SUBJECT REVIEW

2017 END-OF-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 into the content studied in these subjects, but also general tips and advice that past students have provided based on their own experience. 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 for their studies.

In the 2017 end-of-year edition of the *Actuarial Students' Society Subject Review*, 4 new subjects were reviewed, in addition to updating reviews for each of the core subjects of the Actuarial Studies major. The *Actuarial Students' Society Subject Review* contains up-to-date reviews for all subjects that contribute to the accreditation process. In addition to subjects relevant to the *Masters of Commerce (Actuarial Science)* course, an effort is being made to include subjects relevant to the *Masters of Actuarial Science* course.

In the tail end of 2017, the head of the department of actuarial studies unfortunately passed away. Professor Mark Joshi had a profound impact on many of the students studying actuarial studies at the University of Melbourne, being responsible for a wide range of initiatives, including the launch of the new *Masters of Commerce (Actuarial Science)* course. He was a juggernaut in the field of financial mathematics, which was evident in the wit and clarity of his lectures in *Financial Mathematics II* and *Mathematics of Finance IV*. Mark will truly be missed by the Actuarial Students' Society and, on behalf of the society, we extend our most sincere condolences to his wife, sons and extended family.

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 to 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 2017 end-of-year edition of the *Actuarial Students' Society Subject Review*:

Aarish Alinizar	Daisy Li	Ken Xie
Jiani Chen	Yan Liu	Joanna Yang
Jason Fok	Ahra Oh	Max Yang
Phillip Guo	Tishan Paranahewage	Angel Yuan
Patrick He	William Soo	Jack Zhang
Rui Jin	Truman Tang	Emily Zhao
Callan Jones	Nitcha Miwa Tippinyu	Katherine Zheng
David Kwak	Garvin Tso	Bob Zhu

Disclaimer

All opinions and observations expressed herein remain the views of the individual author and do not necessarily reflect the views of the Actuarial Students' Society or the University of Melbourne.

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First-Year Subjects

Contents

ACCT10001 Accounting Reports and Analysis [SM1]

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 (Do not call him professor)
Weekly contact hours	1 × 2-hour lecture 1 × 1-hour tutorial
Assessments	Tutorial preparation and participation 5% 5 online tests 5 × 1% Individual Assignment, due in Week 5 10% Group Assignment, due in Weeks 19 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. The textbook is referred to in the lectures and tutorials but isn't useful. All content is adequately explored in the lecture slides. However, if you are a first time student of accounting, it may be useful to gain a little bit of context.
Lecture capture	Full (both audio and video).
Year and semester reviewed	2017 Semester 1

Comments

Subject content

This subject assumes no prior knowledge of accounting and starts from the basics. However, it covers these fairly quickly. The rough breakdown of the lectures is:

- Week 1 — Introduction
- Week 2 — Conceptual framework
- Weeks 3-7 — Financial statements including balance sheet, income statement and cash flow statement
- Weeks 8-10 — Ratio analysis
- Week 11 — Budgeting and Cost, Volume and Profit analysis
- Week 12 — Exam Preparation and advice

Lectures

Noel Boys' lectures never failed to provide entertainment, through his unique sense of humour which includes endless impersonations and tone shifts. In terms of content, he goes through each lecture in a very logical manner which is relatively easy to follow. He follows a slide presentation which usually includes about 50-60 slides per lecture.

This review was previously published in the 2017 mid-year edition of the *Actuarial Students' Society Subject Review*.

I personally found the lecture slides sufficient in terms of content knowledge and revision. They are well presented and include diagrams and illustrations that help in understanding some of the confusing concepts of financial accounting.

As a previous review suggests, attendance in the lectures is almost discouraged. Missing a lecture does not disadvantage you in anyway as everything covered in the lecture is recorded, given you catch up. It is a common joke among students to boast about the speed at which we watch lectures on lecture capture, and I can assure you 1.7x–1.9x is a real possibility.

One thing to note however is that lecture recordings are only released at the end of the week (Thursday night) which is after his last lecture. Also, out of the four or so lectures, only one is released.

Tutorials

Tutorials in this subject explore the previous week's content briefly before the tutor goes through a slide presentation. This presentation contains questions from the BERK textbook as well as discussion points that are attempted in smaller groups. The tutor then goes through the solutions and addresses any discrepancies. Tutorial slides were however never uploaded onto the LMS.

Assignments

Assignment 1 was an individual assignment that counted for 10% of the overall grade. It was split up into two parts with the first part being a transaction worksheet (very similar to the lecture exercises) that was submitted and corrected online. The answers to this were released after the due date in order to give everyone an equal chance for the second part. This part required a balance sheet and income statement to be prepared based on the transactions from the first part. Although relatively simple, there were a lot of technical issues with marking as it was corrected online and therefore a lot of marks were deducted for not having a specific word in a specific row and cell on excel. It took a very long time for the faculty to review this, as they had to manually correct each assignment. Adjusted assignment marks were released just before exam week.

Assignment 2 was a group assignment that accounted for 10% of the overall grade. Students worked in groups of 3 or 4 to first calculate a set of ratios and conduct trend analysis on data provided. This was generally done by everyone on an excel spreadsheet and then transferred over to a word document. Again, solutions were released prior to the second part. One week was provided for part two which required an internal memo to be prepared advising on the future of the company and whether it was a viable investment, based on the financial ratios and trends.

Online Tests

There are weekly non-assessable online quizzes that count towards the tutorial participation mark. These are generally very straightforward. There are also 5 assessable quizzes throughout the semester. These are usually released on 4pm on a Friday and due by Sunday evening. You are given 30 minutes to complete the test which contains around 15-20 multiple-choice questions and is worth about 1% of the overall grade. Answers to most of these questions can commonly be found in the lecture slides.

A common tactic for the assessable online quiz is having the lecture slides open in another tab and referring to that throughout.

End of Semester Exam

The breakdown of the exam including topics, questions and corresponding marks was provided in week 12's lecture. Noel also uploaded 5 practice exams onto the LMS, some of which were uploaded halfway through SWOTVAC. The exam itself consisted mainly of practical components with 66 marks out of 100 dedicated to the preparation of financial statements and calculations. This included preparing a balance sheet, income statement and cash flow statement as well as a cash budget from scratch, provided the data. The rest of the marks were attributed to theory questions which aim to test the conceptual understanding of why certain accounting practices are applied. Personally, I believe the exam is very doable in 3 hours and there should be ample time to go back and review the more challenging questions, which is generally theory.

Concluding Remarks

Although there is a lot of content, this subject is fairly "mechanical". Students can do reasonably well once they understand which processes to apply.

ACCT10002 Introductory Financial Accounting [SM2] (1)

Exemption status	CT2 *Finance and Financial Reporting*, in conjunction with FNCE10002 *Principles of Finance*. An average of 73 across this subject and FNCE10002 *Principles of 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 4% 2 × Tutorial assignments 2 × 3% Practice set assignment 14% Online assignment 6% 3-hour end-of-semester exam 70%
Textbook recommendation	Carlon, S., Mitrione, L., Kirk, N., Palm, C., Wong, L., & McAlpine-Mladenovic, R. (2016) *Financial Accounting – Reporting, Analysis and Decision Making* (5th ed.). Milton, Au: John Wiley & Sons Australia. ✓ I recommend the textbook. See 'Necessary Resources' in the body of the review for more information.
Lecture capture	Full (both audio and video).
Year and semester reviewed	2017 Semester 2

Comments

Subject content

Concepts covered included (one lecture per dot point):

1. Conceptual framework
2. Double Entry Recording
3. Accrual accounting
4. Inventory
5. Receivables
6. Non-current assets
7. Liabilities
8. Equity
9. Statement of Cash Flows
10. Annual Reports, Performance, Measurement, Disclosure, Debt/Equity Decisions
11. GST

IFA is quite an easy subject, considering ACCT10001 *Accounting Reports and Analysis* is a prerequisite. Many concepts are the same, but IFA reteaches them in the context of the double-entry system. Most of the content is straightforward and easy to understand, and knowing how to apply concepts is a matter of practice. I predominantly used the textbook to learn

and checked lecture slides to ensure I did not miss anything.

Lectures

There were three lecture streams throughout the week. Lecture slides were usually uploaded well in advance and often contained about 60 slides. The slides contained a mix of theory, examples and screenshots from the textbook. Some lectures also had lecture illustrations, which were examples done during the lecture. These helped to show how to do certain types of questions. Warren explained concepts quite well, but spoke quietly and could have been more engaging. He always gave a short break during the lecture to ensure students did not become too bored.

Tutorials

Tutorial work involved a worksheet that was supposed to be completed before the tutorial. I was one of the few in my tutorial who did them beforehand, but my tutor did not penalise those who didn't. As our tutorials were run in a class discussion style, this meant that it took longer for us to get through all the questions if students were attempting questions when picked on. Occasionally, with longer questions, we would compare answers in small groups and write our answers up on the whiteboards around the room, for the tutor to check and explain to the class. I found doing the worksheets useful, as they were a good way to practice new concepts and check whether there were things I needed to ask questions about.

Tutorial attendance and tutorial participation were 2% each. If you couldn't attend your usual tutorial, you could go to any other tutorial (tutorial times are available on the LMS) and have the tutor write a slip to verify your attendance. However, the subject guide states that participation marks are only awarded for participation at your official tutorial.

Assignments and Assessments

There were two tutorial assignments worth 3% each. These were short tasks that took no longer than an hour each.

