scope of the project, then providing a draft report, and then making amendments to the draft based on the feedback provided from the draft report.

Our assignment was on the financial planning industry and required us to explain to the company certain mortality phenomena and how they would impact the company's operations. As part of the assignment, we were also required to produce a newsletter that the company could send out to their clients.

In terms of doing well in the assignment, the most important thing to keep in mind would be who your audience is and in what tone or level of detail you should be writing your report. Also, for the marking of the final report, a lot of weight is placed on how comprehensively you responded to the feedback from the draft report in the final report, so make sure you address every piece of feedback.

End-of-semester exam

The exam is an open-book exam — a very strange feeling for an Actuarial student. The only thing you can't take into the exam is dictionaries, so you can go all out and bring in the textbook, lecture slides, your own personal notes, and, as David Heath jokingly mentioned, even a magazine in case you finish early and get bored. As such, I think one of the biggest challenges to the subject is working out how to study effectively since your studying no longer involves cramming information into your brain.

I would strongly recommend spending time making notes for the subject that you can take into the exam. It is a good way of revising the content from lectures, and it is always easier to find the information you need during the exam when you have made the notes yourself. You will find that for many of the lecturers, their lecture slides only have very brief dot points, so without annotations or other notes, looking at the slides won't be of much help. Therefore, if you see anything on any slides that you don't understand, then you should Google it or ask the lecturer for clarification.

At the end of semester, we were provided with one practice paper with solutions, which gave a very good indication of the style of questions to expect. Questions that will often be asked include:

- What are the risks of this product/situation?
- What are ways of dealing with the risks?
- What are the professional issues in this situation?
- What are some of the design issues with this product?

In many questions, you will also be asked to draft a response to someone, in which case it is always nice to format it like a letter. However, David Heath will also strongly emphasise that you should do dot points in almost all questions. This will help stop you from waffling on too much and also makes it easier for them to mark.

The one thing about the exam that was strange is the way the multiple-choice is done. For each multiple-choice question, there are five options. However, there could be 0, 1, 2, 3, 4 or even all 5 correct — it is essentially five true–false questions combined, and you will only get the mark for the question if you decide correctly for all five options. Therefore, if you circle one incorrect answer, you get 0. If you miss out on one correct answer, you get 0. I found many of the multiple-choice questions to be quite brutal, because they really test whether you fully understand the material.

Exemption procedure

For each of the Part II subjects (APC1, APC2, and APC3), an exemption list will be published online after the results are released (http://fbe.unimelb.edu.au/economics/ACT/courses/exemption_information).

For each exam, a certain mark will be deemed the appropriate "pass" mark. Each candidate is then given a score relative to this pass mark — a positive mark means you scored higher than the pass mark, and a negative score means you scored lower. After completing the three APC subjects, if your total score is positive, then you will receive the exemption for Part II.

Concluding remarks

David Heath will often tell you that when deciding whether or not to pass someone, they will often ask themselves, "Would I want to work with this person?" Indeed, the APC subjects are designed to help you to think in a more commercial and practical sense to prepare you for the big scary adult world. Whilst it won't be tested, I personally would recommend beginning to read any news related to the actuarial profession if you don't do so already, as it will make the knowledge learnt in this subject more meaningful and hopefully provide greater motivation to study.

ACTL40008 Advanced Financial Mathematics II

Exemption status	N/A; this subject does not constitute any exemption requirement but is instead an elective upon satisfactory completion of ACTL40004 *Advanced Financial Mathematics I* (which comprises part of the exemption requirement for CT8 *Financial Economics*).
Lecturer(s)	• Professor Mark Joshi • Professor Daniel Dufresne In 2015, the lecturer was Professor Mark Joshi. **NB:** I do not mean to say that both lecturers teach simultaneously, but rather that one of these two lecturers will teach the entire semester.
Weekly contact hours	2 × 1.5-hour lectures
Assessments	50-minute mid-semester exam 20% 2-hour end-of-semester exam 80%
Textbook recommendation	Joshi, M. S. (2008). *The Concepts and Practice of Mathematical Finance* (2nd ed.). Cambridge, UK: Cambridge University Press.
Lecture capture	Full (both audio and video).
Year and semester reviewed	2015 Semester 2

Comments

Before anything else, I firstly wish to make the remark that the recommended texts and the availability of lecture capture will presumably depend on the lecturer. Naturally, the same applies for the content and/or structure of the subject.

By now, you are most likely aware that this subject is the final subject in the *Financial Mathematics* pentalogy. Notably however, the material in ACTL40008 Advanced Financial Mathematics II (AFM2) is *very* different from that encountered in the first three subjects. Using the material taught in ACTL40004 *Advanced Financial Mathematics I* and ACTL30005 *Models for Insurance and Finance* (AFM1 and MIF, respectively), the focus of the subject is mathematical finance and, in my opinion, its purpose is to serve as a more mathematical foray into the material developed in AFM1.

Subject content

It is somewhat necessary to have a modicum of knowledge about the content that is covered in AFM1 before we can really discuss the material encountered in AFM2 as, surprise surprise, they are sister subjects. Broadly speaking, AFM1 covers:

- principle of no arbitrage (put simply, the idea that opportunities of making money must carry the risk of losing money)
- pricing of derivatives using hedging, replication, and risk-neutral techniques
- Brownian motion, continuous-time martingales, and stochastic calculus (in the latter case, there is some emphasis on stochastic differential equations)
- Black–Scholes model; its partial differential equation, associated Greeks and formulae, defects and extensions
- interest rate and credit risk derivatives and pricing models thereof

This review was previously published in the 2016 start-of-year edition of the *Actuarial Students' Society Subject Review*.

It should be immediate by now for those finishing third year that the focus of both AFM1 and AFM2 is quite different to that of all previous *Financial Mathematics* subjects. In any event, it is probably reasonable to say that the Institute standards of AFM1 mandate a reasonably deep discussion of some of the basic ideas underpinning quantitative finance.

Perhaps the best description of what the material taught in AFM2 comprises of is to say that it is an extension of all the topics encountered in AFM1. I have a personal belief that, as AFM2 is not an exemption requirement, the material is somewhat a bit more malleable and therefore admits extensions, most of which are mathematical. For instance, the concept of a risk-neutral measure is introduced in AFM1, but the way in which it is presented might give the impression that passing to the risk-neutral measure is the only pricing technique employed by practitioners. However, in AFM2, the more general notion of the *numeraire* grants access to a vastly superior pricing method. To illustrate this, the well-known Black–Scholes call option formula

$$C(S_0, 0) = S_0 N(d_1) - K e^{-rT} N(d_2)$$

can be obtained via brute force integration with respect to the (lognormal) probability density function of the stock price process in the risk-neutral measure (pardon the jargon). However, the methodology that is shown in AFM2 is far quicker, and indeed the call option formula may be written down as the linear combination of a (lognormal) survival probability computed in two different measures. Similarly, you will most likely be *told* that the Jarrow–Rudd tree in AFM1 has a risk-neutral probability that is very close to 0.5. However, you will not understand *why* that is the case until AFM2, where a mathematical examination of the asymptotic behaviour of the risk-neutral probability using Landau notation will show that this is the case.

I suspect that the connection between AFM2 and MIF is a little less tenable, but personally I find MIF to be a very suitable precursor to both AFM subjects. Indeed, MIF serves as good preparation for a more rigorous discussion of some fundamental concepts that arise in AFM1 and AFM2. Elements of probability spaces, conditional expectations with respect to a sigma algebra, continuous-time martingales and stochastic calculus are present in both AFM subjects, albeit to varying degrees — one very clear instance of this is the apparent absence of dedicated lectures to probability spaces, perhaps because they are rather theoretical and most computations can be performed without understanding, say, integration with respect to some measure. Nevertheless, I would recommend, be it for students only interested in studying AFM1 for the exemption requirement or those wanting to also study AFM2, taking MIF in third year.

Having digressed, I will now come back to the content in AFM2 specifically. In 2015, we looked at the following topics:

- principle of no arbitrage and pricing on binomial trees
- continuous-time martingales and stochastic calculus
- multiple sources of risk (extension of the above)
- vanilla interest rate derivatives

Immediately one might notice the similarities between these four topics and those listed for AFM1. Black–Scholes is apparently absent, but it instead comes back in different forms throughout the subject. For some time, I will discuss each of these topics in a bit more detail — for those uninterested in the minutiae, feel free to gloss over the next couple of paragraphs.

In the first topic, this is essentially a mathematical extension of the knowledge developed during study of AFM1. Further results include, for instance, the model independent property of call option prices being convex in the strike (proven by no arbitrage). Much of the overarching concepts will be familiar territory after AFM1, but it nevertheless goes into rather deep mathematical detail in some areas in the advancement of new ideas. To exemplify, there is a rather 'obvious' result — that a sequence of portfolios that replicate in the limit some derivative should also have the same price in the limit — which commands a proof spanning almost an entire lecture and demands also a stronger analogue of the principle of no arbitrage.

For the second and third topics, which I can perhaps summarise as 'applications of stochastic calculus', the content covered should be quite familiar but simply applied to different problems. Here, the numeraire is explored in more detail and several techniques that are useful in derivative pricing are shown; it would be a significant advantage for a student studying AFM2 to understand these well as they recur often. Some foreign content appears, such as the time-dependent volatility Black–Scholes model and the 2-dimensional Taylor's theorem, but most of the material here can be handled without losing much sleep. I should caution however that there is a particular lecture deemed by Mark himself to be one of, if not the, hardest lectures you will attend in all four years of your Actuarial tuition. Specifically, the lecture delves into the computational mechanism by which a change of measure is performed; students by the end of AFM1 will be aware that it is *possible* to arbitrarily add drift to Brownian motion by passing to another measure, but the precise details of *how* will form the crux of this lecture. Even though the context — barrier options — is quite a practical problem, the supporting mathematics, which involves finding a joint distribution involving Brownian motion, can be rather difficult. Following this is consideration of the natural extension of stochastic calculus to the case where either

- a single asset is driven by multiple, correlated Brownian motions or
- multiple assets are driven by correlated Brownian motions

Some theorems are given (the multidimensional Itô lemma and Black–Scholes partial differential equation), but apart from a lecture on the pricing of quanto options (where the pricing method can be quite confusing at times), I think it's safe to say that the content covered in these topics are, for the most part, manageable.

Last but not least is the fourth topic: vanilla interest rate derivatives. It will begin with a light refresher on the material encountered in AFM1, before delving into the mathematical aspects of the LIBOR market model. If you are worried by now however that the subject is primarily mathematical, this is certainly not true. Spread throughout the entire course there are discussions of varying lengths dealing with pragmatic issues such as the acceleration of pricing on binomial trees, methods of numerical integration, acceleration of Monte Carlo simulation, and methods of generating random variables (knowledge of first-year linear algebra is somewhat helpful here, as the Cholesky decomposition, eigendecomposition and diagonalisation make an appearance, albeit briefly). However, while the final topic may ostensibly be very mathematical, it is actually perhaps the most pragmatic topic of all.

First off, you will begin by learning how to perform computations of drift with different choices of the numeraire when the model of choice is the multidimensional Black–Scholes model. Mathematical symbols and convoluted equations may obfuscate the apparent usefulness of proven results, but it nevertheless serves as a potent reminder that model users need only an implementation algorithm and not mathematical elegance. Despite the general consensus in the Actuarial cohort being that theory is often more difficult than practice, I would argue the contrary here; without any practical experience in model implementation and appreciation for coding efficiency, I would imagine that much of the pragmatism to be gleaned is lost in translation. In spite of all this, the focus of this topic is practical implementation of the LIBOR market model, so methods of improving approximations to stochastic differential equations as well as a significant discourse spanning five to six lectures on methods of calibrating the model are also put forward. Indeed, it is rather beguiling when the mathematics appears to be sparse; we would expect it to be quite easy to rote-learn the qualitative aspects of the course, but I would imagine for most people that fully understanding a maximally time-homogeneous algorithm of solving a system of equations in n-fold space lying on the intersection of a sphere and cylinder is rather difficult. Thankfully, the subject concludes with a lighter, slightly more formulaic section on an extension to the LIBOR market model.

Of course, please bear in mind that this review was written with regards to the subject in 2015, so the content might differ in future years (although, perhaps, this review might be superseded by then). Having described now all the content (in perhaps too much detail!), I can probably say that the difficulty is **reasonably hard**; however, this should not be surprising, given that it is a fourth-year actuarial subject. Obviously, I cannot compare between the other possible electives, but with certainty I can say the subject is challenging and you might be confused immediately after a lecture on numerous occasions. However, with enough determination, it is certainly possible to overcome these issues with enough revision

and time. Some aspects of the difficulty will simply be attempting to memorise either formulae or theorems; others will be due to the apparently convoluted nature of the problem. I will speculate here and suggest that, as AFM2 is not bound to Institute standards as it is not an exemption requirement, there is more room for rigorous mathematical treatment of financial problems. It is still very accessible and taught very well, and indeed while MIF and AFM1 will prepare you well for the majority of the material encountered in this subject, having a modicum of knowledge in some of the entry subjects should be beneficial but not necessary. In short, the subject in my opinion coherently pieces together the theoretical framework underpinning quantitative finance, ignoring neither the mathematical rigour nor the issues of importance to practitioners. Problems faced will be primarily computational, but not of the numerical kind; most solutions can be written analytically.

Lectures

Being a fourth-year actuarial subject, there are no tutorials. However, you may see particular lectures set aside for discussion of practice problems. To this end, you will probably want to acquire the book and take it with you into said lectures, because Mark will discuss solutions to the practice problem(s) you wish to seek explanations for as well as any other queries surrounding the subject. Consequently, these lectures will constitute the closest thing to a tutorial you will have in this subject. Practice problems are available in the recommended text and additional questions are available on the LMS. Given that the amount of supporting material is quite sparse, you will probably want to finish all the relevant questions. Please note: such lectures are interactive. By now, you have undoubtedly discovered that some classrooms have this perpetual atmosphere of awkward silence, but hopefully with a reduced cohort the attitude of waiting until someone asks the first question slowly dissipates. For me at least, it certainly made the lecture more tolerable when someone — be it myself or someone else — asks a question, since I can tell you first hand that I would rather get a question answered and possibly feel like an idiot after than sit in a room where you can cut the tension with a knife.

For standard lectures, I would say this: absence should be practised at your own peril. If I can say anything that would encourage attendance, it is simply that the lectures are far more bearable than those in previous semesters; the size of the class for AFM2 is usually very small, which makes for a very relaxed closely-knit experience (for the past four years, enrolment has been in the single digits). From memory, lecture slides are intentionally empty in some regions to encourage attendance (so that you can fill them in with reference to the complete slides), but this is not strictly necessary given the availability of lecture capture (**NB:** I personally never used it, but I am fairly sure that there was both video and audio). Given that most students are probably going to be concurrently studying the *Actuarial Practice and Control Cycle* subjects (APC) which have lectures on Tuesday, Thursday, and Friday (at least, this was the case in 2015), you probably have nothing to worry about if you are concerned about wasting your time coming in for a single lecture since you can be productive during the breaks (they are unbelievably long, by the way). Given also that the size of the class is so small, it is possible for engaging discussions to be had even during standard lectures; my personal experience has been that there is an element of informality which makes lectures much more enjoyable. Moreover, both the lecturers have interesting idiosyncrasies — Mark often asks an interview problem (sometimes mathematical, physical, algorithmic, etc.), which is usually thought provoking and highly interesting. Likewise, if you are keen for Daniel's jokes and sense of humour (I'm a bit biased here), then that only gives one more reason to attend. Both lecturers are absolutely fantastic and very approachable which, combined with small class sizes, is particularly conducive to your learning. If not for the benefits to your understanding of the content, I strongly recommend you attend simply because it should make what is most likely your final semester of formal education all the more enjoyable.

Mid-semester exam

In 2015, the mid-semester exam covered content up to and including the fifth week. Normally, it is not overly difficult and is intended more to force one to study so that by the end of the semester, there is not this mad rush to cram everything. You can expect that the questions should test your understanding and not necessarily be computational; I believe that for my mid-semester exam, the scientific calculator was basically useless. I cannot really give any numerical indication of the exam difficulty since the sample size is rather small; if memory serves me right, the average was around the 65% mark or thereabouts.