The Practice Set assignment was split into two parts, with each part being 7%. The first part required preparing general journal entries, ledger entries, a trial balance and financial statements. Excel templates were provided, but students were given the choice to print them out and do the assignment by hand. This assignment was quite time-consuming, particularly for students who were unfamiliar with the double-entry system. The second part entailed using MYOB accounting software to record transactions and prepare a trial balance and financial statements. The computers in the FBE computer labs on Bouverie Street have MYOB installed and are available for use, but I chose to download the free trial on my own laptop. Students were expected to learn how to use MYOB by themselves — I found that the modified tutorial uploaded on the LMS was sufficient. The hardest part of part two of the practice set was learning how to use MYOB; once you were familiar with inputting transactions, it became easy.

The 6% online assignment was a 90–minute quiz at the end of the semester. The 10 questions were very similar in style to tutorial worksheet questions. Since I completed the tutorial worksheets throughout the semester, I found the quiz quite easy.

Final Exam

The final exam was a 3–hour paper, with 15 minutes reading time, that had 100 marks. There is a hurdle of 50% to pass the subject. The 2016 Semester 1 paper was uploaded to the LMS and solutions were provided a little later. This paper was very similar to the final exam in style, so even though it was the only paper available, it was very useful.

The exam had 20 multiple-choice questions and 10 multi-part questions. Overall, it was slightly more difficult than work done during the semester.

Necessary Resources

The textbook required is *Financial Accounting — Reporting, Analysis and Decision Making*. The hard copy textbook is $144.95, the e-text with access to online quizzes is $85 and the e-text by itself is $60. I only had the PDF and did not feel like not having access to all the online resources impacted me. I found the textbook useful as it explains concepts clearly and has examples to demonstrate how to record transactions in different circumstances. However, very occasionally, the textbook uses slightly different account names to what is taught in lectures. This only affected my tutorial work as it did not come up in assessments or the final exam.

Supplementary Resources

The study guide suggests 5 books that may be used as references or wider reading, but I don't know anyone who went out of their way to purchase them, as the required textbook and lecture slides are sufficient.

Some WileyPLUS practice questions are available on the LMS for students who do not purchase access. I only looked at them before the online quiz, but realised that they are all multiple-choice questions and very easy. If you really need to practice simple concepts, maybe they could be useful, but I don't think they are worth the time.

Consultations are available, but I don't think a timetable was ever uploaded to the LMS (I only knew when and where my tutor was available as he told us in the first tutorial). A special SWOT-VAC consultation schedule was made available though; consultations were held every day up to the day before the final exam.

Concluding Remarks

IFA was much more enjoyable and easier than ARA. I found it easy to stay on top of learning the content and doing tutorial work, and liked that the course was structured clearly and closely aligned with the textbook.

ACCT10002 Introductory Financial Accounting [SM2] (2)

Exemption status	CT2 *Finance and Financial Reporting*, in conjunction with FNCE10002 *Principles of Finance*. An average of 73 across this subject and FNCE10002 *Principles of 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 4% 2 × Tutorial assignments 2 × 3% Practice set assignment 14% Online assignment 6% 3-hour end-of-semester exam 70%
Textbook recommendation	Carlon, S., Mitrione, L., Kirk, N., Palm, C., Wong, L., & McAlpine-Mladenovic, R. (2016) *Financial Accounting – Reporting, Analysis and Decision Making* (5th ed.). Milton, Au: John Wiley & Sons Australia. ✓ HIGHLY RECOMMENDED, as the textbook goes through the content in detail
Lecture capture	Full (both audio and video).
Year and semester reviewed	2017 Semester 2

Comments

Subject content

Week:

1. Introduction Conceptual Framework, External Reporting
2. Double Entry Recording
3. Accrual Accounting
4. Inventories
5. Receivables
6. Non-current Assets
7. Liabilities
8. Equities
9. Share Issues/Change in Equity
10. Statement of Cash Flows
11. Accounting for GST
12. Revision

Lectures

The lectures were quite engaging. Warren's explanations were very easy to understand and the lectures were very important especially for people who have no prior knowledge of accounting. I used the textbook more as it covers the content in depth compared to the lecture slides, which were usually 50-60 slides long for us. It is best to use both the textbook and the lecture slides together as the lecture slides provide a brief understanding whilst the text explains it in detail. Many examples were given in the lecture slides so it was very useful. Everything was recorded for us including lectures and the annotations. "Double Entry Accounting" forms the basis of the subject, something that is vital in order to pass the subject, so please master this skill early on or you will have a tough time in later weeks. The hardest weeks for me were Non-Current Assets, Liabilities and Equities.

For those who have learnt accounting before, please don't assume that this is an easy subject even though the first 3 weeks were basically a summary of VCE Accounting and ARA. Do ALL the tutorial work and make sure you understand all of it.

Tutorials

I attended every tutorial, or replacement tutorial if I missed one. Tutors basically go through most of the pre-tutorial questions in class so if you don't understand them, you really should be there listening or asking questions. ATTEMPT the questions before you show up at the tutorial if you want to make the most out of it. If you have not completed the pre-tute questions (or content for that week if you are behind), then you should still go as I realised I learned more in an hour of tutorial than spending hours studying at home. My tutor was Graham and he has been one of the nicest tutors I have had (He memorised all our names in the first week). If you miss it, just attend a replacement and ask for a slip to hand it to your usual tutor next week.

Assignments

Practice Set Assignment: consists of 2 parts — Part 1 involved providing many pages of source documents such as receipts and invoices for students to enter into Excel, creating accounting journals and reports. Don't cram this, as it is very time consuming but it is easier if it is done with 2 screens; one displaying the source docs and the other displaying the excel sheet. Alternatively, you can print out the source documents.

Part 2 is more entry work but you have to use MYOB accounting software. Please start early IF you have never used MYOB before and DO go to the assignment consultations. Students have to know how to enter transactions on MYOB correctly and not simply using the General Journal (you will understand what I mean when you do the assignment) as marks were deducted for not using the correct tools to enter EVEN IF YOUR REPORTS ARE CORRECT AT THE END as your journals will be checked as well. Some people did it at home by downloading the MYOB trial software but I don't recommend this as you have to convert the file so you might as well go to the university computer lab (go early as it will get packed) to reduce the likelihood of an error.

Online Assignment: (1.5-hour time limit) This is "easy" but hard if you want full marks. It is an hour and a half and there are a few traps and several trick questions so MAKE SURE you READ THE QUESTIONS carefully and don't rush to conclusions without thinking it through. Use reliable internet and not WIFI, preferably LAN connection as you cannot log back on if you are disconnected.

Tutorial Assignments: they are pretty simple. Many people have completed them in less than 1 hour, or even 20 minutes if they were familiar with the content.

End-of-Semester Exam

This semester's examination was pretty tough as it was very long and content heavy. Do all the practice and past papers and go through the tutorial questions well in advance so you know what you need to re-learn or make improvements on. There is a hurdle requirement of 50% on final examination. There were quite a lot of written responses and questions requiring explanations. We were given the formula sheet to basic formulas but we were required to interpret the formulas and not just to simply calculate the ratios. Don't expect that there are simple questions such as "given the data and calculate this ratio". Ledger Reconstructions have been on the past exams for many years so MASTER this before going into the exam as it will account for a significant portion if it does appear on the exam.

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)	Associate Professor Shuanming Li
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 7 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. Not mandatory but does provide extra detail and examples
Lecture capture	Full (both audio and video).
Year and semester reviewed	2017 Semester 2

Comments

Overall, a great introduction subject into the world of actuarial mathematics. Whilst it does not go into much depth, the content covered in the subject definitely provides enough material for you to appreciate the way in which actuaries' approach and solve problems, and hopefully get a taste of the actuarial profession.

Subject content

The subject is divided into 3 topics.

Financial mathematics (Weeks 1 to 4) — You learn about different interest rates that are used in valuing different financial instruments, such as simple interest, simple discount and compound interest. After that the course moves onto annuities, and their application in bonds and housing loans. This part of the course is somewhat similar to *Principles of Finance* in semester 1, but new actuarial notation and formulas are introduced.

Demography (Weeks 5 to 7) — This part of the course looks at studying human population models, including population pyramids, mortality rates and life tables which briefly delve into the probability aspect of the actuarial field.

Actuarial practice and Contingent payments (Weeks 8 to 12) — This is by far the most challenging part of the course as by this point, the actuarial notation begins to build up, and every symbol will start looking the same to you. Content covered in these weeks include valuing financial transactions in which payments aren't certain to occur. This is mainly explored with application in life insurance, where an insurance agency seeks to set the correct level of premium for its various customers, who each have different probabilities of survival. Finally, the last two weeks is just theory about actuarial practices in different fields such as life and general insurance.

Lectures

Lectures are timetabled in the afternoon and personally, I didn't attend too many in person. I found watching the recording more beneficial as I could pause and try the questions myself. In terms of the delivery, the lecturer goes through lecture slides that are available in advance and students are expected to fill in the blanks with worked examples throughout the lecture. However, the lecturer was sometimes hard to understand due to his accent, and hence another reason to watch the recordings at home. This was also his first year of teaching the subject so some of the content had to be skipped due to time constraints. Nonetheless, he was definitely very knowledgeable about the subject and answered any queries in detail. He also provided a weekly expectation sheet which was a good summary of the week's content, including key ideas and formulae.

Tutorials

Weekly tutorials include going through problem sheets, which started off as being interactive and participative early in the semester to a point where the tutor simply went through the solutions on the board. Worked solutions are also provided on the LMS at the end of the week, so attendance isn't vital. However, my tutor was kind enough to make her own summary sheets every week which were very detailed and summarised the week's content in a very neat and organised manner. These definitely came in very handy during exam revision.

Group Assignments

Groups could be formed with 4-5 people, and the assignments were fairly straightforward. Ample time was provided for these and median scores were very high (Almost 100% for assignment 1, and 85% for assignment 2). There were two of them and they required presenting answers through a spreadsheet in Microsoft Excel. As for technical Excel skills, there is not much required, and basic knowledge of simple formulas (with addition, subtraction, multiplication, division) as well as knowing how to format and lock reference cells and copying a formula to a range of cells will definitely suffice.

Mid Semester Exam

Speed and accuracy was required as 45 minutes with no reading time meant you didn't have much time to check answers, making this exam more difficult than the final exam. I personally was guilty of making many silly errors and not reading the question carefully. Make sure to highlight key words and subtleties of the question if you have to before attempting the question.

End-of-Semester Exam

The final exam was much easier than the mid-sem and previous years. There were a lot of theory based questions, definitely more than previous years. Ultimately, if you learn and understand all content and formulae, doing well on the final exam is very possible. However, again keep in mind to read all questions very carefully to avoid silly errors.

So enjoy the first "real" actuarial subject in first year as this is just the tip of the iceberg!

ECON10003 Introductory Macroeconomics [SM2]

Exemption status	Not an exemption subject, but is a prerequisite for ECON20001 *Intermediate Macroeconomics* (CT7 *Business Economics* subject).
Lecturer(s)	Professor Lawrence Uren
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. Not absolutely necessary but can have a more detailed and faster explanation than Lawrence's. As stated in previous years, there are a few copies available at Giblin Euson.
Lecture capture	Full (both audio and video).
Year and semester reviewed	2017 Semester 2

Comments

Subject Content

This subject covers the following topics:

- **GDP** — What it is and ways to measure
- **CPI and Inflation** — Inflation targeting
- **Unemployment** — Okun's law and measuring unemployment
- **Labour market and Cobb Douglas** — Learning the production function and how it works
- **Keynesian model** — Graphs
- **Fiscal policy**
- **Money and banking** — Types of money
- **Aggregate demand and supply** — Graphs
- **Solow-Swan model** — Economic growth analysis
- **International trade**
- **Exchange rates** — More graphs
- **Balance of payments**

This subject isn't the hardest subject you'll take, but there is some challenge in its simplicity and straight-forwardness. Take the persona of a rational thinker, and consider every facet of each model you'll study. Most importantly, make sure to scrutinise every assumption involved with the models: what assumptions are made, why the assumptions are made and what would happen without them.

Lectures

Lectures run twice a week for this subject. Towards the start of the semester especially, I would recommend getting to the lecture theatres as early as possible, as they will be very full for sure. Bring some friends to keep you awake, but be attentive to everything the lecturer says, as many of this subjects intricacies are explained orally, and not conveyed so well on paper. Lawrence records the lecture screen with audio, and uploads all the annotated lecture slides, so use them in conjunction with the textbook to review the concepts that you don't understand.

Tutorials

Attendance is recorded and counts towards your final mark. Pre-tutorials are marked and should always be completed ahead of tutorials. Note however, that they're not easy to do unless you've attended the lectures and have some idea of the concepts taught (so attend lectures!!). Try to be in the same tutorials as your trusted friends, as there will be group assignments specific to tutorial groups.

Assignments

There are two group assignments that you can do in groups of two or three with people in your tutorial group. These assignments are not difficult with decent knowledge of the subject, and should be worked through in depth. Try not to over-write unnecessarily; otherwise, full-marking the assignments is easily achievable.

Multiple-Choice Questions

These online quizzes are a lot harder than you may think. Googling for answers rarely gives anything to work with, so make sure you prepare for them properly and don't do them last minute.

End-of-Semester Exam

I would recommend reviewing each lecture prior to the exam, and focus on the Cobb–Douglas and Solow–Swan, as there are usually extended response question based on those models. There are several past papers, but no solutions. Nevertheless, try to look through them before attempting the real exam, as always. Good luck!

ECON10004 Introductory Microeconomics [SM1]

Exemption status	CT7 *Business Economics*, in conjunction with ECON20001 *Intermediate Macroeconomics*. An average of 73 across this subject and ECON20001 *Intermediate Macroeconomics* is needed, with no fails.
Lecturer(s)	Dr Eik Swee Professor John Freebairn
Weekly contact hours	2 × 1-hour lectures 1 × 1-hour tutorial
Assessments	Tutorial attendance and participation 10% 40-Minute online multiple-choice test in Week 5 10% Written Assignment 1 due in Week 7 10% Written Assignment 2 due in Week 10 10% 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. ✓ I recommend buying Principles of Microeconomics. See 'Necessary Resources' in the body of the review for more information.
Lecture capture	Full (both audio and video). Handwritten slides are not captured. One of each lecturer's sessions is uploaded.
Year and semester reviewed	2017 Semester 1

Comments

Subject content

- Week 1: Introduction
- Weeks 2-3: Perfectly competitive markets
- Weeks 4-6: Welfare and markets
- Weeks 6-10: The firm and managerial economics
- Weeks 10-12: Game theory

No prior knowledge is assumed as basic concepts are taught and built upon. A lot of the initial content is quite intuitive and is easy to learn for most students. It's important to understand the reasoning behind these ideas though, as they form the basis for more challenging content later in the subject (the firm and managerial economics). Whilst it is possible to simply memorise the graphs and consequences of different situations, I think understanding them and being able to apply them

This review was previously published in the 2017 mid-year edition of the *Actuarial Students' Society Subject Review*.

makes the subject more enjoyable and the assessments easier to approach. Game theory was most people's favourite topic as it was easy to understand and fun to apply.

I mainly used the textbook to learn the content since the lecture slides would have been insufficient on their own. I found the case studies book quite useful as the case studies demonstrated how the concepts we learnt could be applied to real-life situations, and the stories were often interesting.

Lectures

There are four lecture streams, two with each lecturer. Lecture slides were usually uploaded to the LMS the weekend before and contained about 10-15 slides that summarised the lecture's content. Eik often just read off the dot points that explained theory, so I'd say the purpose of attending lectures was to watch how he worked through examples. Although handwritten slides are uploaded and the lectures are recorded, it can be difficult to understand how a graph has been developed without watching the process, so I would recommend attending lectures for a more thorough understanding. I completed the assigned readings before each week but there is no expectation to do so and there is no disadvantage to reading after lectures to consolidate and fill any gaps.

There were two lecturers in this semester. Eik ran the two morning lectures while John lectured in the afternoon. Eik often started lectures later as he would go through the content faster and he'd try to crack some jokes to keep students engaged. John's lectures in the afternoon were slower and sometimes fell behind. Some students, particularly those who had not studied economics before, preferred John's lectures as he took his time to explain in more detail and reiterate basic concepts.

Tutorials

Tutorial participation and attendance is an easy way to guarantee 10%. Tutors assign a mark out of 10 for tutorial participation and one mark is deducted for each tutorial less than 7 that you attend.

Tutorial work consists of a pre-tutorial and an in-tutorial sheet. The pre-tutorial sheet is generally uploaded during the week of the lectures it covers and is to be done at home before the tutorial. Some tutors check whether students have done the pre-tutorial sheet as an indication of whether they have prepared for the tutorial and may use it to assign their tutorial marks. Other tutors do not check and go straight into the in-tutorial work. I recommend doing the pre-tutorial sheet regardless, as it is a good way to review the concepts taught in the previous week. Solutions to the pre-tutorial sheet are released on the LMS at the end of the week.

The in-tutorial sheet is often very similar to the pre-tutorial sheet, but slightly harder. Most tutors give students some time to attempt the questions first, encouraging discussion with their classmates, before explaining the solutions. The solutions to the in-tutorial sheet are not posted on the LMS, which is an added incentive for students to attend tutorials.

If you are unable to make the tutorial in which you are enrolled, there is a list of all tutorials on the LMS, so you can attend another tutorial later in the week. The tutor will sign your in-tutorial sheet and you can show this to your tutor in your next tutorial to show that you attended a make-up tutorial.

Assignments and Assessments

The first piece of assessment was a 40-minute multiple-choice test in Week 5. There were 15 questions, each worth 1 mark, covering content from lectures 2 to 6. A practice test was provided, and a review session that went through 10 sample questions was held. The questions and answers of the review session were uploaded to the LMS afterwards. Although the content was not difficult and time was sufficient, the twisted wording of the questions made it harder to do well. As the test was to be completed at home, students could access notes.

Both assignments were individual written assignments with word limits of 1000 words each. The tasks were released about 10 days before their respective due dates. Assignment 1 consisted of two analysis questions. Many students struggled to keep within the word limit as it was hard to judge how much explanation was required. Assignment 2 required applying theory to a real-world example. In both assignments, it was unclear how answers should have been structured and many students were confused as to what was expected. The Online Tutor was particularly helpful in clarifying the assignments.

Marking seemed to be quite inconsistent. Some students attained full marks or close to full marks despite feedback that some of their explanations were unclear or insufficient; other students were deducted marks for missing a label on their graph or other minor mistakes. The amount of feedback varied anywhere from a "Good." per part of the question to a few sentences of constructive criticism per paragraph. Whilst it was possible to request a remark, tutors and Eik seemed to suggest it was not worth the hassle and to prioritise the final exam. Suggested solutions were released for both assignments after grades were released and students were recommended to go to consultations if they still needed clarification.

The marks distribution for Assignment 1 was released and during SWOT-VAC, an Excel spreadsheet of non-exam marks was released, containing test and assignment marks out of 10, but tutorial marks were not revealed.

End of Semester Exam

The final exam was a 120-mark paper that ran for 2 hours, with 15 minutes reading time. There is a hurdle of 50% to pass the subject. The 2016 papers were uploaded to the LMS, but more papers could be found on the university library site. No solutions were provided, so most students turned to comparing answers with each other. The Online Tutor was very useful, as some multiple-choice answers were revealed and some students received feedback on answers they had written.