Questions were of equal weighting and roughly of the same difficulty, although depending on how well you recall aspects of the subject, some questions will invariably appear easier or harder than others. Objectively, there was probably only one difficult question, since its suggested solution was far less obvious; the remainder could be described as 'textbook'. It should not be remarkably difficult, provided that you have understood the material covered so far and are capable of identifying and applying the appropriate techniques. Generally speaking, most mid-semester exams are quite gentle, at least in comparison to the final exam.

I also make a brief note of the fact that the assessment comprises only of exams; in my opinion, this is an advantage, since I'd personally much rather study for a single mid-semester exam than be constantly bombarded with assignments, as was the case with those who chose ECOM30004 *Time Series Analysis and Forecasting* (TS). Sure, it might make your SWOTVAC slightly more stressful as the content of a fourth-year actuarial subject is probably harder, but your in-semester workload is somewhat gentler when the proverbial hits the fan and you're looking down the barrel of approaching APC and TS assignment deadlines in conjunction with submission deadlines for the final project or research essay.

NB: THERE IS NO FORMULA SHEET FOR EITHER EXAM.

End-of-semester exam

You might have noticed by now that exams often carry an element of scaling should the situation mandate it; in 2015, scaling was upwards, suggesting immediately that the difficulty of the exam is above average. I have already mentioned this, but the first thing to note is that while you will inevitably use your scientific calculator, there is little emphasis on numerical computation. Hence, if you are able to devise some approach to the question, most of it will flow through quite naturally and without much time wasted on punching buttons.

If memory serves me right, what amounted to mathematical computation was essentially a question that required you to find an analytic expression; these questions will dominate the exam (or at least did in 2015). Questions draw on all four key topics to varying extents, usually dictated by the proportion of the subject dedicated to each topic. For instance, you might be asked to evaluate a particular probability or expectation and leave your answer as an analytic expression. By now however, you should already be fluent in symbolic evaluation, so this doesn't really pose any real issue (other than knowing how to find the relevant probability or expectation of course).

From a holistic perspective, the exam tests understanding of techniques and when to apply them. It may vary from testing your ability to create a replicating portfolio or to perform symbolic simplifications, for instance in pricing a derivative under the Black–Scholes model. Much of the exam will depend on your ability to do computations by applying the techniques you will have learnt appropriately. For instance, in the pricing of a derivative, it might be expected that you integrate; in showing that no arbitrage opportunities exist, a hedging or replication argument might be suitable; in approaching a question on stochastic calculus, applying the multidimensional Itô lemma might be a good starting point. **All the computational tools are taught to you** — but it is up to you to know when to apply it. Time, as with any exam, is always an issue, so there is a significant advantage to identifying efficiencies in solving questions. Take, for instance, the proof of the Black–Scholes call

option formula that I mentioned earlier; would you rather write down lines upon lines of tedious algebra (if you do not use elementary results, the risk-neutral integration requires a substitution that then requires completing the square) wherein mistakes can hide or would you rather write down a solution that could fit in the margin? In 2015, the exam was reasonable; there was ample time for the diligent student to finish, with some time to spare. I am not saying the exam is not hard: while there may be some questions that will make you laugh uncomfortably at your own distress, I would say that the questions in my year were **doable**, in the sense that they did not require insane mathematical working that goes significantly beyond what could be considered reasonable for an exam situation.

I have so far only discussed the quantitative aspects of the exam which mostly, as stated, requires application of several techniques refined throughout the course of the subject. In spite of its namesake, the AFM2 exam is home to some qualitative questions, which can range from requiring you to write a short sentence to a brief paragraph to an essay. If writing ability is an issue, this is certainly one that needs rectification as your written arguments need to be like any other piece of written literature — coherent, persuasive, and so on so forth. It will probably be somewhat self-evident as the subject unfolds where the qualitative aspects can be inserted into the exam; as a general observation, I would imagine that elements free of mathematical abstraction would be prime choices.

Even though there is a wide range of practice problems for you to play with, one thing I would advise against is to fall into the trap of believing that success in practice problems will translate to success in the exam. I am not saying you should not do them anyway; there are numerous cases of practice problems that actively test your ability to use specific mathematical techniques as well as test your understanding of qualitative considerations in mathematical finance. Indeed, it would be remiss of me to simply forget the benefits conferred by encountering various practice problems. However, I think it is wise to bear in mind that mathematics is a massive area and the potential for questions that may appear utterly foreign to you in the exam is very real. It is an advantage to be able to recognise similar questions and thus apply similar techniques, but when (not if) questions arise that are utterly foreign, a study methodology based solely on practice problems will do more harm than good as it will not only deceive you into a sense of false security but also fail to give you the understanding required to apply techniques generally. For this reason, I suggest that if you decide to embark on the AFM path, you should prioritise absorbing theory; an ability to do the exam will come as a byproduct of this, but the converse I do not believe to be true. I acknowledge that this view is my own, however, and that the reader might have very different methods of studying. I have no intention to dictate how you should study, but I would recommend studying theory simply because the sheer expanse of mathematics admits so many different types of plausible questions — preparing for each and every one is nigh impossible.

Concluding thoughts

Overall, I would say that the subject content is delivered well, and you will benefit from both the theoretical and practical aspects of the subject which are both broad and deep. It gives a very good discussion of some of the fundamental principles underlying modern mathematical finance without sacrificing both the elements of rigour and pragmatism. For those interested in the area, this is without a doubt the obvious elective.

I hope that you will not find yourself in the same situation, but I know some that shied away from the subject due to concern over their average breaching the passing benchmark of 65. Daunting as it may be, I think TS, a popular alternative, is far from the 'bludge' or 'free H1' that many may perceive it to be. Rather, it is much easier, having already done AFM1 and been introduced to the basic ideas, to enrol in AFM2 than it is to be thrown into the deep end (i.e. without the proper background) of a third-year econometrics subject. It will depend on personal preference, but I would also much prefer a single mid-semester exam than four assignments throughout the semester.

As with any subject, the difficulty will depend on how much of your time you intend to dedicate studying. Moreover, your study should emphasise understanding theory. Of course, there will be elements which you will inevitably rote-learn, such

as theorems, lemmas, corollaries, propositions, qualitative aspects and whatnot, but for the most part, success in this subject like in any other subject comes from comprehension, not memorisation. Objectively, the material taught is not spectacularly hard, nor is the exam relative to some others. It is certainly within the realms of what one can reasonably be expected to achieve, but that is not without hard work and steady resolve. Poetic aphorisms aside, this subject is definitely one to consider if you enjoyed the content in AFM1 or enjoy mathematics. In making your decision, bear in mind that this is, unless you are intent on postgraduate study, going to be your last semester of formal education — study what you want to study, since you might as well enjoy it. I hope you have enjoyed this review, and all the best for your fourth year of Actuarial Studies.

Breadths and Electives

BLAW10001 Principles of Business Law [SM1]

Exemption status	None.
Lecturer(s)	Semester 1 Ms Tanya Josef Semester 2 Mr David Babovic
Weekly contact hours	1 × 2-hour lecture 1 × 1-hour (optional) tutorial 1 × 1-hour workshop (every 3 weeks)
Assessments	1-hour online multiple-choice test in Week 4 10% 1-hour online multiple-choice test in Week 9 10% 1.5-hour multiple-choice end-of-semester exam 80%
Textbook recommendation	Lambiris, M., & Griffin, L. (2015). *First Principles of Business Law* (8th ed.). Melbourne, AU: Oxford University Press Australia. Note that a newer edition may be required. ✗ The textbook is quite expensive for such a small book, and you don't even use it in its entirety. Try to buy second-hand if you don't mind missing out on the e-tutorial. New books (not second-hand) will come with an e-tutorial software you will have to download and redeem on a computer. Note that these tutorials can be helpful — they consist of multiple-choice questions and can be used for revision.
Lecture capture	None.
Year and semester reviewed	2015 Semester 1

Comments

Is it a bird, is it a plane? No, it's your WAM (weighted average mark) going through the roof! As a completely multiple-choice subject, you have no excuse to do poorly; it is so straightforward, you have a 20–25% chance of guessing every single question right.

As a level 1 breadth subject, this is highly recommended for those who just want to breeze through first year or those who need a WAM lift.

Subject content

The course itself is broken up into different aspects of Australian law. It is primarily focussed on theory, with a lot of cases (more than 30+ cases) which must be memorised or included in a double-sided A4 cheat sheet for the multiple-choice exam. Exactly, you even get a cheat sheet for this multiple-choice exam; what more could you ask for?

This review was previously published in the 2016 start-of-year edition of the *Actuarial Students' Society Subject Review*.

Weeks 1–2 are spent covering Australian legislation and how the Australian parliamentary system works.

Week 3 is spent on the role of courts in law-making (case law) and the Australian legal system.

Weeks 4–8 are spent on contract law. Note that there is a lot to cover in this section: from what constitutes a contract to breaches/resolving breaches of contracts. It gets dry, but there are interesting cases to fill in the gaps.

Week 9: Australian consumer Law (definitely the most applicable part of the course to your everyday life). Don't like those pesky telemarketers calling you after 5pm on a weekday? Turns out they can't!

Week 10: Tort law, focussing on negligence, which is basically when someone fails to take precautions against a **foreseeable risk**.

Week 11: Agency law, basically getting someone to act on your behalf and the consequences for it.

The most enjoyable part of this was definitely the cases involved, as you get to hear a lot about what occurred in the cases which shaped Australian law.

Lectures

Semester 1 — Tanya is amazing! She's passionate, excited, and always looking to make sure her lecture is entertaining. Semester 2 — I've heard otherwise. David, as described to me, is very dry and lacks the enthusiasm Tanya has. Highly recommend taking it in Semester 1.

As for the lectures themselves, they are 2 hours long and cover a lot of cases/content, so it is advised that you do have a computer or a fast-writing friend with you, as the lectures aren't recorded.

Generally speaking, the lectures were quite packed (as everyone understands that they aren't recorded).

However, the ultimate question comes down to, you've come this far, choosing a fully multiple-choice subject, are you willing to go the last step and skip lectures? I would not recommend this. Tanya includes a lot of additional comments and insights in her lectures, and missing them will be detrimental to a degree for your understanding. However, from experience, missing the last 4 lectures of the semester did not result in a less-than-H1 (80+) score, so it is definitely possible to attain a high score and miss some lectures on the side.

Workshop

The workshop consisted of individuals asking questions on what they did poorly on in the practice tests in preparation for the online test. If you struggled with the practice test, you should attend this. However, if you've done your work, the test should be simple, so the workshop can be skipped.

Assessments

The two multiple-choice assessments, which go for 1 hour, are worth 40 marks each.

Basically, you will log onto LMS and complete them in one sitting. Try to ensure internet connectivity is not an issue. The online multiple-choice questions can range from having 3–8 different choices, so it's not as straightforward as a normal test.

The first one was extremely easy, it is definitely doable with little practice or revision. As they are online, just have your textbook by your side with your notes, and you'll do fine.

The shock comes with the **second online test**. Difficulty instantly ramps up, and it is highly suggested that you actually prepare for these. Make notes, revise them, and ensure that you know what you're talking about when it comes to individual cases. I know people who failed because they didn't prepare and expected it to be like the first one.

End-of-semester exam

As you have 90 minutes to complete the exam of 60 MC questions, you will find that there is plenty of time as long as you have a good cheat sheet and have done some revision.

Having missed the last 4 lectures for reasons which will not be explained, the exam at first seemed daunting. However, in previous years, it has been in the last week of exams and so gives you ample time to prepare. Personally, I had a week gap between this and the exam before it.

With upwards of 40 cases to memorise or write down on a cheat sheet and a lot of information missed due to unattended lectures, how do you prepare for this exam?

The answer is simple: utilise your cheat sheet to its fullest extent. Personally, I printed at size 8 font, double-sided and 2 pages per sheet for a total of 4 real pages compressed onto a single piece of paper. This allowed me to fit 9000+ words onto the cheat sheet, and I was able to fit the entire course and every single case (with some information associated with it) onto the cheat sheet. By doing so, I was able to breeze through the exam. You will even notice that some of the multiple-choice answers are ripped straight off the textbook.

Try to colour-code the cheat sheet if the font size is getting too small.

The subject is extremely easy to cram, and only takes around 1 or 2 **full** days of work to have it down pat.

BLAW20001 Corporate Law

Exemption status	None.
Lecturer(s)	Professor Helen Anderson
Weekly contact hours	1 × 2-hour lecture 1 × 1-hour tutorial
Assessments	Individual assignment, due after the mid-semester break 25% 2-hour open-book end-of-semester exam 75%
Textbook recommendation	Hanrahan, P., Ramsay, I., & Stapledon, G. (2015). *Commercial Applications of Company Law* (16th ed.). Melbourne, AU: Oxford University Press Australia. ✓ The textbook is recommended — it contains the details of cases and legislation mentioned in lectures, and you can bring the textbook into the exam.
Lecture capture	Full (both audio and video).
Year and semester reviewed	2015 Semester 1

Comments

This is the second law subject in the law breadth track and a good breadth to choose for anyone interested in the JD, wanting to keep the accounting major option open, or those wanting some working corporate law knowledge. If you expect this subject to be like BLAW10001 *Principles of Business Law*, you will be proved wrong. This subject expects you to be able to analyse a scenario, apply legislation, and ultimately draw a conclusion as if you were a lawyer. These skills were not taught in PBL, so working consistently throughout the semester is highly recommended. The subject also gives you a flavour of what it is like working in the area of law.

Subject content

Throughout this subject, you gain knowledge on the types of companies, decision-making in companies, shareholder rights, directors' duties and agent law.

For example:

- If directors make decisions to purposely benefit themselves (such as give themselves shares with 10 times the normal voting power), what can shareholders do to defend themselves?
- What can a poor director do if all the other directors suddenly gang up on that person and kick them out of the company?
- When am I doing dodgy business if I purposely award a contract to my friend but will secretly get a kickback?
- Some other director in the company screwed up! When will I also be in trouble for his dodgy actions even when I didn't do anything?

This review was previously published in the 2016 start-of-year edition of the *Actuarial Students' Society Subject Review*.

Lectures

Helen is an excellent lecturer who genuinely cares for her students. Her explanations are very clear, and she tries to make the lecture material easy to understand and not dry. In Weeks 8 and 12, she does not teach any new material, but instead goes through a past exam question to show students how the different concepts are intertwined and how many different legal issues may arise from the one scenario — sometimes directors doing one dodgy thing can mean they're in trouble for numerous reasons! To get the most out of these special lectures, it is highly recommended to try analysing the scenario beforehand, even if it means jotting down a few broad areas of law that you think are applicable. This way, once Helen fully analyses the scenario, you are able to clearly evaluate how you're approaching the analysis and how to improve. You will need to do this in the exam, so this is a valuable exercise in preparation for the exam.

Unlike Graham Richards' lecture slides (from ECON10003 *Introductory Macroeconomics*), Helen's slides are very condensed, so it is advised that you make lots of notes for yourself. It is imperative to understand the law and key concepts every week because many of the lectures extend upon the previous lecture's material, so it can be easy to fall behind on a whole topic if you do not understand something from the week before.

Tutorials

Tutorial attendance is not compulsory but highly recommended and imperative to success in the subject. During tutorials, the tutors discuss the answers to the tutorial questions (which are available at the start of the semester in the subject guide). Towards the end of semester, the tutors may also ask you to work in groups, write up answers, and provide feedback on the way your answers are written up.

It is essential to practise writing out answers to the questions, as most of the marks will come from how you write up your answer and whether you have reasoned your way through logically and with sufficient evidence using legislation and cases. Unfortunately, while some people have a good understand of the material and can draw the right conclusions for a scenario, they are unable to demonstrate their knowledge during the exam due to a lack of practice in law writing.

NB: Answers to the tutorial questions are not released on the LMS, so that is another incentive to go to your tutorials.

Assignments

In my semester of completion, the assignment was given in Week 2, and we had the mid-semester break to complete it. The assignment is very similar to the exam. The lecturer gives a scenario, and there are a few questions that require the application of legislation and cases learnt in the first four weeks of semester. There is a very strict word limit, and the 10% rule did not apply.

I would recommend reading through the assignment and highlighting key words when it is released, because the lecturer often drops hints about the assignment during the first four lectures. The assignments are marked to a high calibre, so ensure that all legislation is correctly quoted and used to back up any arguments you make. You should find yourself using up all 1000 words, and if you are significantly under the word limit, it is advised that you further expand your explanations, even if it seems like you are stating the obvious. (On a side note, if you have learnt Gambotto's case leading up to the assignment, it is almost guaranteed to be on the assignment. It may not be obvious, especially if directors are tampering with shareholders' rights.)

End-of-semester exam

The exam is very similar from year to year (past papers are provided) and similar to the tutorial questions, so there will be no surprises. It is open book and you can bring an unlimited number of notes and books. You can also bring in blank pieces of paper, answers to tutorials, the lecture slides — literally whatever you want. However, bear in mind that you don't want to bring so much that your exam table is flooded with paper and you can't find what you need. Once you practise analysing the scenarios, you may find that the lecture slides are not the easiest way to summarise all the course content. The lecturer recommended that we make topic summaries and answer templates with all the relevant legislation included. I personally found this to be very helpful in the exam.

The exam is 2 hours, with an additional 30 minutes noting time. During noting time, you can write whatever you want on your notes or exam, so long as you do not touch the script book. Overall, the exam is tight for time, as there is a lot to analyse, so having answer templates is very helpful in being efficient. If you practise throughout semester, you will definitely be rewarded in this subject.

COMP10001 Foundations of Computing [SM1] (1)

Contributed by David Cochrane-Davis

Exemption status	None.
Lecturer(s)	Professor Tim Baldwin Associate Professor Andrew Turpin Assorted guest lecturers
Weekly contact hours	3 × 1-hour lectures 1 × 2-hour workshop
Assessments	Online worksheets on Grok 10% Individual project, due in Week 6 10% Individual project, due in Week 9 10% Individual project, due in Week 12 10% 45-minute mid-semester test in Week 7 10% 2-hour end-of-semester exam 50%
Textbook recommendation	There isn't one. All materials are either available online or given to you.
Lecture capture	Full (both audio and video).
Year and semester reviewed	2016 Semester 1

Comments

This is one of the breadth subjects that first-year Actuarial students often choose to do. The subject is mostly an introduction to programming with Python, with a small section on HTML, and a lecture or two on algorithms (to encourage students to do the follow up COMP10002 *Foundations of Algorithms*). The assessment is almost all Python programming, with just a small section on the exam being theoretical.

COMP10001 Foundations of Computing has a reputation for being an extremely hard subject, but I disagree. It is certainly challenging; it requires steady work throughout the semester; it can be extraordinarily frustrating at times — but it is not "I'm going to fail!" hard. Though it is challenging, there is also scope for getting a very good mark, as the tutors are pretty nice about marking assignments (and the exam is only 50%).

Do not be put off by the subject because you don't have any programming experience — I went in with absolutely none and ended up with a very high H1.

I found Foundations of Computing to be an excellent introduction to programming and would heavily recommend choosing it as your first semester breadth subject.

Subject content

COMP10001 Foundations of Computing focusses on programming in Python 3.4 — an easy to learn language that is used in a wide variety of areas, including data science, engineering, science, and many other fields. The content can be

separated into two sections:

- Programming with Python [Weeks 1–8]

  The first four weeks of the subject are an introduction to programming aimed at complete beginners, explaining material such as

  – types,
  – variables,
  – conditionals,
  – sequences,
  – functions
  – lists, tuples, sets, dictionaries, and
  – commenting.

  The next four weeks focus on teaching students how to solve problems using Python, as well as introducing concepts such as

  – exception handling,
  – libraries,
  – files and input/output, and
  – debugging.

  The mid-semester test (Week 7) includes material from Weeks 1–6. The three assignments utilise skills and knowledge from the first eight weeks.

  After these eight weeks, you will be competent enough to write programs in Python to solve problems given to you (which is basically what the three assignments are).

- The last three teaching weeks (9–11; 12 is used for revision) cover a few different topics, including URLs and the Internet, HTML, algorithms, and character encoding. There is far less focus on this part of the subject on the exam, but make sure you understand it all.

The subject uses a site called Grok to conduct most of the actual coding — I found it to be very smooth and efficient for a first-time user.

In my opinion, the best two parts of COMP10001 Foundations of Computing were the guest lectures and the assignments. There were five guest lectures spread throughout the semester (always on Thursdays), including people from Google, IBM, some startups, and a cryptography academic. They provide some great insight into what computing can do and what you can get out of learning how to program. Also, the content from these lectures IS EXAMINABLE! Do not ignore them.

The three assignments in 2016 Semester 1 were as follows:

- Assignment 1 required students to program a basic implementation of RSA encryption, mostly by following guidelines. Please note that you are marked on your commenting of code as well as the actual code.
- Assignment 2 required students to write a program that took a list of phonemes and gave the most probable grapheme representation of said list — basically a speech-to-text converter.
- Assignment 3 was in my opinion the highlight of the semester. Students wrote a program to play a card game that Tim (the lecturer) had altered, and then all programs were entered into a tournament against each other. About 25% of the marks were given for how well you did in the tournament.

You get around three weeks to complete each assignment, which is plenty. I would recommend starting early and working steadily on them. They are not doable the night before.

Lectures

In 2016 Semester 1, there were two main lecturers (Tim Baldwin and Andrew Turpin). The ones I went to were mostly Tim, but I watched a few recordings of the ones Andrew did. Both Tim and Andrew are good lecturers and are extremely willing to help if you go to them with questions (just try not to flood Tim's email).

I wouldn't say the first eight weeks of lectures are essential if you are learning well using Grok, but I would heavily recommend at least watching the recordings and going to both the guest lectures, and the lectures in Weeks 9–12.

Workshops

Workshops run for 2 hours, with the first hour being a pretty normal tutorial and the second hour being lab time for you to do worksheets/assignments and ask your tutor/demonstrators for assistance. In the tutorial part, you are given a tutorial sheet (this is different from the worksheets), and you go through the problems on this sheet. These are often similar to those on the exam, except the ones on the exam are easier — don't worry if you are struggling to complete the tute questions by yourself.

Once again, attendance is not essential for the first eight weeks, but I would again extremely heavily recommend going to the ones in Weeks 9–12 and would encourage you to attend all of them.

Mid-semester test and end-of-semester exam

Both of these assessments are based around it being quite accessible to the average student but with both having a few questions that only the best students will get.

The mid-semester test is 45 minutes long and takes place in Wilson Hall; it covers content in Weeks 1–6. Don't worry too much if you don't ace it.

The end-of-semester exam is 2 hours. The format is the same as those in previous years, and multiple practice exams are given along with solutions.

Hurdles

There are two hurdles in this subject. To pass, you need

- 50% (30/60) for the mid-semester test and end-of-semester exam combined; and
- 50% (20/40) for the worksheets and assignments combined.

These are both very easy to get, and Tim is willing to be quite lenient in their application.

Final comments and tips

Learning programming does not just teach you how to write code — it also teaches you how to solve problems both creatively and logically and imparts skills that will be useful in both future studies and work. This subject is in my opinion the most practical of the breadths you can take, and I absolutely loved it — so I would recommend you give it a go!

In order to do well in this subject, you will have to work steadily. Do not try and cram; do not try and do the assignments the night before. Set aside a reasonable amount of time each week to read and practise the material and you'll do well.

COMP10001 Foundations of Computing [SM1] (2)

Exemption status	None.	
Lecturer(s)	Professor Tim Baldwin Associate Professor Andrew Turpin Assorted guest lecturers	
Weekly contact hours	3 × 1-hour lectures 1 × 2-hour workshop	
Assessments	Online worksheets on Grok	10%
	Individual project, due in Week 6	10%
	Individual project, due in Week 9	10%
	Individual project, due in Week 12	10%
	45-minute mid-semester test in Week 7	10%
	2-hour end-of-semester exam	50%
Textbook recommendation	None.	
Lecture capture	Full (both audio and video).	
Year and semester reviewed	2016 Semester 1	

Comments

This subject is a great introduction to programming for people with no prior experience. Before taking this subject, I was intimidated by the idea of programming and struggled to learn in my own time. This subject is very well structured and presents programming concepts in an elementary and welcoming way.

Subject content

Python (version 3) is the only programming language used in this subject. You do not need to download the program itself, as it is presented in a very user-interactive terminal on your browser through the Grok platform.

Weeks 1–6 cover the main tools used in Python to enable you to code. The main concepts covered include variables, types, conditionals, sequences, functions, iteration, and exception handling. Having completed the first six weeks, you should confidently be able to write you own small programs even if you had no prior coding experience.

I found these first six weeks very manageable because all the concepts taught had complementary online worksheets run on the Grok platform. When learning a new skill such as programming for the first time, it is important to simply rote-learn concepts to become accustomed to the language of programming. The external push from the worksheets allowed me to grasp new concepts in a simple manner.

Weeks 7–12 apply the tools taught in the first six weeks to other programming languages, applications, and functions. There is a focus on both the conceptual and practical aspects of computing. The conceptual applications studied are recursion

in programming and algorithm structures. Practical applications include the internet, coding in HTML, multimedia, and character encoding. These concepts require a bit of memorisation but only represent 10–15% on the final exam.

Lectures

In general, lectures are very well structured and followed the online worksheets closely in the first six weeks. The lecturers did not always follow the slides, focussing on conceptual thinking. It is not crucial to attend lectures for the first six weeks given that the online worksheets covered the same concepts.

From Week 4 onwards, this subject also had a revision/advanced lecture or a guest lecture per week. The revision lectures were structured like a consultation with the lecturer just answering questions. As there were two lecturers, the advanced lecture occurred at the same time as the revision lecture. I found the advanced lectures too fast-paced given my lack of past computing experience, but the material was not examinable.

The guest lecture was conducted by programmers in the industry going through their area of work. The coding by the guest lecturers was also on non-Python languages/terminals like JSON and JavaScript, and I found it difficult to follow. However, the bigger picture concepts and ideas these professionals worked on were very interesting and also tested on the final exam. In 2016 Semester 1, the guest lectures covered speech recognition, cryptography, simulation, and programming chatbots.

Tutorials

Tutorials are 2 hours long, consisting of a weekly tutorial sheet and computer lab time. The first hour involves working through a revision sheet with programming questions similar to the ones in the exam. The purpose of this is to prepare students to code on paper to prepare better for the exams. I found coding on paper very organised compared to working on the computer.

The second hour of the tutorial was simply doing online Grok worksheets or projects at your own pace with the tutors and demonstrators offering help. I personally found the second hour boring as you could do the online exercises in your own time. However, I strongly recommend attending the entire tutorial because when you are learning a skill for the first time, there are many conceptual problems that you did not think was an issue in the first place. Attending the tutorial can uncover some of these problems that you can then work on in your own time.

Assignments

Out of all the subjects I have done, the projects in this subject were by far the funnest and most engaging. The project questions were structured like separate questions where you had to write a function for each question. These components of the project combined to serve a practical purpose in computing such as cryptography and speech recognition. However you did not need to know any extra details to do the questions. The third project involved writing a program to play a specific card game. This was also structured as a sequence of smaller questions and required you to think for yourself as a programmer. For two out of three projects, there was even a bonus question that allowed you to gain up to 2 extra percentage points to your overall score. It was not uncommon to see students get full marks for the projects having finished the bonus questions.

Mid-semester test and end-of-semester exam

As for the mid-semester test and end-of-semester exam, the main focus is on handwriting simple functions and understanding the structure of computing data types. There is also a small section on the practical applications of computing such as algorithms, HTML, the internet, and guest lecture material. This exam is not something you can cram for, because the questions that you encounter are most likely to be completely new. The exam tests your intuition in regards to the logic of programming and this skill can only be developed by continuously improving throughout the semester and thinking about underlying concepts in your worksheets rather than just completing the question correctly.

Suitability for breadth

Programming is an essential skill for actuaries. Personally, I find it extremely difficult for students with no programming background to learn the skill in their own. A university subject is a great way for students to get comfortable with the language and thought process of computing.

For Actuarial students with strong work ethic and problem-solving skills, the difficulty of this subject should not be a hurdle as long as you continuously practice. I strongly recommend students with no experience in computing to take this subject for breadth.

Tips

My main tip for success for this subject and other computing subjects is to simply practise continuously. To do well in this subject, you must obtain a sense of thinking like a programmer, i.e. knowing intuitively how you can use a limited set of resources and functions to solve a larger problem. In the exams and projects, you will most likely have never seen any similar questions before and will need to rely on your intuition. However, this sense can be easily developed by practising on a continuous basis. Trust the process and the results will come.

COMP20005 Engineering Computation [SM2]

Exemption status	None.
Lecturer(s)	Semester 1 Professor Alistair Moffat Semester 2 Dr Jianzhong Qi
Weekly contact hours	3 × 1-hour lectures 1 × 2-hour workshop
Assessments	Individual assignment, due in Week 9 10% Individual assignment, due in Week 12 20% 30-minute mid-semester test in Week 7 10% 2-hour end-of-semester exam 60%
Textbook recommendation	Moffat, A. (2012). *Programming, Problem Solving and Abstraction with C* (2nd ed.). Frenchs Forest, AU: Pearson Education Australia. Though it is not essential, the textbook does provide an extensive list of exercises and detailed explanations for various concepts. It also goes a bit further than what is covered in the semester for those who are serious about learning programming. ✓ Strongly recommended.
Lecture capture	Full (both audio and video).
Year and semester reviewed	2015 Semester 2

Comments

Remember that question in MAST10008 *Accelerated Mathematics 1* where you were required to find the nth rational number? The solution for this problem (outside of brute-forcing it) was to simply get a program to do it for you!

When working with computers, being able to program is an invaluable skill. Odds are most of you reading this will end up working with a computer for a large portion of your life (probably with Microsoft Excel). COMP20005 Engineering Computation provides an excellent introduction to the toolkit most programming languages utilise.

Subject content

This subject focuses on the programming language of C — a procedural language that is used in a broad range of fields, including computing, engineering, and scientific calculations. The subject's content can be divided into two sections.

- The "Computation" — The Programming Toolkit [Weeks 1–8]

  The programming toolkit and how it is implemented in C is covered in the first section of the subject. Number manipulation, selection, loops, functions, as well as pointers, arrays, strings, and structures are covered, allowing you to solve a plethora of problems (e.g. what is the sum of the first 1000 prime numbers?).

- The "Engineering" — Problem Solving Strategies & Miscellaneous [Weeks 9–12]

This review was previously published in the 2016 start-of-year edition of the *Actuarial Students' Society Subject Review*.

Numeric approximation techniques, interpolation techniques, and differential equations are all covered, equipping you with a number of different strategies for tackling problems. Actuarial students may be familiar with some of the techniques covered here, such as Gaussian elimination from MAST10008 *Accelerated Mathematics 1*, and fixed-point iteration from MAST10009 *Accelerated Mathematics 2*. You will be expected to be able to explain each technique, as well as any limitations any of them may have.

The method in which a computer stores numbers (aka binary representations) is also covered and may uncover some of the mysteries you encountered earlier in the semester (e.g. why does 2147483647 + 1 give me a negative number?). You will be expected to be able to write a decimal number in binary (both twos-complement and floating-point), as well as convert binary representations back into decimal numbers.

Near the end of the semester, there is a brief introduction to memory allocation, function pointers, recursive data structures, and more. This content is beyond the scope of the subject and is not assessed but is interesting nonetheless. If you are serious about learning programming you might want to take notes.

This subject uses the freeware JEdit — a text editor commonly used for a variety of languages, not just C. While you are not forced to use JEdit over other text editors such as notepad++, it helps when following along with the lecturer's in-lecture programming shenanigans and is fairly user-friendly.

Lectures

In 2015 Semester 2, the lecturer took great care to address students' concerns and took feedback very seriously throughout the semester. He regularly gave real life metaphors for the programming techniques covered and cracked a few jokes (with mixed reaction from the students), which greatly helped with the understanding of the content.

At times the lecture capture was unstable, with audio occasionally being omitted from recordings. Despite this, I felt no pressing need to attend lectures until the final 4 weeks of the semester, as the first 8 weeks of the semester was based off of content in the textbook, which was more than sufficient.

Semester 1's lecturer (who is also the author of the textbook) is apparently amazing — enough for him to get a fanpage. Overall, you are unlikely to have a bad lecturer for this subject.

Workshops

Workshops are 2 hours long, consisting of a brief recap of the content of the previous week followed by some programming exercises. The recaps often gave tips and different perspectives on the various topics throughout the semester, which was helpful for digesting some of the content. Programming exercises were taken straight from the textbook, with **sample** solutions being provided at the end of the week (I stress sample since there are many different ways of doing each problem). This is your only opportunity to find worked solutions for select problems from the textbook. I strongly recommend attending workshops in the last few weeks during the "engineering" topics, when the brainpower required for the subject increases (though that is not to say that you should not attend your workshops before then).