There were three sections: multiple-choice, short-answer and long-answer application questions. The questions were all fair and straightforward, even if Section C was challenging. The main concern for most students was time. Many students ended up writing in dot points in Section C whilst some did not even have time to attempt some of the latter parts.

Necessary Resources

The textbooks required were *Principles of Microeconomics* and *Microeconomics: Case Studies and Applications*. I bought the PDF versions of both for $15 online (the combined RRP is about $200). I chose to purchase the most recent edition of both books, but older editions are accepted, and the subject guide has the corresponding page numbers for older editions. *Principles of Microeconomics* has clear explanations and uses examples that are easy to understand. The case studies book is good for consolidation and understanding how theory relates to real life, but is not necessary. A PDF handout was uploaded to the LMS for game theory and I found its explanations useful (although some pages were scanned out of order).

Supplementary Resources

The Online Tutor was extremely helpful, often answering questions that had already been asked and providing more information than expected regarding assessments. A list of tutor consultation times was available on the LMS for students that wanted to ask questions in person. Pit-stop tutorials were also available prior to each assessment and the final exam. These were of a similar nature to consultations, but focused on quick questions about the tasks.

Concluding Remarks

Introductory Microeconomics is a relatively easy subject as a lot of concepts are intuitive. It's important to be able to apply theory to real life situations, whether that be drawing diagrams or explaining in words. The subject requires being able to understand what a verbose question is asking and deciding on how to approach broad questions. I highly recommend looking at the Online Tutor posts before starting the assignments, even if this means you have a little less time to complete the task, as it reduces the risk of misinterpreting the question or taking the wrong approach.

FNCE10002 Principles of Finance [SM1]

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)	Associate Professor Asjeet S. Lamba
Weekly contact hours	2 × 1-hour lectures 1 × 1-hour tutorial
Assessments	Tutorial participation 10% Online Assignment due in Week 6 10% 1-hour mid-semester exam in Week 7 20% 2-hour end-of-semester exam 60%
Textbook recommendation	Berk, J. & DeMarzo, P. (2017), *Corporate Finance: The Core* (4th ed.), Pearson Global Edition Brealey, R., Myers, S. & Allen, F. (2017), *Principles of Corporate Finance* (12th ed.), North Ryde, AU: McGraw-Hill. The subject is doable without purchasing any textbooks. See 'Necessary Resources' in the body of the review for more information.
Lecture capture	Full (both audio and video).
Year and semester reviewed	2017 Semester 1

Comments

Subject content

- Weeks 1-2: Overview and Introduction to Financial Mathematics
- Weeks 3-4: Applications in Financial Mathematics
- Weeks 5-6: Modern Portfolio Theory and Asset Pricing
- Week 7: Mid-semester exam
- Weeks 8-9: Capital Budgeting
- Weeks 10-11: Capital Structure and Payout Policy
- Week 12: Introduction to Options

Principles of Finance was very formula-based, particularly in the first 4 weeks. There wasn't much theory to understand or analysis required until after the mid-semester exam. A lot of the content was rather boring since it isn't relevant to our everyday lives, so rote learning might be the best way to approach this subject.

I learnt from the textbook instead of attending lectures and found that to be sufficient. Some people preferred learning from the lectures. I'd say that it's only necessary to do one or the other to learn all the content.

This review was previously published in the 2017 mid-year edition of the *Actuarial Students' Society Subject Review*.

Lectures

There were three lecture streams. Lecture slides were usually uploaded at least by the weekend before. These often contained 50-60 slides. Asjeet would often start with something from the news before lecturing to pique students' interest. Content was often followed up with an example or two and he would reveal working out (using PowerPoint animations) as he explained. Students were expected to do the required readings before lectures, and it probably would have made it easier to understand lectures, but lectures were still digestible without having done so.

Asjeet was quite engaging, especially given how dry the content was sometimes. At the beginning of the semester, Asjeet stated that he may lecture at slightly different paces between the lectures and thus uploaded the lecture capture for each stream.

Tutorials

Tutorial participation was marked by the submission of work at the beginning of each tutorial. Tutors did not mark a roll, so if you had not completed the work for that week, attending the tutorial did not go towards your final grade. It also would have been fine to hand in your work and not stay for the tutorial. Eight out of ten pieces of work must be handed in for the full 10%.

Tutorial sheets were often uploaded at the same time as the corresponding lecture slides. The sheets were divided into two parts. Part I was to be handwritten and in original (not a photocopy), and submitted at the beginning of the tutorial. Students were expected to do Part II at home but did not need to submit their answers. Some tutors let students discuss in small groups first and then explain their answers to everyone else; others just explained the solutions like a teacher. Solutions to the tutorial sheets were provided on the LMS about a week or two after the corresponding tutorials had run. Solutions to Part I were detailed and students were expected to check their submitted work (which is not marked or returned by tutors) but only brief answers for Part II were provided. This is to encourage students to attend tutorials.

A list of tutorials with excess capacity was available on the LMS if you were unable to make your registered tutorial. No specific instructions were provided on what needed to be done though.

Tutorial marks were released in the grades section of the LMS during SWOT-VAC.

Assignments and Assessments

The online assignment consisted of 14 multiple-choice questions with equal weighting, covering material from weeks 1 to 4. The assignment was released about two weeks before the answers needed to be submitted online. The questions were straightforward and similar in nature to tutorial questions. Many students attained full marks. The assignment was also supposed to help students prepare for the mid-semester exam.

The mid-semester exam was a 1-hour closed book exam with no reading time. A formula sheet was attached at the back of the exam and calculators were allowed. Like the assignment, it consisted of 14 multiple-choice questions with equal weighting, but also covered material from week 5. Two sample exams and corresponding solutions were provided three weeks before the actual exam. Three variations of the mid-semester exam were written for the three lecture streams. These exams were all almost identical to these sample exams. Thus, students who had looked at the sample exams found the mid-semester exam easy and were able to achieve high scores.

Mean and median marks were released on the LMS. Mid-semester exam marks were released in a table that showed which questions were answered correctly or incorrectly.

End of Semester Exam

The final exam was a 100-mark paper that ran for 2 hours, with 15 minutes reading time. There is a hurdle of 50% to pass the subject. Students were permitted to have an approved calculator and a formula sheet was provided. The focus of the final exam was on material covered after the mid-semester exam, but it was still important to have the earlier material fresh in your mind. Two sample papers and corresponding solutions were uploaded to the LMS in week 11. The format of the sample papers was different to the actual paper, but this had been advised on the LMS.

The final exam consisted of two sections. Section A had 12 multiple-choice questions, each worth 3 marks. These were similar in style to the assignment, the mid-semester exam and multiple-choice questions that had appeared on tutorial sheets. Some were quite lengthy and required a lot of careful deliberation whereas others only required simple calculations. Section B had 5 multi-part problems, worth about 10-15 marks each. There was a good variety of calculations and theory, and one question only required labelling a graph. Since the exam was relatively straightforward, some students finished early and left. However, the last question had been missing a vital piece of information and a paper correction was announced within the last 15 minutes that allowed many students to finish their calculations. Students that left early were thus disadvantaged.

Overall the exam was fair and straightforward, even though some of the multiple-choice questions were more challenging than expected.

Necessary Resources

The required textbook was *Corporate Finance: The Core*. There are apparently two versions – a graduate version (*Corporate Finance*) and the core version (*Corporate Finance: The Core*). Also, Asjeet disagreed with using older editions and only referred to the 4th edition. I bought the PDF of the graduate version online for $10. I had friends who paid full price ($50) for the core version and they found it easier to understand. The graduate version is very theoretical and dry, despite its attempts to use examples to explain concepts. I didn't have any trouble learning from it though, so it's personal choice. If you hate reading but would like the textbook as an extra resource, the core version is probably a better choice. When the textbook is bought new, it offers an online platform, MyFinanceLab, which is an optional, stand-alone tool that Asjeet said was unnecessary.

Supplementary Resources

The Online Tutor was available to answer relevant questions. Answers were generally brief explanations and the tutor would point students in the right direction if the answer could be found in lecture notes or readings. A list of tutor consultation times was available on the LMS if students wanted to clarify or ask for help in person. Pit-stop tutor consultations were also available for two weeks prior to the final exam.

Asjeet uploaded "Some Fun Stuff" to the LMS, hoping to pique students' interest in finance. This consisted of two lists — a list of movies with a finance theme and a list of books on finance and financial markets.

Concluding remarks

Principles of Finance is quite easy for students who are willing to rote learn, mathematically-inclined or interested in finance. If that's not you, you might find yourself avoiding studying for the subject, as it is quite boring. I think it's really important to do the tutorial sheets (attempt them even if you're unsure) and go through the solutions when they are released. The sample exams will help immensely with the mid-semester exam and the final exam.

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)	Dr Iwan Jensen
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	✓ Make sure to get the green lecture book and exercise book on your first day of class from the Co-Op store.
Lecture capture	Full (both audio and video).
Year and semester reviewed	2017 Semester 1

Comments

Given you obtain above the prerequisite mark for Specialist Mathematics in high school, this subject should not cause a problem. Calculus 2 overall felt like an extension of Specialist undertaken in high school. The assignments were quite challenging but were helpful in aiding with exam preparation at the end of the semester, as well as the tutorial sheets. With 3 lectures a week, you do not want to fall behind in this subject otherwise it may be difficult to catch up.

Subject content

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

Other Comments

The material is quite straightforward and the lecture recording proved to be enough for studying the content. I found that jotting down everything on the partial lecture notes from the lecture capture and then revising back to understand the steps was sufficient to learn the required topics, and then going back and listening again to the lecturer's explanation for information I had trouble understanding.