Additionally, there is an online discussion forum (similar to the Online Tutor, but without the anonymity), where students are able to ask and answer questions about the course content. I understand that the Actuarial cohort is typically timid when it comes to asking questions, but it is still helpful to see the answers to questions others have posted.

Assessment

The assessment tasks involve the manipulation of input data (from a text file) to produce a prescribed output. The output of your program and the lecturer's program will be compared (with their own test files), and the smallest difference will result in penalties. Additionally, the presentation of your code and your method used are scrutinised. Receiving full marks is difficult, as the rubric for marking is somewhat extensive and subjective at times. Despite this, the average for both assignments hovered around 85%.

Timed assessments come in the form of a mid-semester test and an exam. The mid-semester test consisted of a true-or-false section and some programming challenges, where students were required to handwrite code that had a specific purpose. The exam had a multiple-choice section, programming challenges, as well as a short-answer section which focussed on the problem-solving techniques covered in the latter portion of the subject.

Like most subjects, you should do well if you have diligently kept up with the subject. Handwriting code may be a bit awkward to have to deal with. However, nothing can be done about that, as laptops and computers are not allowed for tests. If you are extra keen for marks, you can handwrite all of your responses to the questions in the textbook and check them on a computer if you would like extra practice for the exam.

Also, there appears to be a large discrepancy between the style and format of assessments between Semesters 1 and 2, but that should not affect your studying.

Suitability for breadth

The benefits of taking a programming subject will continue to manifest itself in various places, including, of course, your studies and your work.

Any programming subject will generally lend itself to be a simultaneous exercise of logical and critical reasoning. For the Actuarial student whose degree will (eventually) swim around highly technical areas, the benefits of this subject are obvious — not that you are learning any maths in the Actuarial course, but the thought process of sequencing and debugging code has an overlap with the skills used when you solve a maths problem. (Note that simulation and numerical approximation techniques **are**, however, a part of the Actuarial course, and you will be introduced to the basic principles in this subject.)

Moreover, comfort in being able to arrange a problem effectively into smaller, simpler problems is sure to be useful even outside your studies, and in this subject the skill is practised extensively.

While not everyone may find programming a daily activity in the office, machine automation is a highly integral process central to any project which may deal with analysis of large amounts of data (the so-called "big data"). As you have probably grasped, actuaries would very commonly be involved in such work. Programming is also central to quantitative finance; you would do well to gain some prior experience before considering entering such a field.

Students in this subject tend to come from engineering (surprise surprise), computer science, physics, or maths backgrounds. There do tend to be a few commerce students; in my semester of completion, I recognised a few familiar faces from Actuarial Studies.

Students who enjoy the challenge of a good logical puzzle will find themselves very comfortable in this subject. Regardless of your skill and background in programming, this subject will likely stop you in your tracks at some stage with a very worthwhile problem.

Tips for success

For those of you who decide to do this subject, I have a few tips for success:

- Keep up with the subject (can be applied to all subjects, but more so with this subject)
  - Programming is like learning an instrument; you cannot learn it well overnight.
  - Cramming may work for other subjects, but it is impossible to do effectively for this subject.
- Have the goal of learning a rewarding and valuable skill, rather than focussing on marks.
  - Do not be afraid to mess around and try to make wacky programs that do nonsensical things, as even these will develop your skills in programming.

COMP20005 Engineering Computation is a good kick-start to your journey with programming and one of the more practical breadths you can take. The content here will complement other subjects such as MAST20004 *Probability* and MAST20005 *Statistics*, both of which also utilise programming languages.

ECON20002 Intermediate Microeconomics [SM1]

Exemption status	None.	
Lecturer(s)	Summer Semester	Ms Svetlana Danilkina
	Semester 1	Dr Reshad Ahsan
Weekly contact hours	Summer Semester	2 × 2-hour lectures 2 × 1-hour tutorials
	Semester 1	2 × 1-hour lectures 1 × 1-hour tutorial
Assessments	Tutorial attendance and participation	10%
	30-minute online multiple-choice test	10%
	2 individual assignments	2 × 10%
	2-hour end-of-semester exam	60%
Textbook recommendation	Pindyk, R. S., & Rubinfield, D. L. (2013). *Microeconomics*. Harlow, UK: Pearson Education. Many students do exceptionally well without knowing what the front cover of this textbook looks like, so it is not essential.	
Lecture capture	Full (both audio and video).	
Year and semester reviewed	2015 Semester 1	

Comments

For the more maths-inclined student (i.e. most of the people reading this), this subject may be more enjoyable than its first-year counterpart.

All of the topics in ECON10004 *Introductory Microeconomics* are touched on, and some of those topics will be explained further.

Subject content

Following an explanation of the use of models and a brief revision session of the content in ECON10004 *Introductory Microeconomics*, the following topics are covered. They are loosely categorised for your viewing pleasure.

1. Consumer Preferences — Lectures 3–10

   How does a consumer allocate their limited budget among 2 goods? This is derived from the consumer's satisfaction from a given combination of 2 goods, the consumer's income, and the prices of the two goods. Behaviour of consumers in the event of uncertainty closes out this topic.

2. Theory of the Firm — Lectures 11–16

This review was previously published in the 2016 start-of-year edition of the *Actuarial Students' Society Subject Review*.

Given a firm's budget, in a perfectly competitive market, how can they allocate their resources between capital and labour to produce the optimal amount of output? How a firm minimises their cost for a given level of output as well as how a firm maximises profit are explored.

3. General Equilibrium — Lectures 17 and 18

   Often when welfare is gained by one consumer, welfare is lost in another consumer (as the market for different goods may affect each other). This is explored here with the use of Edgeworth boxes and the concept of Pareto efficiency. Arguably the trickiest part of the subject.

4. Monopolies and Oligopolies — Lectures 19–22

   The social cost of monopolies is explored initially, before moving onto how monopolies maximise profit, as well as various interventions that can be used to maximise social welfare. Oligopolies cap this section off, showing how multiple firms (ECON20002 Intermediate Microeconomics deals with only 2 firms) with a bit of market power compete, combining game theory with profit maximisation.

In terms of mathematical ability, be prepared for plenty of algebra and (partial) differentiation, as well as working with tangent lines.

Lectures

If ECON10003 *Introductory Macroeconomics* left a bad taste in your mouth, be assured that the second-year economics subjects more than make up for it.

Reshad talks through the lectures slides, explaining and elaborating on concepts as they appear. Very simplistic examples for the various concepts are spoken through, allowing the vast amount of content to be digested relatively easily.

Slides are posted about a week in advance, leaving you plenty of time to print slides and bring them to lectures. Some formulae have elements omitted and unanswered questions are peppered around the slides to encourage you to come to lectures, but these are shown in lecture recordings, so attendance is not necessary.

All in all, the lectures are amazing. Reshad was a fantastic lecturer, being able to explain the concepts clearly and use a plethora of examples.

Tutorials

ECON20002 Intermediate Microeconomics tutorials follow the same structure as its introductory counterpart; pre-tutorial work consists of a "blue sheet" (handed out in the previous tutorial, or in the first lecture for your first tutorial) and tutorial work is covered in "pink sheets" (handed out during the tutorial). Unlike previous economics subjects, there is very little difference in the difficulty of questions between the two, allowing for a myriad of practice problems come exam time.

Ultimately (like all subjects), your experience in tutorials will depend on your tutor. Some tutors like to go through each question on the pink sheet as a class, while others give you time to finish the questions before writing them up on the board and explaining the working out.

Tutorials commence in Week 2.

Assessments

The 2 assignments really test your ability to work with variables (rather than numbers). The questions covered are a leap in difficulty compared to examples covered in lectures and tutorials, and the questions may seem extremely intimidating at first. Mathematical prowess alone will not guarantee a good mark for assignments. You are expected to be able to provide economic intuition (which may not be obvious initially) for the conclusions you come across in assignments.

You have the option to form groups of up to 4 students in your tutorial; however going solo is also acceptable. Be prepared to use the mathematical equations tool in Microsoft Word (or if you want to impress your tutors, use LaTeX).

The online mid-semester multiple-choice test (MCT) has a time limit of 30 minutes, just like in ECON10004 *Introductory Microeconomics*. It has a good mix of both theory and calculation questions. It has plenty of "tricky" questions that really test your understanding of the topics (as do most MCTs). It covers all of the topics in consumer preferences.

The exam consists of 10 multiple-choice questions, 2 "easy-ish" short-answer questions (similar to the pink and blue sheets) and 2 "trickier" short-answer questions, which extend on content covered in tutorials and lectures, testing your understanding of the core concepts. You are allowed to have a foreign language/English dictionary as well as a non-programmable calculator (unlike ECON10004 *Introductory Microeconomics*).

Do not be lulled into a false sense of security by past exams. The 2015 exam paper for ECON20002 Intermediate Microeconomics was much harder than in previous years, so be prepared for anything. (Just a tip in general: do not try to assume that the difficulty of an exam will be the same as it was in previous iterations of the subject).

Suitability as an elective

Ask yourself:

- Did you like ECON10004 *Introductory Microeconomics*?
- Are you willing to put in a non-trivial amount of effort into a breadth/elective subject?
- Are you comfortable with mathematics? (This is mainly a rhetorical question.)

If you answered no to any of the above questions, then this subject probably is not for you. Whilst you might be comfortable with mathematics, relating the mathematics with economic intuition is not always straightforward. Despite that, ECON20002 Intermediate Microeconomics is a fulfilling subject.

FNCE10001 Finance 1 [SM1]

Exemption status	None.
Lecturer(s)	Dr Zhuo (Joe) Zhong
Weekly contact hours	2 × 1-hour lectures 1 × 1-hour tutorial
Assessments	Individual assignment, due start of Week 4 10% Individual assignment, due start of Week 10 10% 2-hour end-of-semester exam 80%
Textbook recommendation	Terry, C., & Hunt, B. (2015). *Financial Institutions and Markets* (7th ed.). South Melbourne, AU: Cengage Learning Australia. The textbook contains a lot of content not covered in this course. I rarely used it. ✗ Would not recommend.
Lecture capture	Full (both audio and video).
Year and semester reviewed	2016 Semester 1

Comments

Finance 1 serves as an introductory subject to and provides a broad overview of the field of finance. It's a good elective choice for first-year students looking to do an easy and useful subject. Note: students who have completed FNCE20001 *Business Finance* will not be permitted to enrol in Finance 1.

Subject content

The course is mainly the study of the financial system: in particular, the functions and nature of the financial markets, market participants, and the management of risks. You will soon be very very familiar with terms like price discovery, flow of funds, time value of money, and risk premium.

Weeks 1–3 cover basic financial mathematics to price mortgages, debt securities, and shares. You learn basic concepts such as simple interest and compound interest, which are used to discount future lump-sum payments and calculate yields on investments, as well as annuities, perpetuities, and methods to discount series of future cash flows. It is important to have a solid understanding of these concepts and formulas early on as they are used extensively throughout the subject.

Week 4 is about the payment system and deposit-taking institutions (banks), how payments orders such as cheques are settled between the banks, the difference between retail and wholesale payment systems, the risks faced by the banks, and the role of the central bank in regulating the payment system.

Weeks 5–7 cover the debt security markets: the short-term money market and the long-term bond market, which provide alternative avenues of borrowing for the government and large enterprises other than the bank.

Week 8 introduces hedging as a form of risk management: in particular, interest rate and exchange rate risks. You will learn about the pricing of forward agreements and how to identify and calculate arbitrages.

Week 9–10 cover the foreign exchange market: calculating cross rates and estimating movements in exchange rates based on various theories, such as purchasing power parity.

Finally, Weeks 11–12 cover the equity market: the stock exchange and venture capitalists. The various techniques used to price shares, the process of an IPO, and recent innovations in the equity markets, such as dark pool and algorithmic trading are taught.

Overall, Finance 1 is not a challenging subject. The mathematics should be easy to grasp, especially for Actuarial students, and the content can be a bit dry but is intuitive and easy to understand.

Lectures

Joe is humorous and easy-going. His lectures are not dragged out and are easy to sit through. In fact, he often finishes early, but that does mean he often skims over things and is unable to explain contents in depth and provide examples.

Joe follows the lecture slides very closely, and the slides are pretty much summaries of the textbook chapters, so again in my opinion there's little need to purchase the textbook.

Joe likes to include a "scandal of the week" section in his lectures, where he tells a story about the real-world applications of the theories covered. They can be very interesting but most of the time are out of context and difficult to understand. I ignored them for my revision.

Given that Finance 1 is an introductory subject, the content is very broad. The lectures may seem disjointed and at times difficult to tie together.

Joe is a relatively new lecturer at the university. I believe this was his first time teaching Finance 1, but nonetheless he was a well-rounded lecturer and genuinely cared about his students.

Assignments

The first assignment consisted entirely of financial maths questions. With a good understanding of the formulae, it is relatively easy to score high. The second assignment was a report on why Apple issued bonds in Switzerland. This one was more time-consuming as it was a real life example and required a lot of research — nonetheless, very doable and not mind-boggling. However, assignments change depending on the lecturer, so there's a very big likelihood that they will be completely different next time around.

End-of-semester exam

The exam is half computational questions and half theory. The computational questions predominantly ask you to price a security; most of the time it is a simple process of identifying the variables and substituting them into the appropriate formula. For the theory questions, if you studied the lecture materials closely, they should be very simple. Generally, not much high-level thinking is required to answer the exam questions; most answers will be straightforward, but there is a lot of content to memorise. The style of the exam questions is very similar to the style of the tutorial sheets and past exams.

The exam is worth 80% and has a total mark of 100. To get a good grade for this subject, it is important to score well on the final exam. A formula sheet was provided.

For my revision, I made notes summarising the lecture content, redid all tutorial and assignment questions, and attempted the only past exam provided with solutions. There are other past exam papers available on the library website without solutions. Generally, the style was similar to my exam even though Joe was a new lecturer.

Concluding remarks

The bottom-line is that the assignments and exam are fair. However, to do well in the exam and in the subject, you are required to put in the effort. It is a really good idea to attend all tutorials and attempt the tutorial worksheets beforehand.

FNCE30007 Derivative Securities [SM2]

Exemption status	None.
Lecturer(s)	Weeks 1–6 Dr Jonathan Dark Weeks 8–12 Professor Federico Nardari There were no lectures held in Week 7.
Weekly contact hours	1 × 2-hour lecture 1 × 1-hour tutorial
Assessments	Mid-semester test 25% 3-hour end-of-semester exam 75%
Textbook recommendation	Hull, J. C. (2013). *Fundamentals of Futures and Options markets* (8th ed.). Harlow, UK: Pearson Education. ✓ The textbook is recommended — it contains many practice questions and good explanations.
Lecture capture	Yes (Semester 1 only; both audio and video).
Year and semester reviewed	2015 Semester 2

Comments

FNCE30007 Derivative Securities is one of the three third-year subjects required to obtain a Finance major. It is a good elective to take for anyone who wants to keep the Finance major pathway option open, enjoyed the derivatives part of FNCE20001 *Business Finance*, or wants a bit of a challenge.

Subject content

Subject content varies slightly from semester to semester but usually consists of:

- Forward and futures contracts: the basics, hedging, and basis risk
- Options: the basics of European and American options, valuation using the binomial model, and Black–Scholes–Merton Model
- Historical and implied volatility, the Greeks, and portfolio insurance
- Interest rate swaps (dependent on the lecturers)

Lectures

Lectures are not as scary as people make them sound, but it is crucial to stay on top of the material from week to week. The lecturers do not rush through and take their time to explain the concepts. Overall the lecture quality is very good. There was no lecture capture during the semester I took it, but Semester 1 had lecture capture.

This review was previously published in the 2016 start-of-year edition of the *Actuarial Students' Society Subject Review*.

Tutorials

Tutorials are crucial to attend, although no attendance is recorded. I personally found that the tutorials extended my knowledge and gave me a chance to really understand the material. Attempting the questions before the tutorial is recommended. The thing with Finance is that there is a tendency to underestimate the difficulty of the exams and mid-semester tests because the lecture examples are relatively straightforward. In the tutorials, some questions have slight tricks. Some tutors are especially good at pointing out the potential pitfalls and traps that are set. (They ended up turning up in the exam!)