I recommend keeping up with the exercise booklet questions, as it contained a wide variety of problems to tackle and solidify your understanding of topics. It is not something you want to fall behind in and leave all up to in SWOTVAC.

The assignments were almost always more challenging than the problems encountered in class, but with the aid of classmates and research they prepared you maybe a little too well for the exam, as the exam was nowhere near as difficult as some of the questions in the assignments. There were 4 worth 5% each, with a week given to complete and submit them.

The resources given to prepare for the 3-hour exam was more than adequate, with a number of past exams and answers provided to practice as well as consultation hours to ask tutors/lecturers difficult problems. Routinely completing these exams prepared us well with the format and the types of questions encountered in the exam. Overall, I found that the exam was very similar to the past exams, hence nothing struck out as surprising and the questions were relatively straightforward.

In conclusion, this subject gives you an introductory insight into the Mathematics in this major and it is not impossible to meet the 75% requirement as long as you work persistently in this subject.

MAST10007 Linear Algebra [SM2]

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)	Paul Norbury, David Ridout, Jesse Gell-Redman
Weekly contact hours	3 × 1-hour lectures 1 × 1-hour tutorial 1 × 1-hour computer lab session
Assessments	10 × individual weekly assignments 10% 45-minute written computer laboratory test in week 12 10% 3-hour end-of-semester exam 80%
Textbook recommendation	There isn't a prescribed textbook, although the lecturer suggests any textbook on linear algebra in the ERC as additional material. ✓ Make sure to get the orange lecture book and exercise book on your first day of class from the Co-Op store.
Lecture capture	Full (both audio and video).
Year and semester reviewed	2017 Semester 2

Comments

Subject content

You can imagine the Linear Algebra course to be set up with many "tools" or bits of theory (i.e. Gauss-Jordan elimination, triple cross product) that you'll be using in conjunction to understand more complex and abstract theory (i.e. General vector spaces, eigenvectors) taught later in the course.

1. Linear equations

   At the start of the semester you learn about systems of equations and how to do row operations to solve the system. It's important to really understand this theory because it is the foundation for the rest of the course.

2. Matrices and determinants

   You'll review matrix operations then learn a lot of terminology regarding matrices. Elementary row operations will be brought up again and related to the rank and determinant of matrices.

3. Euclidean vector spaces

   Here the lectures leave the matrices and move into vectors and operations with vectors such as the dot product and cross product.

In the first 3 topics, you'll basically learn 'tools' that are specific operations that you'll be applying and building on for the rest of the course. The tools will feel unrelated but it is essential to memorize to be able to focus on grasping the more

abstract, complex theory later on.

4. General vector spaces

   This is very theoretical part of the course and an extension of Topic 3, but also a foundation you'll need to understand completely to build upon. You will learn about vector spaces that are to Cartesian planes like vectors are to functions. In addition, you'll be introduced to spanning sets and bases as well as linear independence.

5. Linear transformations

   This topic will build upon what you've learnt in Topic 2 and 4. You will combine matrix operations and general vectors (by defining the vector space in terms of matrix vectors) to learn about a way to transform vectors and vector spaces.

6. Inner product spaces

   This topic is basically an alternate, more abstract version of Topic 4, where the definition of the "tool" dot product you learnt in Topic 1 is altered.

7. Eigenvalues and eigenvectors

   This topic is a more sophisticated extension of Topic 3 and 4, where you learn to manipulate vector spaces with matrix operations such as multiplication and row operations to simplify linear transformations that you learn in Topic 5.

So as you can hopefully see, the theory taught in Linear Algebra is very linked to each other and you should make sure you keep up with the theory, otherwise it is easy to get confused by the twists and next-level theory that's introduced. To cement your understanding, the exercise book is an excellent help. Understanding the foundations and the intuition behind the operations you apply, and not just memorizing how to apply the operations, will make grasping the next-level theory later easier as well.

The actual maths and algebra involved in Linear Algebra is not that complex; it's mainly addition and multiplication, so you just need to be careful with negative signs and not making silly mistakes. However, remembering all the theorems (for vector spaces, matrix operations, determining determinants, finding eigenvectors, etc.) is difficult.

Tutorials

In addition to the exercise book being a great help in cementing theory, the tutorials where you'll be able to ask your tutor questions about the theory and intuition are incredibly useful. Like most other maths subjects, you'll get extra questions to work on in addition to the exercise book and the questions are set up chronologically to deepen your understanding the theory.

Assignments

Unfortunately, you will be getting 10 weekly assignments for Linear Algebra. It was very tedious to do them but they are pretty short. Usually you write the assignment but sometimes it is done online (or both). Not all the questions are marked.

It is excellent to go to the tutorials because questions in the assignment are often similar to the tutorial questions and by getting feedback on the answers and method to solve the questions, you can avoid many mistakes in the assignments.

MATLAB

Beside the theory you'll be learning, you'll also be learning how to use MATLAB to do Linear Algebra. The language to use MATLAB also requires memorization so it is good to go to the lab classes after every tutorial (the Tutorial 2 you'll see on your timetable), because systematic repetition to memorize is very true with MATLAB. The MATLAB test in Week 12 is pretty straightforward so just make sure you know how to do questions unique to MATLAB that can't be done on paper, as you'll be primarily tested on those. You'll also be tested on more tedious questions that can be handwritten (for example changing parametric equations to Cartesian equations).

End-of-Semester Exam

There are not many twists and turns in the examination, but due to the variety of questions to be asked with the range of theories to be tested on, you really need to understand all the bits and bobs of theory. The theory in Linear Algebra is mainly to do with methodology so by just remembering the methods to solve, you can apply it mechanically and if you don't make silly mistakes you'll get the right answer.

Key takeaway is: Linear Algebra is simple if you can conquer the numerous theorems and methods to solve. And to really ingrain all that into your mind, it is effective to understand the theory and its intuition and (depending on how you like to learn) to practice, practice, practice!

MAST10008 Accelerated Mathematics 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)	Dr Craig Hodgson
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	✓ I recommend the printed lecture notes available from Co-op, which include all the blank lecture slides. Also would recommend for revision a YouTube account "Mathispower4u" which contains many helpful tutorial videos. Anton, H., & Rorres, C. (2013). *Elementary Linear Algebra: Applications Version* (11th ed.). New York, US: John Wiley & Sons. This is the textbook recommended by the uni. Whilst it can be helpful, the textbook is not essential to success, and I found that using other sources like YouTube and Google were a lot more helpful.
Lecture capture	Full (both audio and video).
Year and semester reviewed	2017 Semester 1

Comments

Subject content

This subject covers the following topics:

- Linear Equations and Matrices
- Vectors and Solid Geometry
- Mathematical Induction, Proofs and Numbers
- Complex Numbers
- Vector Spaces
- Inner Product Spaces
- Linear Transformations
- Eigenvalues and Eigenvectors

This review was previously published in the 2017 mid-year edition of the *Actuarial Students' Society Subject Review*.

- Functions of Two Variables

Topic-by-Topic tips

Linear Equations and Matrices — Learn to row reduce quickly and efficiently. Matrix arithmetic should be generally familiar from VCE Maths Methods and Specialist Maths. Learn how to find both inverses and determinants of matrices using two methods (cofactor and row reduction for both), and understand how the determinant of a matrix relates to area or volume.

Vectors and Solid Geometry — Like matrices, vector arithmetic should be familiar from VCE maths. It is important that you have a good visualisation of orthogonal vectors. Also understand how vectors and the cross product relate to finding an area or volume of a shape. Similarly, learn how to visualise lines and planes. Make sure you are very familiar with converting from parametric form to Cartesian form for lines and planes. Learning angles, distances and lines between points, lines and planes can be approached formulaically, but it is important you understand the concepts behind finding them. Refer to the lecture notes, which include a systematic way to approach these types of questions.

Mathematical Induction, Proofs and Numbers — Learn the axioms of mathematical induction proofs, and pay close attention to the wording and formatting when solving these proofs. Mathematical induction is relatively systematic, so learn the steps to the proof, for both equality and inequality induction proofs (they are quite different). Remember: you cannot prove by example, but you can disprove by example. Make sure you understand the meaning of "iff (if and only if)", and how to apply this to your proof. Set theory and inequalities should be familiar from VCE maths, but my tip is to sketch the moduli graphs if you are unsure.

Complex Numbers — As always, the arithmetic aspect can be derived from previous VCE maths knowledge. Be careful to always use exponential form for polar form, instead of the familiar "cis" form from VCE. Practice differentiating and integrating using the complex exponential, as it can be difficult at the start. In general, this topic is similar to its VCE counterpart.

Vector Spaces — Vector spaces is one of the most important topics, and is the first topic which is completely foreign to first years. It is extremely important that you listen properly during these few lectures, because understanding the concepts and visualisation can be difficult, and is absolutely necessary for the exam. Properly learn all the axioms and conditions for each space to exist, including the matrix sets.

Inner Product Spaces — First things first, learn your inner product axioms. The main thing to watch out for is when you are applying the Gram-Schmidt process, to use inner product for the vector projections. Practice the definite integral questions, as they commonly appear on AM1 exams. The least square method just requires familiarisation, and should not pose a problem.

Linear Transformations — Linear transformations is certainly one of the most difficult topics to grasp in this course. Similarly to inner products, learn the axioms for linear transformations, and how to apply them to any form of question they can throw at you. Practice the workbook questions especially for this topic. Understanding how to represent linear transformations as a matrix can be difficult at first, but it is mandatory to this topic. Above all, concentrate on the change of bases concept, as it is not only difficult, but also an examiner favourite. There are several helpful websites and videos regarding change of bases.