Mid-semester test

Usually there are no practice tests for the mid-semester test, so the best way to prepare for it is to go through lecture examples and tutorial questions. Make sure to learn everything, and be crystal clear about the definitions of terms. (I assumed something was too simple and methodical to be tested in an exam, but it came up on the mid-semester!) The difficulty of the mid-semester can be up to the lecturers, but usually they are very tricky, not difficult. A formula sheet is given.

End-of-semester exam

Again, the exam difficulty can fluctuate from being quite straightforward to being extremely difficult. The best way to study for the exam is again thorough understanding of the lecture examples and tutorials. A formula sheet is given, as well as normal distribution tables. It is important to show all working out and understand the theory behind the formulas. If you try to understand the formulas and the intuition behind the concepts, the subject is overall accessible and definitely rewards those students who put in the hard work.

GERM10008/GERM20001/GERM30021 German 7

Exemption status	None.
Lecturer(s)	There are no lectures in this subject. There was only one tutor, and that tutor also took the seminars.
Weekly contact hours	1 × 2-hour seminar 1 × 1-hour tutorial
Assessments	Essay written outside of class, due in Week 3 Essay written in class in Week 6 in 2 hours 30% 1-hour listening comprehension test in Week 5 1-hour listening comprehension test in Week 10 20% 3–5-minute oral presentation in Weeks 9–11 20% 2-hour end-of-semester exam 30% This subject has hurdle requirements: • Regular participation in tutorials is required with a minimum of 75% attendance. • All pieces of written work and listening comprehension exercises must be completed and the oral presented to pass this subject.
Textbook recommendation	Buscha, A., & Szita, S. (2011). *B-Grammatik: Übungsgrammatik Deutsch als Fremdsprache: Sprachniveau B1, B2*. Leipzig, DE: Schubert-Verlag. My tutor told me it wasn't necessary, but they may have changed up the subject in 2016. My suggestion is to go to class or email the co-ordinator for the subject and ask if it's necessary. If you need the textbook, you will have to buy it from Co-op anyway, as it is a workbook.
Lecture capture	There were no lectures.
Year and semester reviewed	2015 Semester 1

Comments

GERM10008 German 7 is a subject for students who have intermediate knowledge in the German language, and aims to extend the students' knowledge in areas of culture, as well as improving the students' speaking, listening, comprehension, written expression, and verbal communication. It is for students who have done well in German as a VCE subject and is ideal for those who have achieved a study score of over 38 in the subject. German 7 is a subject which emphasises the ability to self-learn, so how much you want to get out of the subject will depend on your willingness to learn.

When you choose a language to study for the first time at the University of Melbourne, you are required to complete a placement test. It is essentially a test which measures your basic abilities of the language. The test involves filling in the gaps and selecting words which don't fit in in a paragraph. The test is conducted under a time limit, and as soon as you finish the test, you will receive a German subject which you can register in. If it says German 7, then you can register in German 7.

It is important that you complete this test well in advance of the first week.

This review was previously published in the 2016 start-of-year edition of the *Actuarial Students' Society Subject Review*.

Also, because not many people do German 7, classes will have a combination of students in their first, second, and third years.

Subject content

In German 7, the content which is explored includes communications media, consumer culture, pollution, sustainability, and cultural greetings, and these topics will be assessed in the essay section of the exam. Overall, the content of the subject is not difficult. The topics discussed can easily be understood, and terminology is kept to a minimum. The difficulty lies in being able to express ideas relevant to the topic effectively through written expression and being able to justify your opinion on issues.

During Weeks 1–4, consumer culture and communications media are explored. There are topics such as impulse buying (buying items you don't need), supermarket strategies to encourage shopping (having cheap items like milk or bread, manipulation of lighting, and playing music), and young people's use of social media.

During Weeks 5–8, topics such as pollution and renewable energies will be covered. An area that will be studied extensively in these weeks will be the bin sorting system in Germany. This will then lead to the other topic of sustainability, where themes such as renewable energy will be discussed.

During Weeks 9–12, the topic that will be discussed is cultural greetings. During Week 12, there will be exam preparation. You will be inspecting a past exam, which will be very similar to what will actually be on the exam.

Tutorials

The tutorials are split into a 2-hour seminar and a 1-hour conversation tutorial. It is expected that German will be spoken most of the time, with minimal assistance from the English language.

During the first part of the 2-hour seminar, you will read articles provided in German and answer questions on the text. There will be some discussion in groups, and some discussion with the class as a whole, with written responses to the text kept to a minimal. The articles will mainly focus on broad themes relevant to German-speaking societies including communications media, consumer culture, and pollution. Although participation is not assessed and you only need to have a 75% attendance rate, staying engaged and speaking in class is very helpful to make sure you understand what is going on, and contributing in class will allow you to receive feedback on your responses.

The second part of the 2-hour seminar involves learning grammar. You will be given exercise sheets, and have to fill in the blanks. Topics include passive voice, subordinating and coordinating conjunctions, and adjective endings (it's not as easy as it sounds, as more difficult scenarios are considered).

The conversation tutorial encourages students to speak in German in groups and as a class according to the ideas explored in the seminar. Videos may also be shown here, which will be discussed afterwards.

Tutorial content will be highly relevant to the exam, where the themes explored in the seminars will be assessed in the essay. There will also be a grammar section based on grammar explored in the seminar.

Assignments

The first assignment will be a hand-in essay of approximately 500 words. When I did the essay, the theme was consumer behaviours, and I had to discuss my personal experiences as to how supermarkets may induce me into impulsive purchasing. It may sound a bit confusing here, but once you read the scenario, it will be a straightforward task. The few big things to watch out for here is to not make any simple mistakes such as verb–subject agreement and positioning of verbs in a sentence. It will undermine an otherwise good essay, and the tutor hates it. After receiving your essay back, make sure to discuss it with the tutor. This will help you write better essays later on in the subject.

The second assessment will be a listening comprehension test. When I first did the test, the words flew right pass my head. I suggest that you read the question carefully so that you can listen out for key bits of information. If you are unable to answer a question based on the listening, take a guess. It may be more accurate than you think. There isn't really any way to improve your listening comprehension skills quickly. There are German broadcasting radios which you can check out. SBS radio has a dedicated German section during 7–8pm. Listening to this might help you feel more comfortable with the listening comprehension.

The third assessment will be an in-class written essay. The time limit is 2 hours, which quite honestly is enough to write the 500 word requirement. No dictionaries are allowed so make sure you have a clear understanding of the themes discussed in previous seminars, as the content will be linked with the essay topic. Again, double-check and triple-check that you haven't made any simple mistakes which the tutor will frown upon.

The fourth assessment will be the second listening comprehension. This listening was much easier than the first one, but I'm not sure if that was intentional. Again, not much to do here except perhaps listening to some German beforehand.

The fifth and last assessment will be the oral. The oral that I had to do was based on cultural greetings, such as handshakes, bows, and kissing someone's hand. You have to research a greeting, which you can choose for yourself. I suggest that you complete your speech as soon as possible, and practise it as much as possible. The tutor is really big on making the speech sound natural and may take marks off if they think you are just reciting a speech, so make sure your presentation comes out naturally, and you may find it advantageous to stumble at points and think for a little moment to give the impression you are trying to express something which you momentarily cannot put into words.

The exam is split into two sections: a grammar section and an essay. The time limit is 2 hours, but many student were leaving the venue at the 1.5-hour mark. The grammar section will be based on work done in the seminar. The grammar section shouldn't take too long, as you will either know what to do or you won't know. For the essay, you will have a choice between three scenarios. It is important to get the structure correct (are you writing an article, speech, or email) and the style of writing (persuasive, evaluative, personal). It helps to have written a few practice essays before the exam and showing it to your tutor to get feedback. Overall, the exam is quite straightforward and if you understand the content and grammar, you will be fine.

Concluding remarks

German and actuarial studies may seem like two highly unrelated areas of study. However, learning how to self-learn and having the initiative to speak up are skills which will definitely help in tackling the more difficult subjects which you will face, and you may find yourself better prepared than others in searching for resources to assist with your learning. I can speak from experience that many students doing the actuarial subjects are reluctant to speak out, and I was the one who had to consistently answer questions and enter into discussions.

JAPN10001 Japanese 1

Exemption status	None.
Lecturer(s)	Dr Ikuko Nakane
Weekly contact hours	2 × 1.5-hour seminar 1 × 1-hour lecture
Assessments	Test held during seminars 15% Oral assessment, due middle of semester and end of semester 20% 600-word cultural discovery project, due end of semester 15% 2-hour end-of-semester exam 50% A minimum of 80% class attendance is required for the subject; the roll is marked in both lectures and seminars.
Textbook recommendation	Banno, E., Ikeda, Y., Ohno, Y., Shinagawa, C., & Tokashiki, K. (2011). *Genki 1 Textbook: An Integrated Course in Elementary Japanese*. Tokyo, JP: Japan Times. Banno, E. (2011). *Genki 1 Workbook: An Integrated Course in Elementary Japanese*. Tokyo, JP: Japan Times. ✓ The textbook and workbook set is highly recommended, as the lecturers and tutors frequently refer to these books' exercises in lectures and seminars.
Lecture capture	Full (both audio and video).
Year and semester reviewed	2015 Semester 1

Comments

Subject content

This subject is designed for students with no Japanese learning background. Students will develop the essential foundation of Japanese literacy, which allows engagement in social events and situations in an appropriate manner, while drawing on background knowledge in their first language. Specific learning objectives include:

- The two sets of Japanese syllabaries (hiragana and katakana) and around 60 kanji characters;
- Communication skills required to deal with initial social encounters (self-introduction and greetings), exchanging information on everyday life routines and surroundings, and activities in which they are likely to engage in establishing a new life in a foreign country (e.g. shopping, finding ways); and
- Development of an intercultural understanding through identification of common Japanese rituals and routines, reflecting on their own culture, and comparing them.

Lectures

Lectures in this subject contain a summary of the week's content — usually a combination of syllabaries/characters, grammar, conversations in social encounters (e.g. self-introduction, asking for directions), as well as some fun Japanese cultural facts. The lecture only provides an overview of the week's content, and further details and more exercises will be carried out in seminars to help strengthen understanding and aid memorisation. Meanwhile, lectures are fully recorded, and complete lecture notes are usually uploaded to the LMS beforehand progressively (some lecture notes are particularly helpful as a summary sheet of the week). Although you can still keep up with everything without going to every single lecture, it should be noted that 80% attendance of both lectures and seminars is a hurdle to pass Japanese 1; you will need to go to the lecture stream in which you registered to mark your name on the attendance sheet.

Seminars

Seminar attendance is necessary and strongly recommended in Japanese 1. A lot of the subject content that is only gone through briefly in lectures is discussed in much greater details in seminars. There are two seminars per week, each containing a combination of reading, listening, and speaking components that are structured along the textbook exercises. Generally, there is more speaking practice than reading and listening — you'll be paired or grouped with people sitting next to you. Tutors are usually very kind and encouraging, which helps beginners with little prior knowledge of Japanese like me step out of my comfort zone to interact with other people in a new language. Personally I find that speaking Japanese really consolidates the grammar or key points in my mind. Thus, seminars are a great opportunity to master the subject.

Assessments

There are a few parts of assessments in Japanese 1.

- Five in-class tests that are worth 15%, each of which is marked out of 30. These are held in the seminars every two weeks, starting from Week 3. The questions usually include translation, vocabulary, characters, and dictation (listening) sections and are quite straight-forward. If you engage in seminar activities and put some effort into memorising the grammar and vocabulary after class, it is pretty easy to do well. As a reference, in 2015 Semester 1, most people in my class received above 20/30.
- Two oral assessments that are each worth 10%. You need to find a partner in your seminar and act out some role-play activities. Both conversations will be around 10 turns (about 3 minutes) and describe social encounters such as meeting and greeting, discussing hobbies and past experiences, or asking for the time or directions using phrases/grammar you've learnt in class. The marking is based on the creativity, originality, pronunciation, and, most importantly, variety in the use of grammar and vocabulary. From personal experience, it's not hard to get a reasonable mark for oral assessments, yet extra effort in creativity/pronunciation/familiarization/performance is needed if you want a very high score.
- A cultural discovery project worth 15% that is due before the exam period. This is a short essay that justifies and compares Japanese with another language you speak, in terms of characters such as gender markers, polite forms, and how attitudes of speakers are revealed. This analysis needs to be based on your second oral conversation's content; thus it's important to keep what you want to include in this cultural discovery project when writing your script for the oral assessment.

- The end-of-semester exam worth 50%. The exam is 2 hours long, and most of my peers found that this was sufficient. The lecturer will release the structure of the exam closer to SWOTVAC, and there's no listening section in the exam. There was no specimen exam or past exam paper provided (at least in 2015 Semester 1), so I'd say the best way to prepare is to revisit the textbook and redo workbook exercises that you initially got wrong, as well as the in-class tests. The exam itself is not very hard, and good attention to detail can help you get great grades relatively easily.

Suitability as a breadth

This subject is a good breadth to choose for anyone interested in Japanese culture and, obviously, wanting to learn Japanese systematically. It is definitely fast-paced for those who have barely learnt Japanese before, and there's a lot of content to learn and memorize, e.g. it covers hiragana and katagana in the first four weeks and then 12 kanji characters each week afterwards. However, as long as you try to keep on top of everything as the subject progresses, it is still manageable; otherwise, it is just going to be too much of a pain when exams approach. For those who have a bit background in learning Japanese, this subject shouldn't be too hard, and for students who know Chinese characters well, as you may already know, the kanji part will be quite similar, which might give you an advantage.

Overall, Japanese 1 is a quite fulfilling subject, especially if you're into Japanese culture. It is also very well-organized by the faculty and fairly easy to pick up by beginners; I would recommend anyone wanting to find out more about Japan and its language to give it a go.

MAST30020 Probability for Inference

Exemption status	None.
Lecturer(s)	Professor Konstantin (Kostya) Borovkov
Weekly contact hours	3 × 1-hour lectures 1 × 1-hour problem-solving class
Assessments	10 individual assignments 20% 3-hour end-of-semester exam 80%
Textbook recommendation	Karr, A. F. (1993). *Probability*. New York, US: Springer-Verlag New York. The lecture slides and problem sheets contain references to this book. It is available as a digital copy for free as long as you are a student at the university, though it is not really needed; the lecture notes are self-sufficient.
Lecture capture	Full (both audio and video).
Year and semester reviewed	2016 Semester 1

Comments

MAST30020 Probability for Inference will open your eyes to how hard undergraduate studies in probability can be.

This is a demanding subject in every possible way. The theory is dense and the workload immense. Neither breadth nor depth are sacrificed in the delivery of this subject. Probability for Inference is a rigorous treatment of probability theory within the limitations of an undergraduate course, and it approaches the field from the perspective of measure theory, which is an area only taught at a graduate level at this university. There is reasonable discussion on an unexpectedly wide variety of aspects, even though a perfect understanding would require tools beyond those of an undergraduate.

Fortunately you have the perfect lecturer for this subject: Kostya (which he is called instead of Konstantin) is a lively and humorous lecturer who is able to balance the very rigorous topics with accessible explanations. He is always prepared to help the students who help themselves. That is, he will not mollycoddle you, but he is certainly very willing to guide and prompt you, and I find that approach to be optimal in this subject.

In many respects, Probability for Inference resembles MAST10009 *Accelerated Mathematics 2*. Both reconstruct an area of mathematics of which you have a rudimentary knowledge prior to taking the subject. AM2 guides you through the rigour that was sorely missing in your high school calculus studies, while Probability for Inference revisits the content in MAST20004 *Probability* far more meticulously. Indeed, just like AM2, you will probably struggle heavily for the earlier parts of the course, and it is these earlier topics that will support your understanding and star in some vital arguments for other problems and topics occurring later in the semester.

This subject is an elective for the *Statistics and Stochastic Processes* specialisation of the Mathematics and Statistics major in the *Bachelor of Science*. Naturally, most of the cohort for Probability for Inference are students intending to specialise in *Statistics and Stochastic Processes*. However, you will quickly find that many of the students are those from other specialisations who have returned for a second taste of probability after a pleasant experience in MAST20004 *Probability* or MAST20006 *Probability for Statistics*. There are also some *Master of Science* students taking this for their secondary area of mathematical study.

As fickle students you are probably aware that subject choices often come down to the quality of the lecturer (or, more precisely, a vicarious judgement thereof). The rather high enrolment in this third-year subject (59 students in 2016 Semester 1) despite its notoriety for being so difficult and its status as merely an elective is only a testament to just how fantastic of a lecturer Kostya is.

Subject content

Probability for Inference ties together many of the loose threads in *Probability* and *Statistics* while introducing some new tools and techniques. Overall I would label Probability for Inference as a subject in both probability theory and mathematical statistics (mathematical statistics referring to the mechanics behind various statistical tools and frameworks). The course (as well as Kostya himself) places heavy emphasis on rigour and proof, and the content is heavily abstract and conceptual but is delivered exceptionally well in an accessible manner by Kostya.

Probability for Inference begins with the same few definitions that you probably glossed over at the beginning of *Probability*. However, it introduces the concept of σ-*algebras*, which may have been tersely mentioned in *Probability* as the set of events which are "nice". One of the most fascinating aspects of σ-algebras to me is that it can be seen as the mathematical manifestation of information or, more strictly, information "potential" from observations of a random quantities. This particular way of viewing information as a σ-algebra is precisely the motivation behind the use of martingales in higher level financial mathematics (ACTL40004 *Advanced Financial Mathematics I* and beyond, although to some extent ACTL30005 *Models for Insurance and Finance* also).

A few properties of probabilities (i.e. the function that assigns fractional values to events, often with the familiar notation $\mathbf{P}$) are discussed. The probability axioms are, of course, part of this. Most of the other properties relate to sequences of events, which is something you will not have seen in *Probability*. Following this are the familiar faces of distribution functions, probability mass functions, and density functions, but they are of course introduced in the context of our newer framework.

Random variables and expectations are the next point of discussion. Again these are rebuilt from a more rigorous perspective than in *Probability*, and again some unfamiliar properties of and results regarding expectation are discussed (yes, there is more to expectation than just linearity). The concept of conditional expectation is the next topic; it is probably the first hurdle in this subject if you have found the content manageable so far, as conditional expectation is no longer the tame computational beast that it may have been in *Probability*. In my opinion, conceptualising expectations and conditional expectations as the "best guess" of some random quantity (possibly given some information beforehand for conditional expectations) is the way to navigate through this topic and further uses of expectation. In fact, thinking about conditional expectations in this way corresponds very naturally to the Bayesian estimator under the quadratic loss function, which you may recall from MAST20005 *Statistics*.

With so much content falling under the field of probability theory, you may doubt the relevance of "Inference" in this subject's name. Fear not, for the weeks you have spent learning mind-numbing probability theory is about to find some use in statistics right within this subject! The discussion on statistics in this subject takes place in two parts, with the interlude dedicated to two areas of probability theory, one of which is the unequivocal cornerstone of (frequentist) statistics, and the other of which is indispensable in the study of further probability theory.

The first part of discussion on statistics covers and extends some of the theoretical topics encountered in MAST20005 *Statistics*: maximum likelihood estimation and sufficiency. The prominent theorems in this section are none other than the Neyman–Fisher factorisation theorem and the Rao–Blackwell theorem. This section is entirely taught from first principles, as *Statistics* is not actually a prerequisite for Probability for Inference. I enjoyed the treatment of these two topics far better than I did in *Statistics*, although that likely comes down to a personal appreciation for more theoretical discussion.

The two sections of probability theory that follow this opening discussion on statistics are limit theorems and characteristic functions. From *Probability* you should already be familiar with the law of large numbers and the central limit theorem; these are the main limit theorems, and in this section the mechanics behind these two theorems and other related phenomena will be examined. There is a slight resemblance to limits as taught in AM2, in that you should be prepared to maintain an ϵ–N-level of rigour in your solutions.

The section on characteristic functions was, to me, the most eye-opening of this subject. Characteristic functions may have been mentioned in passing in *Probability*, around the time that moment-generating functions and probability-generating functions were introduced. Characteristic functions retain many properties of moment-generating functions (uniqueness, can be used to circumvent convolution integrals, can be used to compute moments through differentiation), but are (subjectively) **better**. One of the ways in which it is superior is that the characteristic function of a random variable is always well-defined; the same cannot be said for moment-generating functions. The characteristic function of a random variable is the Fourier transform of its density (with respect to an appropriate measure), and indeed a perfect inspection of some of its properties will mandate some results from complex analysis; however, the lectures will be manageable without having studied complex analysis. As a consequence, the density function and the characteristic function of a random variable (or rather, its distribution) are intimately connected. I gather that many of the properties discussed in this subject likely follow from corresponding results in Fourier analysis; in any case, the expectations of the cohort for characteristic functions will not require experience with complex analysis.

Characteristic functions are mainly used to revisit and establish some of the limit theorems. This is done with the assistance of Taylor polynomials. In Probability for Inference, you must be[come] very comfortable with single-variable Taylor polynomials (and be willing to accept that Taylor's theorem holds in the complex case if you have not studied complex analysis). In particular, whereas in AM2 you may have used Taylor's theorem with Lagrange's form of the remainder, in Probability for Inference, the use of Taylor's theorem is accompanied by Peano's form of the remainder, which simply uses Landau's Little-O notation to express the remainder term in Taylor expansion. For the purposes of this subject, Peano's form is probably more concise and suitable than Lagrange's form is.

The return to statistics is signified by an excursion into the validity of the chi-squared goodness-of-fit test. In *Statistics*, it is not immediately clear how the claimed null distribution of the test statistic is a valid approximation. With the results on limit theorems and characteristic functions, you are now able to conclusively establish the rationale behind the null distribution used in this goodness-of-fit test.

The subject concludes with the discussion of empirical distribution functions and asymptotic behaviour of maximum likelihood estimators. The discussion on empirical distribution functions culminates in the fantastic Kolmogorov–Smirnov goodness-of-fit test, and like the chi-squared goodness-of-fit test, the null distribution is derived rigorously (with the quotation of some intermediate results which would probably take too much time to discuss). The discussion on maximum likelihood estimators shows how they are asymptotically normal and unbiased and establishes the relevance of Fisher information (remember the Rao–Cramér lower bound from *Statistics*?) in the mean-squared error (variance).

I would say that there is non-trivial overlap between Probability for Inference and ACTL30005 *Models for Insurance and Finance*, even though the ultimate aims of the two subjects are rather different, with MIF intending to be a foray into the probability theory required to handle the *Advanced Financial Mathematics* subjects in the Actuarial Studies Honours program. Both are constructed to be students' first exposure to probability theory from the perspective of measure theory (i.e. rigorous probability theory). For example, in both subjects, students will be introduced to σ-algebras and (a rigorous take on) conditional expectations, and while I have not completed MIF at the time of writing, neither of these can be introduced successfully without the dedication of a few lectures.

Lectures

From the very beginning of the subject (actually, even before), the lecture slides for the entire subject are available online. They can be found on the LMS or on a page where Kostya makes available to the public the main resources in the subject (the link is http://www.ms.unimelb.edu.au/~s620323/). The set of slides is an excellent resource, and of course Kostya's lectures follow the slides perfectly (but he will add a bit more). There are usually some references to problems on problem sheets, so Kostya will update the slides every now and then if the problem sheets have changed since the last iteration of the subject.

Kostya delivers his lectures with the document camera switched on, and in the Russell Love Theatre (where most third-year maths subjects are held), the document camera occupies one of the projector screens, while the current slide occupies the other. In my semester of completion, the lecture recording consisted only of the activity on the document camera, so you would not be able to see what slide Kostya was currently discussing in the lecture recording.

The lectures are interactive, entertaining, and of course very educational. Kostya delivers lectures in his characteristic exuberant manner without sacrificing the care needed in rigorous arguments. As I have mentioned, I found that Kostya has the uncanny ability of translating the "burly" and intangible rigour of probability theory into very accessible intuitive arguments. Of course, what is intuition to one can easily be an absolute mystery to another; some of these pieces of intuition are not completely obvious, so to say, but with experience from lower level maths subjects (and particularly the variety of mathematical problems therein), what Kostya delivers as intuition should be mostly regarded as such by the cohort. For example, geometric properties of projections and convex sets are mentioned throughout the discussion of conditional expectations. This is perhaps not the best example of intuition (being a consequence of considering the set of random variables with 0 mean as a Hilbert space), but it highlights Kostya's resourcefulness in using analogies from other areas of mathematics to which most students will have had exposure. Another example is Kostya's explanation of Lebesgue integrals, which he summarises as partitioning the integrand by range rather than by domain as in the Riemann integral (with a strange example of counting money spread on the floor).

Kostya is always ready to ask the audience questions: some just to see if knowledge in the recent few lectures has been retained; others a prologue into the topic of discussion for the day; and occasionally a "Can I put this on the exam?" to make us ask ourselves whether we really know the content. Kostya's questions almost created an atmosphere of discussion, which I feel in the university study of mathematics is very necessary. Of course, the "discussion" was usually dominated by Kostya, but his questions were rarely unanswered, and the interaction between student(s) and teacher in the lecture hall created a sense of engagement which I have rarely found in a university subject.

The actual structure of a lecture naturally varies according to what's on the lecture slides. A lecture could contain

- an explanation of a difficult proof;
- outlines of proofs when they are beyond an undergraduate student;
- explanations of multiple smaller proofs (particularly when exploring properties); or
- intuition for or demonstrations of the more abstract concepts.

None of these are particularly surprising in a maths subject, but it is of course the higher proportion of proofs in this subject which gives Probability for Inference its overall theoretical orientation. Now, Kostya's (unspoken) expectation is that any proof which is given completely in lectures (i.e. not those which are clearly stated as beyond the undergraduate student) is fair game in an exam, and it is rather daunting that this refers to probably half of the slides. Kostya's aim is certainly not to encourage rote-learning. In fact, Kostya encourages the cohort to form the good habit of retaining the key ideas of a mathematical proof, which, when combined with the mathematical tools at hand, are sufficient in reproducing the proof. I would strongly recommend highlighting and remembering the key ideas or techniques in all the proofs in the lecture slides. It develops your mathematical maturity and is also quite fulfilling when you realise that you are able to reproduce proofs

without further assistance by just noting these key ideas. Of course, it is even more fulfilling to find these key ideas yourself; unfortunately that is rather difficult and thankfully not an expectation.

For a few weeks during the semester, Kostya also conducted in-class quizzes (not contributing to the final grade). This was done on the Socrative web platform, and students took part using their mobile phones. The questions were all true–false or multiple-choice questions and generally tested knowledge in the last few lectures or so. This was opt-in, but there was nothing to lose since the performance did not contribute to the final grade, so it was a good revision tool to check your understanding of the recent lectures. Not all the questions were as straightforward as you would expect of multiple questions, especially since there was an unofficial time constraint of however much time Kostya decided was necessary. Most questions seemed to set up some random variables and ask if certain statements regarding the random variables were true, which ranges from simple to quite puzzling given the scope of Probability for Inference.

In the final week, if there is time Kostya will spend some lectures doing a past exam. In my semester of completion the discussed exam was not a past exam to which solutions were available online (that would have been slightly redundant), so it is ideal to be present for these lectures.

Problem-solving classes

When you look at the university timetable entries for Probability for Inference, one of the most striking things is that there is only one time slot for the practical class. Unlike practical classes in other maths subjects, in Probability for Inference, these resemble lectures more than they do tutorials. In fact, they take place in the same place as the lectures (at least this was the case in my semester of completion).

Kostya calls these classes "problem-solving classes", and the entire class will consist of Kostya solving problems on the weekly problem sheet, which Kostya will print and bring to the classes as well as post online. These problems are not straightforward; even though Kostya readily encourages students to present solutions in problem-solving classes, there is hardly ever any student brave enough to do so. Even so, Kostya maintains interaction with the cohort as he does in lectures. Some of the problems in these classes are simple applications of the theory learnt in the lectures in the week before. However, by and large these problems require new techniques or arguments not seen in lectures. Kostya will also sometimes offer extra insight into the theory during these problem-solving classes, although this is the natural thing to do when completing problems which require new methods.

I think the benefit of attending problem-solving classes is clear. Any passionate student should want to see how the content in lectures can be used or extended in various problems. I think it is fair for problems resembling those on problem sheets to appear on exams, so you assume some risk by missing these classes (they are not recorded like the lectures). Kostya will also tell you that it should not be surprising if the exam contains similar questions; I do not recall that happening in my end-of-semester exam, however, so perhaps he was feeling generous in my semester of completion.

Problems listed on problem sheets are quite often referenced in lecture slides, and this creates a strong sense of coherence between the material in problem-solving classes and lectures. Often the situation will be that the significance of a certain problem on a problem sheet is highlighted in a later lecture (usually in the form of some small phenomenon). This reserves time in lectures for the more important aspects, but ensures students have a robust knowledge of everything that is happening.

It is regrettable that there is often not enough time for Kostya to go through all the problems on the problem sheet. Kostya often resorts to skipping computational steps or claiming some steps are obvious in order to save time; he will more readily claim that something is obvious in these problem-solving classes than in lectures. Solutions are posted online after the class, but I still personally believe greater value is gained from hearing Kostya's explanations for some of the more difficult

problems rather than reading solutions on paper. Nevertheless, for the problems not covered in the problem-solving class, it is your responsibility to be familiar with the solutions posted online.

Assignments

This is quite possibly the single aspect of Probability for Inference that will leave students with somewhat bitter memories.

You have ten assignments for this subject in total. In 2016 Semester 1, each was due at 5pm on Mondays from Weeks 3 to 12. These are all standard-length maths assignments — the length of these assignments does not compensate in any way for how many there are (the length of those in MAST20004 *Probability* are a good indication). This is simply an enormous time commitment for a single subject, and while I think the assignment workload is somewhat warranted due to the difficult theoretical nature of the subject, for me, ten assignments still falls on the extreme side.

The assignments problems are on the same sheet as the problem sheet (usually on the next page), and they are of a similar difficulty. The trouble is that to do well on the assignments requires (in my opinion) an excruciating amount of effort, not to mention how many of them there are to begin with. Kostya expects the rigour and detail which he himself displays in lectures, and for a first exposure to rigorous probability theory, sometimes it can be difficult to identify the areas that necessitate more rigour. The level of detail Kostya presents in problem-solving classes is a bad indication of what is expected of you; as I have said, Kostya is under time constraints during those problem-solving classes. However, a good indication, outside of the lecture slides, is probably the solutions to the problem sheets which Kostya posts online. One example of the level of detail required is that Kostya expects "by linearity" to be written somewhere when you use the linearity property of expectation or conditional expectation.

The scoring system for assignments is as follows: For each assignment, Kostya (or someone to whom he has delegated the marking) will select a question to mark for the entire cohort. This gives a mark for each assignment (or really, just the respective question selected for the assignment) that is usually out of 5 marks (but sometimes more). The average percentage over all ten assignments (equal weighting among all ten) then receives a 20% weighting in the calculation of the final grade, with the percentage on the exam receiving the remaining 80% weighting.

This also means that a mark on one assignment may have more effect on your final grade than that on another assignment (very marginally), but you will not know which assignments these are, as you are not told beforehand the maximum mark of any assignment. For example, if there were 3 assignments marked out of 2, 10, and 50 (just an example — the maximum marks are more consistent in reality), and your scores were 1, 10, and 50 respectively, then the percentages earned on your assignments would be 50%, 100%, and 100% respectively, and your average percentage would be 83% (rounded down). Notice that if the single mark you had lost was on the third assignment rather than the first, your average percentage would have been 99% instead (rounded down).

Kostya published assignments marks twice throughout the semester: once after the fifth assignment, and once after all ten assignments. Students were listed by student number (no names). For brevity, here were the summary statistics after all ten assignments in my semester of completion, the data in consideration being the the average percentages multiplied by 20. (The minimum of 0 is not a mistake.)

Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
0.00	10.29	12.65	12.33	16.23	19.20

As mentioned, the questions on assignments are of similar difficulty to those on the problem sheets, though probably slightly easier. The questions are usually either computations or applications of the theory to prove some properties. Not all assignment questions are straightforward; some will require some thinking as to the optimal method of approach, although

for the computational questions this is usually not the case. For some questions Kostya will provide hints; sometimes I found these somewhat unnecessary or a slight giveaway, but other times they offered the right amount of guidance.

As it was for problems on the problem sheet, the lectures slides will sometimes reference problems on the assignments. The reverse also happens; sometimes an assignment question will be the investigation of a property that was merely quoted but not established fully in lectures. All in all, the assignments and problem sheets are very coherent aspects of the subject which aim to give a more holistic understanding of probability theory.