Eigenvalues and Eigenvectors — Perhaps this is the easiest of the unfamiliar topics; nevertheless, as untrodden ground it is important to learn. The simplicity of this topic lies in the fact that the breadth of possible questions is not ungraspable, and you should find that most questions relating to eigen-thingos are repetitive. If anything, practice determining whether a matrix is diagonalisable.

Functions of Two Variables — Despite being the last topic, which is likely taught in the last week, do not fall in the trap of easing off on your SWOTVAC laurels. Whilst this topic is much easier to grasp than others in AM1, there are many definitions and formulae you need to be familiar with, so take caution, as letting your guard down may be detrimental.

Lectures

The lectures are important to go to, as the lecture slides are mostly blank. As there are four lectures a week, the pace is very fast, so make sure to catch up and understand the concepts as you progress through the semester. If you do happen to fall behind, watching the lecture captures can be constructive, and googling questions you may have, I have found is very helpful. The lecturer himself is very cheerful and friendly, and always structures his lessons clearly, with signposting at the start of the lesson, and concluding the lesson.

Tutorials

Whilst tutorial attendance is not mandatory, I would highly recommend you attend all of them. The tutors are all very capable and will make you flex your brain in ways they haven't been flexed before. You will each be placed in a (windowed) room with many whiteboards, which, in small groups, you will be doing maths questions on. Go to tutorials — not only are you comfortably assisted with maths help from tutors and peers, by being forced into small groups, you can make friends — who doesn't want friends?

Assessments

The assessments are split between the online maple assignments and individual written assignments. With the online assignments, you have three attempts, so do these earlier rather than later to maximise the chance of full marking it. Use every resource you have to attempt these, and pay attention to the way you format each answer. As the system is based online, any slight error in formatting will cause you to lose marks. The individual assignments are slightly more difficult, and will take plenty time to complete, so prioritise it and give yourself ample time to complete each one. Similarly, use the resources you have.

End of Semester Exam

Preparing for this exam can be daunting. A general tip is to prepare yourself for the exam by reviewing your knowledge of each topic. Then take a look at the past papers, which are definitely strong indicators of both difficulty and sometimes content in your own exam. Give yourself the full exam time (3 hours) and sit the exam without breaks as you would in the actual exam, and, just as importantly, give yourself reading time too! Completing every workbook question prior to taking the exam is much recommended. Some workbook questions have appeared on the exams.

Concluding Remarks

AM1 is a difficult subject, however, once you learn all the concepts and understand the content, it is very rewarding and enjoyable. You can always seek help from others if you are struggling, and, above all, practice the workbook questions

throughout the semester to save yourself from cramming. Should you ever fall behind, do not panic; it is always possible to catch up, as long as you have the dedication, and based on experience, preferably at least four days.

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	MAST10009 Accelerated Mathematics 2 — Textbook (yellow one that matches the lectures). It is your life from now onwards — consult it regularly for success.
Lecture capture	Full (both audio and video).
Year and semester reviewed	2017 Semester 2

Comments

Subject content

This subject covers the following topics:

- **Sequences** — convergence, divergence, Landau symbols, limit theorems, Cauchy and contractive sequences (6 lectures)
- **Functions, Limits and Continuity** (8 lectures)
- **Differential Calculus** — mean value theorem, l'Hôpital's rule, iterative solutions, Taylor polynomials, hyperbolic functions, inverse hyperbolic functions (9 lectures)
- **Mid-Semester Test** (1 lecture)
- **Integral Calculus** — Riemann integrals, integration techniques (4 lectures)
- **Differential Equations** — first-order and second order linear ODEs; applications to: population models, mixing, motion with drag, electric circuits (8 lectures)
- **Improper Integrals** — applications: probability density functions, Fourier transforms (3 lectures)
- **Infinite Series** — convergence, power series, complex series, Fourier series (7 lectures)
- **Revision of past exams** (2 lectures)

As you probably would have already heard about this subject, it's intensive and fast paced, and certainly not something to be taken lightly. This subject is a blast if you really enjoy maths, but probably not what you want to take if you don't. Either way, you won't ever have nothing to do in your spare time. Aside from staying up to date on lectures on a week to week basis, it's important to pinpoint the proofs, concepts and definitions that are game changing, if not all of them.

Lectures

There's truly nothing more therapeutic than waking up super early to make it on time to Barry's 9am lectures. With four of them a week, it further stresses the point of enjoying this subject and maths in general — don't take it if you won't! The lecture attendance is essential for several reasons. Whilst the accompanying slides are recorded with the audio, all of the important worked examples and demonstrations are presented on the blackboards, which you won't see if you don't attend his lectures. The yellow textbook is amazing — however, whilst it encompasses everything you need to know in the course, many of the examples do not have worked solutions (some are at the back of the book). To maximise success in this subject, note down every example, and vehemently peruse the concepts in your spare time. It's worth even spending a few minutes on public transport every day flipping through the textbook and your notes.

Tutorials

Attendance is strongly encouraged, but does not contribute towards your final score. In tutorials, you'll be attempting several questions from the textbook on whiteboards, so make sure that you're always on top of things from week to week. Take the tutorials as seriously as you can — when writing out solutions, give the full working, stating all of the necessary theorems adopted in your working. This way, when your tutor walks over to yours, he can scrutinise the small details or mistakes that you missed, especially in the presentation of your solution. If it's not too late already, try to make your tutorial early in the week rather than late, so that the topics covered in the previous week are still relatively fresh to you, and you don't have to learn another week's worth of material before covering the previous week's.

Assignments

Here is where you will need impenetrable presentation of your solutions. Marks can literally be taken off for whatever your tutor wants, so make sure you're familiar with what your tutor looks out for before you write each assignment. The marking is tough; if you forget to mention a theorem or misrepresent the exact wording, you will lose marks. The assignments do take a bit of time, so don't leave them to last minute.

Mid-semester test

This exam will come sooner than you expect. For the mid-sem especially, make sure your definitions are well understood and learnt, proofs included. If the proof is not impossibly difficult, then you will need to know it. Try to get your hands on a past mid-semester exam if possible.

End-of-semester exam

No matter what happens, make sure you look through all of the past papers before you take the actual exam. They are worthwhile and well structured, and give a solid demonstration of what to expect. There are two lectures towards the end of the semester where Barry will go through two papers with worked solutions for each. Make sure to attempt these before the lectures so you truly understand what's going on, and what to expect henceforth. Otherwise, clench as hard as you can, and good luck!

Second-Year Subjects

Contents

ACTL20001 Financial Mathematics I

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)	Dr Ping Chen
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. ✓ Recommended to buy for practice problems.
Lecture capture	Full (both audio and video).
Year and semester reviewed	2017 Semester 1

Comments

Subject content

This subject may seem to be remarkably similar to ACTL10001 *Introduction to Actuarial Studies*, and indeed it does cover similar concepts, but the topics are greatly expanded upon. Also, like ACTL10001, this subject is heavily calculation dependent, meaning speed and accuracy are necessary to achieve high marks, though sometimes a bit of intuition and technique can simplify a question immensely.

The biggest issue I ran into with this subject was memorising the formulae for various applications as no formula sheet is provided. Although they can be derived through the knowledge learnt, under exam conditions there is always an emphasis on efficiency due to the time constraints.

My biggest tip for this subject is to not just rote learn and memorise formulas provided in the lecture slides, but know how to manipulate them to fit every question.

Subject Content

This subject focuses on calculations of cash flows, interest rates, project valuations and some basic financial instrument theory. The slides follow the structure of introducing an idea and then elaborating upon it with exercise questions that are discussed during lectures. Majority of the subject is calculation focused, and the topics covered were divided into 4 chapters as shown below:

This review was previously published in the 2017 mid-year edition of the *Actuarial Students' Society Subject Review*.

Chapter 1 — A revision of ACTL10001, where we start off with simple, compound, continuous, and nominal vs effective interest rates and their applications. Next, the concepts and calculation of present, discounted, and future value are covered, including how to calculate them through application questions. We encounter new notation to represent interest rates through a period of time as well as the accumulated amount after a certain time period, but the concepts are nothing new compared to *Introduction to Actuarial Studies*. We also expand on our knowledge of continuous interest rates as well as various proofs which involve algebra manipulation and some basic Taylor series approximations.

Chapter 2 — The focus of this chapter is valuing cash flows, which includes bond/mortgage repayments, dividends from shares, and annuities. We once again revise the formulae for our various annuities: in arrear, in advance, accumulations, deferred, multiple payments per period etc. In addition, a new concept of continuous payments is introduced, where the calculations for annuity/accumulation have changed to introduce the use of integration. This concept is not particularly hard to grasp, and the formulae provided in the slides are straightforward and easy to apply, so just watch the lectures and do the tutorial questions for a solid understanding. Calculations start becoming arduous and annoying to process around this part of the course since there are several variables (such as compounding periods, changing interest rates, changing compounding methods etc), but are still manageable with the correct understanding and setup of the question.

In addition, the concept of linear or geometrically increasing/decreasing payments is introduced along with its set of new formulae, as well as new calculation techniques: changing the time unit, principle of payments of equal PV, and using first principle (summing individual payments directly). The first principles technique is where Taylor series will be necessary in order to simplify a large summation type question. The combination of varying payments and type of interest payment make this section very prone to error if you don't read the question carefully or understand the formulae fully.

The concept of the *Equation of Value* is introduced as a method to value investments, where the EQV is equal to the cash flows made for the project with respect to their time values and are solved through polynomial calculations to find the internal rate of return. This section is similar to the calculations made for NPV or IRR in your first year accounting subjects, but with extra methods to calculate the required rate of return, such as linear interpolation or bisection.