End-of-semester exam

This is a 3-hour exam that is probably on the long side due to the nature of the content in Probability for Inference. No cheat sheet is allowed. A scientific calculator is allowed but will not be of much use.

I think that the level of difficulty of the exam is very consistent with the subject as a whole. This contrasts quite starkly with some of the actuarial subjects, where the difficulty of the subject before the exam and difficulty of the exam itself can potentially be night and day. That is to say, there are hardly any surprises on the exam for Probability for Inference, but it is still far from being easy.

The exam is more computational than the assignments, but theoretical questions still have decent representation.

Kostya expects a high degree of familiarity with the lecture slides (and possibly more, but you will perform decently with just being familiar with the lecture slides, although that is no small task anyway). As mentioned earlier, the proofs on these lecture slides will almost surely (but not certainly!) make an appearance on the exam. I mean this literally; there will be subquestions which effectively amount to reproducing some portion of the slides. You would, however, be a fool to rote-learn the proofs on the slides. That is not recommended, optimal, nor, in my opinion, acceptable for a student of third-year mathematics. In 2016 Semester 1, there were also some subquestions which had featured almost identically on assignments.

I believe the way to approach exam preparation for such a theoretical subject is no different to the preparation for the general theoretical mathematical subject. Familiarity with all the results of key theorems and properties is absolutely essential, but the next step varies in difficulty from student to student. Perfect preparation for the exam will involve, more specifically, familiarity with the techniques used to establish the key theorems and properties, and also some of the content outside the lecture slides. It is not possible to form an exhaustive list of areas with which you should be familiar, as this is nevertheless a third-year mathematics subject, and creativity and critical thinking, as well a good memory, will underpin any level of success in the subject. For example, something as simple as the square of any real number being nonnegative is a well-known fact to most students, but would you be able to recognise its utility for a question asking you to provide a proof (of something else)? Would you be able to recognise that an expression was in the form of the Taylor series for the exponential function if it wasn't explicitly provided in that form? These are the kinds of questions that you need to ask yourself if you are aiming for the highest levels of achievement in this subject and further mathematical studies (particularly if they are heavy on theory).

In terms of topic coverage in the exam, elements of all topics will be present, although this is only to be expected if you have personally experienced the twelve weeks of teaching by Kostya in Probability for Inference. Due to this, the structure of exams seems to remain somewhat invariant, in that there will be generally be

- one or two questions on the probability ($\mathbf{P}$) definition, axioms, and properties;
- one or two questions on the σ-algebra definition and properties;
- a question requiring the plot of a distribution or density function as well as the computation of other quantities relevant to the distribution;

- questions involving computations with or properties of expectations and conditional expectations;
- questions involving sufficient statistics and maximum likelihood estimation; and
- questions involving the convergence modes and characteristic functions.

Again, this is not an exhaustive list. There are most likely other more specific topics which make appearances on the exam less frequently, such as empirical distribution functions or multivariate (normal) distributions. However, the above list should contain the topics common in all exams for Probability for Inference. There will generally be proof-style questions for most of the topics present on the exam, but I believe more of the exam is computations rather than proofs.

Also of note is a true–false question (with multiple subquestions). These are not pure true–false questions, however; you still need to provide justification for your answer. These questions resemble those in the in-class quizzes, and the justifications will be mostly very short. Why is there a true–false question on the exam? Kostya admits that they are easy to mark — very honest answer.

Kostya is hesitant to make available the solutions to too many past exams, as he prefers students to learn content rather than "learn exams" (i.e. prepare specifically for the sorts of questions on previous exams). In my semester of completion there were just two past exams with solutions provided. More past exams were available on the library website, but Kostya refused to provide solutions to those.

Concluding remarks

MAST30020 Probability for Inference is a well-administered and rewarding subject, but certainly not for the light-hearted. It is an excellent foundation to have for further studies in probability theory and (mathematical) statistics. As an Actuarial student, if you are prepared to dedicate effort into a subject which may only be breadth study and you are interested in the intricate mechanics of probability theory, then I highly recommend this subject.

An interesting fact: Kostya's father was a student of the great Kolmogorov himself! I was also told that Kostya's father was in fact Kolmogorov's best student, although I was unable to verify that myself. In fact, Kostya publishes research with his father, who is by now somewhere in his eighties.

D-MATHSC Diploma in Mathematical Sciences

Opening remarks

If you are reading this, you have most likely enrolled in a *Bachelor of Commerce* degree (BCom) at the University of Melbourne to major in Actuarial Studies (ACTL). As an Actuarial student, you undoubtedly have some interest in mathematics, so why is it that you chose a *Bachelor of Commerce* degree in actuarial science over a *Bachelor of Science* degree (BSc) in mathematics? Of course, there is no unique answer to this. Aspects such as employability, prestige, mathematical aptitude, and the level or type of interest for mathematics quickly come to mind. However, for some, this question leads to no clear answer and may be a reminder of a somewhat arbitrary decision that has led to you to enrolment in BCom.

If you may feel that your mathematical interests were somewhat compromised due to choosing the actuarial science degree over the mathematics degree, then it would be wise to consider another option which will still allow you to be an Actuarial Studies graduate while studying further mathematics: the Diploma in Mathematical Sciences (Diploma).

Selection

Little is known about the selection procedure for the Diploma. The D-MATHSC handbook entry mentions that prior (tertiary) academic performance is considered. It is also necessary to have a study score of at least 30 in VCE Specialist Mathematics or equivalent achievement in mathematics subjects of other high school–level certificates.

I have personally never heard of rejection from the Diploma. Self-selection is probably the main reason behind this; as a concurrent diploma is not compulsory, I would find it absurd for students who have not demonstrated success in previous mathematical studies to voluntarily pursue further mathematics.

Course structure

The Diploma is a 100-point (i.e. 8 subjects) degree that is to be taken (partially) concurrently with a bachelor's degree. All 8 subjects in this degree must be mathematics and statistics subjects, i.e. subjects having the "MAST" prefix in their subject code.

At least 50 points (4 subjects) of the degree must be level 3 subjects, and the subject selection must be such that you are eligible to be awarded any one specialisation (essentially a sub-major) that is available to students completing the Mathematics and Statistics major (MAST) in the BSc.

Neither the bachelor's degree nor the Diploma can be awarded (i.e. you cannot graduate) while the student is enrolled in both but has yet to pass all subjects for at least one of them. Generally, students will take 7 or 8 semesters (3.5 and 4 years respectively) to complete both degrees, but in some cases they can finish both in 6 semesters (3 years).

Typical arrangements made by students to complete the bachelor's degree as well as the Diploma include

- completing core subjects in the bachelor's degree in a later semester than is standard;
- taking Summer Semester, Winter Semester, or other intensive forms of subjects;
- cross-crediting; and
- overloading.

To finish in at most 8 semesters, students will invariably have to employ at least the first of the 4 aforementioned strategies, as level 3 maths subjects (of which the Diploma requires 4) are mostly only offered in one semester of the year and are not available in intensive form. Cross-crediting is done by almost all students, while overloading is avoided by many students.

Crediting arrangements

If you are unfamiliar with the term, "cross-crediting" is defined in the University's policy library as

> Where a subject taken towards one award course may also be included in the Points required for a second award. Cross-crediting allows a student to complete awards without accumulating the combined total Points of each award.

In context, this means that if you cross-credit a (passed) maths subject (MAST10008 *Accelerated Mathematics 1*, MAST10009 *Accelerated Mathematics 2*, MAST20004 *Probability*, MAST20005 *Statistics*, or a maths breadth if you happen to have one) which was on your BCom study plan to your Diploma, then you can count it as a passed maths subject for the Diploma as well.

The University allows cross-crediting for up to 50 points of subjects, so if you decide to do the Diploma alongside your BCom, then you are not required to complete 100 points of additional subjects; you can complete the Diploma with just 50 additional points (which will require cross-crediting of 4 maths subjects in your BCom), potentially meaning completion of both degrees in 7 or fewer semesters.

Fees

The option to cross-credit also means the cost of completing the Diploma can be lowered, simply due to having as few as 4 additional subjects rather than 8 for which tuition fees must be paid. In fact, the University allows the final 50 points of subjects which are credited towards the Diploma or both the Diploma and the bachelor's degree to be exempt from HECS debt, which means that they are free of charge. This is a likely an incentive by the University to encourage the study of concurrent diplomas. Notably, if you end up taking exactly 50 points of extra subjects in addition to the 300 points of subjects in the bachelor's degree, the entire Diploma is effectively awarded free of charge (but not free of blood and sweat, of course).

Note that this option is not available in all concurrent diplomas.

Differences in the maths

There is no doubt that an ACTL student is already exposed to a wealth of mathematics (at least relatively within the Faculty of Business and Economics), so the obvious questions to ask yourself are:

- Will the maths in the ACTL major of the BCom satisfy me?
- How different would the maths in the Diploma (or the School of Mathematics and Statistics in general) be?

It must be clarified that while the fields of study in the ACTL major cover a wealth of mathematics **relative** to the vast majority of degrees and majors, the true first-place among undergraduate majors for the coverage of mathematics is simply the MAST major of the BSc. Being among the ACTL cohort day in, day out, it may be easy to forget this fact.

With regards to specific fields within mathematics, the ACTL major mainly traverses the fields of probability, statistics, and financial mathematics (aka mathematical finance or quantitative finance; there are possibly some differing opinions to my classification of this as a field of mathematics). Notably, there is an absence of any reasonably deep inspection of pure mathematics, applied mathematics, discrete mathematics, and operations research — at least compared to those in the MAST major of the BSc. The lack of pure mathematics will actually end up a hindrance, should you suddenly decide to pursue graduate studies in mathematics rather than become an actuary.

Having established differences in coverage, there is also a minor difference in style. In the ACTL major, the typical student desires to gain exemptions, become professionally accredited, and ultimately become an actuary or work in business. In particular, aspirations in research are quite difficult to identify in the ACTL cohort. (Personally I don't think I've ever heard of an ACTL student expressing interest in becoming an academic.) This contrasts with the MAST major, where a sizable portion of students will intend to pursue studies in the form of a master's degree or even a doctoral degree, with industry employment in consideration afterwards or, quite possibly, postdoctoral work followed by a career in research.

Whether by accommodation or by coincidence, the approach to mathematics in the ACTL major is overall process-oriented (you become familiar with certain types of problems and certain procedures which you will apply to those types of problems). While I cannot say that the MAST major is a complete departure from this, having completed 6 actuarial subjects and 9 maths subjects at the time of writing, in my mind I ascribe a greater necessity for creativity and expansive knowledge (or a good memory) to my maths subjects. Perhaps one way to validate this is to ask yourself: when was the last time you were required to produce an original proof which was not produced in full in lectures for an actuarial exam? This has been required of me in a maths subject before (and was a rather interesting encounter). This is certainly not to say that actuarial exams are easier than maths exams — I only mean to convey that the styles are distinct. Personally I have actually found actuarial exams more difficult than maths exams, although perhaps this is a forced comparison between apples and oranges.

I am also of the belief that the Centre's obligations to the Actuaries Institute's exemption curriculum requirements have steered these actuarial subjects towards such a style. In that sense, the more process-oriented style of maths would be a trade-off for professional accreditation.

Of course, there are staff in the Centre for Actuarial Studies (the Centre) who greatly subvert such a stereotype in the actuarial subjects they teach. Anyone who has successfully survived an exam/apocalypse delivered by Professor Mark Joshi should be able to attest to this.

All in all, the maths you meet in the Diploma will almost certainly be different in style, if not in content too, to the maths in the ACTL major.

Specialisations

There are 4 available specialisations, and your subject selection for the Diploma must meet the requirements of at least one of them. The specialisations are

- *Pure Mathematics*,
- *Applied Mathematics*,
- *Discrete Mathematics and Operations Research*, and
- *Statistics and Stochastic Processes*.

Apart from *Statistics and Stochastic Processes*, the maths in the other specialisations will have little overlap with the maths encountered in the ACTL major (as mentioned above).

I will briefly describe each specialisation, its relevance to the actuarial science student, and the difficulties faced in meeting the specialisation requirements alongside a BCom degree with an ACTL major that seeks to meet professional accreditation requirements. I restrict myself to a cursory discussion as I am unfamiliar with many of the fields and what many specialisations in the MAST major are like.

Pure Mathematics

> Pure mathematics is to mathematics as mathematics is to science.
>
> Yours truly

Perhaps the least practical (at a glance), pure maths is more than meets the eye. Pure maths is often described as "the study of mathematics itself" (hence the popular opinion that it is least practical). From my experience, the results in pure maths are tools used in many other fields of maths, and you are certainly handicapping yourself if you attempt to study mathematics at a graduate level without a sufficient grounding in pure maths.

First-year maths subjects MAST10008 *Accelerated Mathematics 1* and MAST10009 *Accelerated Mathematics 2* introduce basic elements of pure maths. Things like vector spaces, inner products, matrix diagonalisation, limits, convergence, and the Riemann integral I would label as topics in pure mathematics. Perhaps many of you have often wondered how many times you would ever use (linear) vector subspaces or the comparison test for convergence of positive series outside of your mathematical studies. The answer is almost definitely no times at all, but the reason why people investigate such topics is in the same way almost definitely not to apply them directly to developing an optimal pricing process for a new insurance product. As you progress through your academic studies in actuarial science, you will eventually learn to appreciate the relevance of pure maths to more practical theory.

In terms of relevance to a prospective actuary . . . very little. While studying pure maths may train mental flexibility and improve analytical skills, such benefits are hardly ever why you enter a field like pure maths and are also hardly unique to it.

A certain occupation where pure maths degrees are quite common (but normally at a doctoral level, or master's at the least) is a quantitative analyst, which a select few of the cohort may be interested in becoming. Loosely, a quantitative analyst ("quant") develops mathematical models relevant in finance, mostly using mathematical tools which lie beyond that of an undergraduate actuarial science course (certainly at least the 3-year undergraduate program at the University). The occupation attracts (and requires) people with graduate or doctoral credentials in various numerate disciplines; pure maths is obviously only one of these disciplines.

Unfortunately the "quantitative" in "quantitative analyst" has broadened in meaning somewhat, and its use in job titles may not perfectly correspond with the role I have just discussed — perhaps an Australian phenomenon.

Should you aspire to specialise in *Pure Mathematics* in the Diploma, you will need at least 8 standard-load semesters to complete the BCom with an ACTL major (and meet accreditation requirements) and the Diploma. If you are willing to overload or take intensive subjects, the time can be reduced to as few as 6 semesters.

Applied Mathematics

Whenever I think of applied maths, I find it hard to stray far away from thinking of mechanical and occasionally tedious processes which originate from beautiful results from pure maths. At an early undergraduate level of study in applied maths, I would say this is quite true.

Applied maths revolves around the mathematical modelling of systems encountered in fields such as physics, economics, finance, meteorology, biology, or computer science. As such, people readily identify applied maths as far more useful than its pure sibling, since practical examples that use applied maths are almost always just that one step away. Given the reliance of applied maths techniques on results from pure maths, I would take caution in adopting such a belief.

At the University of Melbourne, undergraduate applied maths subjects tend to investigate systems with more deterministic behaviour, such as those in classical physics. On the contrary, as systems encountered in business almost always involve interaction with vast human populations or wider natural phenomenon, the actuary works mostly in a probabilistic or stochastic environment.

While there may be a discrepancy in the nature of the systems studied under this specialisation at the University and the work undertaken by actuaries, the common ground of modelling will most likely prove beneficial. Inference from existing samples is an activity common in the modelling of any systems, as are simulation and numerical approximation. Techniques pertaining to these aspects of mathematical modelling are abundant in the *Applied Mathematics* specialisation. From what I read of the handbook entry, one of the core *Applied Mathematics* subjects MAST30028 *Numerical and Symbolic Mathematics* is even dedicated to the usage of mathematical software such as MATLAB or Mathematica in implementing these kinds of algorithms.

The differential equations topic encountered in MAST10009 *Accelerated Mathematics 2* is unequivocally applied maths but is, however, only a very basic introduction. Other than that, first-year maths subjects do not provide much insight into applied maths.

If you decide against pursuing an actuarial career, a degree in applied maths is likely to make you more viable for positions in the various fields I have mentioned above. However, it will probably be very difficult if you do not complement your skills of mathematical modelling with knowledge of the field itself.

As with the Pure Mathematics specialisation, you would generally spend 8 semesters to complete both the BCom (ACTL major and accreditation) and the Diploma if you choose the *Applied Mathematics* specialisation. This can be reduced to 6 or 7 semesters depending on your willingness to overload and take intensive subjects.

Discrete Mathematics and Operations Research

This is an interesting specialisation and by far the one you will encounter least in your ACTL major. My understanding of this field of study is also probably the least clear.

Discrete mathematics and operations research are two different areas of mathematics, but their applications have a lot of overlap, which is perhaps why they're coupled together as a single specialisation at the University. I source the School of Mathematics and Statistics' website (the School) for a description of the two:

> Discrete Mathematics, the study of algorithmic development including the programming of the most efficient mathematical solutions, has arisen from the huge revolution in computing in recent decades.
>
> Operations Research provides a scientific approach to decision making. It involves formulating mathematical models of these problems, and developing mathematical tools to obtain solutions.

People tend to be unfamiliar with these 2 areas of mathematics, but I would say that, outside of applications in physical sciences, discrete mathematics and operations research are probably the most practical areas of mathematics. (Applied mathematics still takes the cake for applications in physical sciences.)

In discrete mathematics you might encounter some counting methods and networks, which are topics in VCE Mathematical Methods and Further Mathematics (I think) respectively. Operations research seems to revolve around optimisation with respect to some utility or some objective and techniques to arrive at approximate or even exact solutions. There is an abundance of algorithms in both areas, so it helps to have some experience in programming, so that you may have some pragmatic understanding as to what an algorithm is, or how to implement an algorithm in a certain language to actually test and use it.

Personally, I have only studied one subject (MAST30011 *Graph Theory*) that is from these areas of mathematics (it was a discrete mathematics subject). The mathematics was quite removed from the other maths subjects I had done, in the sense that as long as you knew what constitutes a mathematical proof, you could probably have done the subject in your first year without having done the standard first-year maths subjects.

Utility theory, a topic in ACTL30006 *Financial Mathematics III*, would be classified as operations research, but otherwise the core subjects in the ACTL major are largely void of any discrete mathematics or operations research.

Discrete mathematics seems to lie more on the abstract side, but I gather that the theory developed is used in operations research. Now operations research finds practical uses in many fields. You may often hear operations research described as being relevant in "decision science" or "management science", particularly along with phrases like "logistics" or "supply chain" in business contexts. As the name suggests, it is used somewhat to optimise operations, some examples being how to organise the postman's route so that all the mail is delivered but the least distance is travelled or how to schedule university classes so that as few clashes occur over all students' timetables as possible. A quick glance of the handbook entry seems to further suggest some use in microeconomics, particularly in game theory or utility theory. Financial economics would likely find some use for operations research.

The specialisation's core subject MAST30013 *Techniques in Operations Research* has a unique structure for a maths subject which involves a group project and oral presentation on an operations research–related task. This looks to imitate the use of operations research in a professional context and is likely a worthwhile experience for students interested in the specialisation.

As with the other Diploma specialisations so far, it is possible to complete the BCom (ACTL major and accreditation) and a *Discrete Mathematics and Operations Research* specialisation in the Diploma in 6 or 7 semesters, with variable amounts of overloading and intensive subjects. Doing so without overloading or taking intensive subjects will require 8 semesters.

Statistics and Stochastic Processes

This should be a rather familiar field. By the time I graduate, I will probably have to admit that there is nothing majorly different in the probability and statistics content covered in this specialisation and all the "ACTL" prefix subjects — the alert student will probably be able to comfortably modulate his or her understanding of probability and statistics between the teachings of the School and the Centre.

Echoing the earlier sentiments about the differences in the teaching of mathematics between the School and the Centre, there is more time spent on theory in the subjects taught by the School, while the Centre aptly has a greater focus on applications in an actuarial context. Some of the theory taught by the School will be overlooked in the subjects offered by the Centre, most likely because there is no clear actuarial application; however, this only constitutes a small part of the overall content taught by the School.

Since this is the most likely consideration for ACTL students, I will discuss subject selection in greater depth.

Completion of this specialisation requires the completion of both of

- MAST30025 *Linear Statistical Models* and
- MAST30001 *Stochastic Modelling*,

at least one of

- MAST30020 *Probability for Inference* and
- MAST30027 *Modern Applied Statistics*,

and any other level 3 subject offered by the School if less than 50 points of level 3 subjects would be completed otherwise.

However, students are not allowed to complete MAST30027 *Modern Applied Statistics* for credit points if they are being awarded credit for both ACTL30001 *Actuarial Modelling I* and ACTL30004 *Actuarial Statistics*. This clause is, of course, a reminder of the similarity in content between the "ACTL" prefix subjects and the "MAST" prefix subjects.

For ACTL students seeking accreditation, this effectively means that, to complete the Diploma with a *Statistics and Stochastic Processes* specialisation, all 3 of

- MAST30025 *Linear Statistical Models*
- MAST30001 *Stochastic Modelling*
- MAST30020 *Probability for Inference*

must be completed, as well as one other level 3 maths subject which is not MAST30027 *Modern Applied Statistics*.

The remaining free choice is something unique to the *Statistics and Stochastic Processes* specialisation. I advise you use it wisely as an introduction into another area of maths which interests you.

So what exactly does the normal ACTL student miss out on when they conclude their study of maths subjects with MAST20004 *Probability* and MAST20005 *Statistics*?

The short answer is **not much**. Most main topics in the level 3 *Statistics and Stochastic Processes* core subjects have probably been reshaped, rearranged, and redirected towards actuarial applications at various different points through the level 3 subjects offered by the Centre.

From comparing handbook entries, here is a partial mapping of the content:

- Parts of *Linear Statistical Models* are taught in *Actuarial Statistics*.
- Parts of *Stochastic Modelling* are taught in *Actuarial Modelling I*, *Actuarial Modelling II*, and *Models for Insurance and Finance*. In particular, the areas common with *Stochastic Modelling* are
  - some of the discussion on multiple-state Markov mortality models and Poisson processes in *Actuarial Modelling I*;
  - Unit 4 of *Actuarial Modelling II* (discrete-time Markov chains); and
  - an introduction to Brownian motion, which is also given in *Models for Insurance and Finance*, although the topic is developed beyond an introductory level in MIF.
- Parts of *Probability for Inference* are taught in *Models for Insurance and Finance*.

The similarity between the probability and statistics content of the ACTL major and the *Statistics and Stochastic Processes* specialisation means that the marginal benefit of undertaking the Diploma with a *Statistics and Stochastic Processes* specialisation is minimal when looking at employment prospects immediately after graduation. Rather, a BCom ACTL

student thinking of completing the Diploma with a *Statistics and Stochastic Processes* specialisation should have a genuine interest in probability and statistics and intrinsically appreciate a deeper inspection of the theoretical aspects therein. Having more time to consolidate concepts that are covered by both the Centre and the School should be viewed as a welcome luxury rather than a chore.

Pros and cons

If you have decided that the Diploma is worth considering, below are some of the pros and cons of completing a Diploma in Mathematical Sciences, some of which have already been mentioned above.

Pros

By doing the Diploma, you can

- gain expertise in a wider range of mathematical fields;
- potentially access more career options;
- receive an extra tertiary qualification upon graduation;
- become eligible for entry into the *Master of Science* (MSc) degree at the University for graduate study and research in maths;
- learn from some (more) fantastic academics;
- become part of a very different cohort who shares your enthusiasm for maths; and
- consolidate your knowledge in some actuarial subjects (especially if you choose the *Statistics and Stochastic Processes* specialisation).

I stress that your main motivation for taking on the Diploma must be a desire to access and appreciate more mathematical theory. I strongly believe that tertiary education is, for most of you, the first time you will be able to access elements of a variety of mathematical fields; the multitude of techniques, problems, concepts, and frameworks you encounter are simply astounding and certainly deserves some extra study if you find it worthwhile.

While there are indeed benefits of doing the Diploma beyond the educational value, I see very few of them as being substantial enough to warrant studying extra subjects. Many younger students may be under the impression that career options expand considerably with the Diploma qualification. However, the truth is that if you are planning on gaining employment in a business role immediately after your undergraduate years, the Diploma does not say any more than your ACTL major in a BCom degree. Any graduate-level business role that asks for mathematical ability (or, more loosely, "quantitative skills") will not demand much further than what you have accessed in the ACTL major of the BCom. In fact, your Actuarial degree will probably give you more than enough preparation for the "quantitative skills" that are expected of you in a graduate-level business role.

I have already mentioned several times that content delivery by the School tends to be more theoretical than that of the Centre. An accurate indicator of how much you will enjoy further mathematical studies at the School is how much you enjoyed the style of *Accelerated Mathematics 2* — if you did not enjoy AM2, I find it hard to believe that your experience with third-year maths subjects will be much different.

However, if you enjoy exploration of the mathematical theory, then you are in the good company of a reasonably passionate and curious cohort, and you will also most likely be taught by some fantastic professors who are both experienced academically and skilled pedagogically. Given that mathematical studies can quickly become very abstract at the School,

a like-minded cohort and flexible teaching will go a long way in helping you to understand and appreciate the content. Although this will not be the case for every subject at the School, when it is you will find the subject very worthwhile.

It is also possible that you will encounter common areas between the content delivered by the School and the Centre. In this case you may find that your experience of doing subjects in the School (Centre) may help you learn quickly or more effectively some content in the Centre (School). This effect would be most notable if you select the *Statistics and Stochastic Processes* specialisation, which I have discussed briefly already.

Lastly, the Diploma also allows you to be eligible for entry into the MSc degree, provided you intend to specialise in an area in which you will have completed the set of subjects corresponding to that major, e.g. you would not be able to specialise in *Pure Mathematics* for the MSc if you had not completely the set of subjects constituting the *Pure Mathematics* undergraduate major (either as part of the Diploma or otherwise). For some people this is a useful option to have: Unless you are somewhere in your third year of the ACTL major, you are yet to be exposed to the bulk of the ACTL content offered by the Centre. It is risky (but alas unavoidable) to only come in contact with the bulk of the content so late into the degree; if you decide that the content or style is not to your liking, you have very few study alternatives to turn towards. At the very least, with the Diploma you have an alternative graduate study option in the MSc in place of the Honours program (if you had previously planned to proceed onto Honours).

Cons

On the other hand, in order to complete the Diploma, you may have to

- delay graduation (and hence employment);
- divert attention away from actuarial subjects; or
- overload; or
- pay more fees.

You are the best judge of your own personal situation. If your circumstances cannot accommodate for delayed employment or fees in addition to those for the BCom, then it may be the case that the Diploma is not a viable option for you.

In my opinion, extending your bachelor's degree with the Diploma requires some self-confidence in your ability to gain employment. If you have a heavy fear of unemployment, it may be difficult to reconcile with the fact that you have voluntarily extended your degree and delayed the search for proper employment. There is only one reason as to why you, as an ACTL student, should do the Diploma: you want to fulfil your intellectual curiosity by being exposed to a wider variety of mathematical theory. If the fear of unemployment is going to be looming in your mind throughout the entire duration of the Diploma, it is probably better to have a complete tertiary qualification in hand earlier so that you may begin job applications and thus dissipate your insecurity as soon as possible. In other words, if you do the Diploma without overloading, then you have, in a sense, prioritised your interests over your career (temporarily), and you must be at peace with this choice you have made.

I would also think twice before overloading. In return for maintaining timely graduation, you must be prepared to sacrifice something else — this could be leisure time, socialising, health, your presence at some classes, or final results as high as you would otherwise have achieved. Be prudent if you decide to do 5 subjects in the same semester: there is a multitude of factors beyond your influence that can quickly make your semester very draining. To name a few, the timing of assignments, contact hours, and exams for 5 subjects can be devastating if you are unfortunate enough; indeed, sometimes even with 4 subjects it is not easy. It is simply not possible to grasp beforehand how much and how suddenly you must adjust when you overload (vicarious experiences are irrelevant). What I have mentioned here is only the bare minimum of considerations when making the decision to overload. Avoid any rash decisions to overload at all costs.

Concluding remarks

The Diploma is a fantastic opportunity which you can make use of, particularly if you would like to open your eyes to mathematics beyond the ACTL major. There are some amazing fields to study and very respectable people to learn from but also some compromises to make. In the end, it is not for everyone; however I can guarantee that it will enrich and enhance your undergraduate education if you do decide in favour of the Diploma.

List of Exemptions

Table 1: Actuaries Institute exemption subjects and corresponding university subjects

Exemption subject	University subject
Part I	
CT1 Financial Mathematics	ACTL20001 Financial Mathematics I ACTL20002 Financial Mathematics II
CT2 Finance and Financial Reporting	ACCT10002 Introductory Financial Accounting FNCE20001 Business Finance
CT3 Probability and Mathematical Statistics	MAST20004 Probability MAST20005 Statistics
CT4 Models	ACTL30001 Actuarial Modelling I ACTL30002 Actuarial Modelling II
CT5 Contingencies	ACTL30003 Contingencies
CT6 Statistical Methods	ACTL30004 Actuarial Statistics ACTL40002 Risk Theory I
CT7 Business Economics	ECON10004 Introductory Microeconomics ECON20001 Intermediate Macroeconomics
CT8 Financial Economics	ACTL30006 Financial Mathematics III ACTL40004 Advanced Financial Mathematics I
Part II	
Part IIA The Actuarial Control Cycle	ACTL40006 Actuarial Practice and Control I ACTL40007 Actuarial Practice and Control II
Part IIB Investment and Asset Modelling	ACTL40009 Actuarial Practice and Control III

Source: Centre for Actuarial Studies
Current as of 14th November 2015.

Equivalent Graduate Subjects

Subjects offered as part of the 2-year MC-ACTSCI *Master of Actuarial Science* or 1.5-year MC-COMACSC *Master of Commerce (Actuarial Science)* degrees allow graduate students to gain professional actuarial exemptions from the Actuaries Institute. Due to the overlap in content between these subjects and actuarial subjects offered as part of the B-COM *Bachelor of Commerce* and the BH-COM Honours program, we have listed graduate actuarial subjects with their undergraduate counterparts below. The reviews for undergraduate subjects included in the *Actuarial Students' Society Subject Review* will serve as an accurate reference of the content in the corresponding graduate subjects.

Some of these graduate actuarial subjects will share the same lectures as their undergraduate counterparts, as in Table 2. Others will just contribute to the same exemption subject as their undergraduate counterparts (and hence have common content), as in Table 3.

Table 2: Graduate and undergraduate actuarial subjects with common lectures

Graduate subject	Undergraduate subject
ACTL90003 Mathematics of Finance III	ACTL40004 Advanced Financial Mathematics I
ACTL90004 Insurance Risk Models	ACTL40002 Risk Theory I
ACTL90009 Actuarial Practice and Control III	ACTL40009 Actuarial Practice and Control III
ACTL90010 Actuarial Practice And Control I	ACTL40006 Actuarial Practice and Control I
ACTL90011 Actuarial Practice and Control II	ACTL40007 Actuarial Practice and Control II
ACTL90014 Insurance Risk Models II	ACTL40003 Risk Theory II
ACTL90015 Mathematics of Finance IV	ACTL40008 Advanced Financial Mathematics II

Table 3: Graduate and undergraduate actuarial subjects with common exemption subjects

	Graduate subject	Undergraduate subject
CT1	ACTL90001 Mathematics of Finance I	ACTL20001 Financial Mathematics I ACTL20002 Financial Mathematics II
CT4	ACTL90006 Life Insurance Models I ACTL90007 Life Insurance Models 2	ACTL30001 Actuarial Modelling I ACTL30002 Actuarial Modelling II
CT5	ACTL90005 Life Contingencies	ACTL30003 Contingencies
CT6	ACTL90008 Statistical Techniques in Insurance ACTL90004 Insurance Risk Models	ACTL30004 Actuarial Statistics ACTL40002 Risk Theory I
CT8	ACTL90002 Mathematics of Finance II ACTL90003 Mathematics of Finance III	ACTL30006 Financial Mathematics III ACTL40004 Advanced Financial Mathematics I
Part IIA	ACTL90010 Actuarial Practice And Control I ACTL90011 Actuarial Practice and Control II	ACTL40006 Actuarial Practice and Control I ACTL40007 Actuarial Practice and Control II
Part IIB	ACTL90009 Actuarial Practice and Control III	ACTL40009 Actuarial Practice and Control III