Chapter 3 — The financial analysis of loan contracts and business projects are further explored, following on from the end of chapter 2. This part of the course is again similar to ACTL10001 with loan repayments, principle outstanding, repayment due, initial loan, and other. Concepts of flat rate loans and varying repayment amounts are used, prompting you to use some intuition to simplify the given information to solve an otherwise very messy question, such as grouping various payments together or changing the interest rate period. Payback periods, discounted payback periods, NPV and IRR are the project valuation methods used in this chapter. Inflation is also introduced along with the differentiation between money return vs real return.

Chapter 4 — This is the only theory based chapter, covering major asset types, their advantages and disadvantages, as well as forward and future contracts for hedging, which are all finance concepts. This chapter is quite disconnected to the other chapters, and can be rote-learned to the standard required in the exam.

Lectures

There are full lecture recordings for this subject, so the viewing experience at home is similar to attending the lecture, though you can voice your confusions if you actually attend. Actually, I would strongly recommend at least watching the lectures instead of just reading the slides for the first 3 chapters as Ping does write extra information and works through the examples in more detail than what is shown in just the slides. In addition, I found her explanations helpful as the notation/wording in the slides can sometimes be confusing, such as a variable popping up that hadn't been previously defined. Those who did ACTL10001 will find the lectures quite slow moving for the parts you've already learnt, but the new

material is worth paying attention to carefully so you can fully understand the formulae used in order to reproduce them in exam conditions.

Assignments

The two assignments, worth 10% each, can be completed in groups or individually if you please. The assignments closely resemble the questions discussed in the lecture slides, and are generally not too hard to complete. In fact, the median for both assignments in my semester of completion was 100%, so sans the calculation error, there shouldn't be any reason to lose this 20% of the subject.

Assignment 1 was 7 questions, worth 20 marks in total, and covered chapter 1 and the beginning of chapter 2. Assignment 2 was 5 questions, worth 20 marks in total, and covered the rest of chapter 2 and chapter 3.

Tutorials

The tutorial questions are a slight departure from lecture content, expanding onto more fringe topics as well as harder extensions of slide questions. I highly recommend attending the tutorials as Ping stated that tutorial questions will be the most likely style of questions to appear on the exam after the lecture questions. Apart from the expected calculation questions, there are also many interesting proof of relations, which showed up on the mid-semester test. Tutorial practice is essential to solidifying your understanding of the material, especially towards the later stages of the subject where the setup and execution of a question may determine the amount of time you spend trying to solve it.

Mid-Semester Test

The mid-sem lasted 45 minutes, with 5 minutes reading time, worth 40 marks and 10% of your subject score. The material tested all came from the first chapter and the first half of chapter 2, and included 80% calculations and 20% proofs. Overall, most people were pressed for time, so this is where efficiency and fast work will save you many marks. The questions themselves were not extraordinary, and mostly stemmed from lecture slide and tutorial questions, but took a long time to solve if not familiar with the setup. The mid-sem is mainly used to consolidate one's knowledge and to identify your weaknesses in order to prepare better for the final exam, with areas such as annuities, continuous interest, discount securities, and accumulations being tested. No formula sheet is provided, so remember your formulas well!

Final Exam

The final exam's difficulty ranges, as you will find out by doing the past exams posted on the lms. Once again, time pressure is an issue, so efficient work is needed to complete the exam quickly and accurately. Apart from remembering the myriad of formulas from the lecture slides, the understanding of how to change them in order to fit the question's specifics is crucial, and thus purely memorising the formulas is not enough to guarantee a satisfactory performance. Rather, understanding how specific formulas are derived, what their variables do in the context of the equation as well as its applications will determine how quickly you can set up a question after understanding its meaning. There are many shortcuts that can be taken in order to simplify calculations, but these can't be rote learnt, so the only way to recognise a chance to find an elegant solution is understanding and doing a wide range of questions before the exam.

Concluding Remarks

Overall, I found this subject interesting despite the overlap with my previous knowledge, since so much is expanded upon. The best way to work faster and more efficiently during the exam is to do enough practice beforehand to encounter different styles of questions. I would also recommend discussing challenging questions with friends or tutors as they may have a shortcut or method that you hadn't seen before, saving you time in your next encounter.

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 *Professor David Dickson took the last 4 lectures due to Mark's passing*
Weekly contact hours	2 × 1-hour lectures 1 × 1-hour tutorial
Assessments	Microsoft Excel individual assignments 2 × 10% 45-minute mid-semester test 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 a good source for different explanations of lecture material as well as extra questions for practice. However, these questions are not always relevant to examinable material/ tutorial questions.
Lecture capture	Full (both audio and video).
Year and semester reviewed	2017 Semester 2

Comments

Many students consider ACTL20002 Financial Mathematics II to be the hardest subject of second year, and with good reason. Although the subject starts with content related to ACTL20001 *Financial Mathematics I*, it goes much more in depth on familiar topics as well as introducing new abstract concepts that may be difficult to grasp. In addition, we quickly discover that memorising formulae to substitute into questions does not work, as each question is uniquely tailored such that critical thinking and manipulations are required for the correct answer, unlike many other rote learning subjects before it. Due to this, cramming for this subject is especially undesirable as an adequate understanding of each topic and its various applications are required to be able to solve any sort of problem at all.

Subject Content

- Discount Securities & Coupon Bonds (Price and Yield Calculations) — Weeks 1–2
- Measures of Investment Performance — Week 3
- Interest Rate Risk, Bond Market Structure — Weeks 4–5
- Derivative Securities (No Arbitrage Pricing, Put-Call Parity) — Week 6
- Valuing with Default — Week 7
- Non-Deterministic Interest Rates, Valuation w/ Stochastic Rate of Return, Moments — Week 8
- Life Insurance Applications, The Lognormal — Weeks 9–10
- Simulation, Time Series Models — Weeks 11–12

Personally, I found a massive gap in difficulty between weeks 1-7 and 8-12, with the first half being quite manageable with appropriate time allocation and practice. Topics such as valuing bonds, floating rate notes, after tax yields etc in the first 2 weeks are built upon the basics of FM1. These topics, although straight-forward in theory, are easy to mess up in practice as questions often throw curveballs, requiring extra thought instead of just substituting numbers into annuity formulae. Weeks 3-6 are also fairly easy to digest, where understanding where to use which formula as well as how to derive their variables are enough to get you through. Concepts like selling a put or buying a call etc can become confusing especially when adding in the factor of time along with the different rates of interest, so take make sure your understanding of this finance component is sound.

Week 7 arrives at this point along with the mid semester test, and it takes the place of one of the lectures, leaving only 1 lecture about valuing defaults this week. Starting from week 8, the content ramps up exponentially in difficulty, with many people being completely lost in the vast amount of formulae and variables that come with confusing explanations. This section of the subject is quite application based, with the concept explained at the beginning and many differing examples that follow in the lectures, making it more up to the students themselves to fully understand the nuances of different variables in different situations. Luckily, the exam questions based around this are usually of similar nature to the lecture slides, so a solid understanding of lecture material should score you a decent mark.

Mid-Semester Test

The mid semester test is a 45 minute test with no reading time, scientific calculator allowed. Although the topics covered are not very difficult comparatively, scoring well is not guaranteed as the difficulty and content varies, so past mid semester tests will not be a completely accurate representation of your year's test. Definitions, proofs, problem solving and application are all part of the scope of the mid semester test.

Tutorials

I highly recommend attending tutorials even though this subject does not have attendance marks. The tutorial questions can become quite tricky and are often extensions of the lecture material, meaning you have no clear way of getting an accurate answer without the tutor's explanations. Although answers do go up at the end of each week, they are sometimes unclear and skip steps in working out. In addition, tutorials are a good place to consolidate your knowledge and ask tutors about textbook questions as well.

Assignments

Both assignments are to be completed in Excel by creating a model through manipulating formulae to fit given sets of data points. I imagine this would be similar to what people actually do as actuaries, so it was a good and interesting experience. It is emphasised that the models submitted in the assignments should work different inputs, so your model must actually have adaptive formulae and accurate components to still be correct after changes to inputs.

End-of-Semester Exam

The final exam usually has 8-10 questions, and has a time limit of 2 hours. These questions are mostly problem solving, with a rare definition or proof questions as well, which could be difficult if there is no solid understanding of the topic since

there are no cheat sheets available.

Overall, this subject definitely tackles difficult concepts and arithmetic, however, with appropriate preparation one shouldn't struggle too much. Due to the unfortunate passing of Mark, the subject content and tests may be subject to a change in style in future years, but I believe it will remain the subject most reflective of an actuary's job in second year.

ECON20001 Intermediate Macroeconomics

Exemption status	CT7 *Business Economics*, in conjunction with ECON10004 *Introductory Microeconomics*. An average of 73 across this subject and ECON10004 *Introductory Microeconomics* is needed, with no fails.
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, set in Week 6 5% Group assignment, due in Week 8 12.5% Group assignment, due in Week 10 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.
Lecture capture	Full (both audio and video)
Year and semester reviewed	2017 Semester 2

Comments

Lectures

There were five main topics covered throughout the course:

1. Short-run macroeconomics (the IS/LM model) — 3 weeks
2. Labour markets and unemployment — 1 week
3. Macroeconomic adjustment (the AD/AS and DAD/DAS models) — 3 weeks
4. Long-run macroeconomics (the Solow model, endogenous growth model and productivity) — 3 weeks
5. Open-economy macroeconomics (interest rate and exchange rate regimes) — 2 weeks

The lecture slides for this subject were relatively sparse in detail, but sufficient to grasp the main concepts. Many diagrams were accompanied by an insufficient explanation in the captions. Thankfully, Mei often annotated these diagrams and provided a more detailed verbal explanation. At times, the algebra on slides skipped multiple steps, but once again Mei added in annotations as necessary. However, the slides occasionally contained typos or broken English which was a slight annoyance.

Mei explains concepts very clearly but at times speaks quickly when she gets into a rhythm. This generally occurred when she explained concepts multiple times (i.e. movement in the IS/LM model in different scenarios). By that point, we were familiar enough with the topic to follow what she was saying.

Lectures often had an example question tagged onto the end of every second lecture. These covered concepts covered in that week's lectures. Mei worked off slides with solutions which were distributed after the lecture. Mei often forgot or ran out of time to go through these, but this was not an issue as they were generally straightforward and solutions were provided.

Tutorials

Like other economics subjects, tutorials used the blue and pink sheet system. Blue sheets were often too easy. Several tutors didn't bother checking them and thus some students didn't bother doing them. They were sufficient for light revision of some topics, but were not stimulating. On the other hand, the pink sheets were much more challenging. Especially in the later weeks, where they required some tedious algebra. Whilst the algebra is important, I feel that some tutors spent too much time focusing on the algebra rather than the intuitive explanations for results in questions.

Textbook

The Blanchard and Sheen book covered most of the concepts we studied, apart from labour markets (topic 2) and the dynamic AD/AS model (part of topic 3). We were provided with supplementary material for the DAD/DAS model from Mankiw's textbook, but our only material for labour markets was in the lecture slides.

Online Text

The online test (held in week 6) was conducted on the LMS and consisted of 12 pooled questions. A set of sample questions and answers were provided. The questions were relatively straightforward and covered the first two topics.

Assignments

There were two assignments throughout the semester, due in weeks 8 and 10. We had the option of working individually or groups of up to 3 people from the same tutorial.

The first assignment covered the IS/LM model and the dynamic AS-AD model. The IS/LM questions were relatively straightforward as they merely required us to look up numbers in a report and complete brief calculations. The dynamic AS-AD question was more challenging and required the use of excel to plot time-paths for inflation and output.

The second assignment covered the Solow growth model and other variations. Much like the dynamic AS-AD question from assignment 1, most of it was based on using excel to plot time-paths of various parameters. Many students found this assignment confusing as there was a wide scope for interpretation.

The mark allocation for assignments was at times unbalanced which led to confusion amongst students about how much detail was required in responses.

End-of-Semester Exam

The end-of-semester examination ran for two hours and consisted of 60 marks. The paper had three equally-weighted sections. Section A consisted of 12 multiple choice questions which were relatively similar in style but more difficult than those in the online multiple choice test. Sections B and C had three multi-part short-answer questions each, of which students were required to answer two from each section. This brought in a new dynamic to exams as choosing the "right" question also became a deciding factor in the exam. Section B questions were more mechanical, whilst section C questions were slightly trickier.

Mei explicitly stated that we did not need to memorise formulae as they would be provided in each question. However, the formulae given in the question were sometimes inadequate and required derivation to get an answer. Therefore, it is important that students memorise and understand how to derive the formulae in the course.

I found Intermediate Macroeconomics to be an enjoyable extension of concepts covered in *Introductory Macroeconomics*. Despite the occasionally annoying focus on algebraic proof at the expense of intuitive explanation, the subject was well-taught and not too difficult. Good luck!

MAST20004 Probability

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%
Textbook recommendation	Ghahramani, S. (2005). *Fundamentals of Probability, with Stochastic Processes* (3rd ed.). Upper Saddle River, US: Pearson Education. The content covered in the lectures are explored in depth in the textbook, with more examples and questions. Although the textbook is not available in Co-op, a pdf version can be easily found online. Copies are also available in the ERC library (High Use).
Lecture capture	Full (both audio and video).
Year and semester reviewed	2017 Semester 1

Comments

Subject Content

The subject starts off being very straightforward, it might even feel like revision of high school probability. But it is important that you don't let your guard down and try your best to keep up with the content. The pace of the subject accelerates from week 4, and the assignments also become increasingly difficult. It might be okay to start your first assignment the day before it's due, but if you do this for your third or fourth assignment, it is highly probable that you won't even finish one question. The exam will be merciless.

For many, the subject starts to become confusing around week 4, when we shift our mindset from events and sets to random variables and distribution functions. If you do happen to fall behind (which is inevitable for many of us), fret not, it is relatively easy to catch up at this stage. I suggest you catch up by watching Mark's lectures, he tends to teach this subject at a faster pace and his proofs are easier to understand (more on this later).

Overall, the subject is well taught and the students are well-supported by resources, you won't run out of questions to do and it is easy to get help from teaching staff.

Week 1: Axioms of Probability — rigorously defining probability, events and the outcome space. Basic set theory, and proving probability laws, such as the addition theorem, using the axioms.

Week 2: Conditional Probability and Independence — formally defining and deriving the conditional probability formula, independence of events and the law of total probability.

This review was previously published in the 2017 mid-year edition of the *Actuarial Students' Society Subject Review*.

Week 3: Introduction to Random Variables and Distribution Functions — This is where the fun begins :)

Week 4, 5 and 6: Special Probability Distributions — This section is separated into two categories: discrete and continuous random variables. The subject begins with discrete random variables: Bernoulli, Binomial, Geometric, Negative Binomial, Hypergeometric, Poisson and Discrete Uniform. This is followed immediately by continuous random variables: Continuous Uniform, Exponential, Gamma and everyone's favourite — the Normal.

Week 6: Transformations of random variables — linear, monotonic, and square functions. In this section, especially with the square function transformation, be very careful with your domain and check where the distribution function is defined.

Week 7, 8 and 9: Bivariate Random Variables — This section is double-integral concentrated, so please revise double integrals and always draw a diagram. Remember sometimes you may need to spilt up the region of integration.

Week 10 and 11: Sums of Independent Random Variables and Limit Theorems — We learn the definitions and properties for generating functions: probability generating functions and moment generating functions, as well as convergence in distribution: law of large numbers, central limit theorem.

Finally, yet importantly, the subject concludes with the topic of **Stochastic Processes**. In particular, we learnt branching processes, modelling population growth, and discrete-time Markov chains, modelling transition of states.

Lectures

Two streams were offered; each lecturer took one from start to finish. Both streams were recorded, however, later in the semester, some of Mark's lectures in the Laby theatre were only recorded with audio due to equipment failures. Best to attend in person.

Please note, only the document camera will be recorded. This isn't too much of a problem for Mark's lectures, as he annotates printed slides — you will know exactly where he is up to. However, Nathan prefers to write his notes on blank pieces of paper, with lecture slides projected on the other screen, which you won't see on lecture capture. This makes watching Nathan's lectures at home a guessing game and difficult to follow.

As with most maths subjects, in my opinion, lectures should be attended when possible. I chose to attend Nathan's lectures and watched Mark's when I found a topic difficult to understand. From my experience, Mark's lectures were taught at a relatively fast pace — he would normally be one lecture ahead of Nathan. I personally found Mark's explanations to be clearer and less baffling than Nathan's. Moreover, Nathan would occasionally go off on tangents and drift away from the syllabus, often presenting unnecessarily complicated proofs and examples, this is not to say these tangents are not value-adding, they provide many insights and aid in developing a more in-depth understanding.

Tutorials

Probability tutorials are run in the same style as other subjects in the Maths and Stats department. During tutorials, we worked on tutorial questions in groups on the whiteboard, and a tutor will be there to help you. Personally, and this goes for all subjects, attending tutorials is a good way to force yourself to keep up with the content and make friends doing the same subject as you. These are the people that will help you to get through the assignments and the final exam.

A computer lab class is held immediately following the tutorial, in which we used Matlab to solve problems using simulation. One question from the exam will be based on the labs (it did happen), so try not to skip the labs and make the most out

of it. The good thing is no programming knowledge or actual Matlab code will be examined. However, Matlab questions in assignments are possible. We had assignment questions that required us to perform simulations. As someone with zero prior Matlab knowledge, I found them to be fairly straightforward.

Assignments

The most important thing to be aware of for the assignments is that they become more and more difficult and time-consuming. The good thing is the level of rigour and detail expected is far from that required for *Accelerated Mathematics 2*. You should be okay with not justifying every minor detail of your working out and stating every theorem you are using. But of course, we were still expected to justify our logic.

Four assignments were released at regular intervals starting from week 2, you will have one or two weeks to complete them. Keep an eye out for them on the LMS, as you might not always get an email about the release.

Each assignment is worth 5%, and each consists of around 4-5 questions. Please note, only 2 questions from each assignment will be marked, and hence it is totally possible to get 3 questions completely right and receive zero for the assignment. This was something that I've found rather annoying, but it saves time on marking, we got our assignments back normally within one week.

End of Semester Exam

Well, it's a maths exam, the exam will make or break your mark for this subject — respect the exam please. We were supplied with plenty of past assignments and exams. Before 2014, the exams had noticeable similarities, the same set of questions were examined and hence were easier to prepare for. Unfortunately, this took a turn in 2014, and since then exams became increasingly more challenging and different. So don't solely rely on the past exams for your revision and don't believe that it will be similar to them, learn everything!

In my opinion, the best way to prepare for the Probability final exam is, as with most things, practice! You have the luxury of having an abundance of resources available at your disposal — the Problem Sheets, Tutorial Sheets, past exams, past assignments and Gharahmani questions. Do as many questions as your time allows!

We were allowed to bring one A4 page double sided handwritten cheat sheet into the exam. However, I've heard that this tends to change from year to year, the lecturer will update you on the details. I wrote up my cheat sheet the night before the exam, which worked out okay for me. During my revision, I would do the questions closed-book and write down the formulas and theorems that I couldn't remember or got wrong. Doing this last minute was quite stressful. A few items I think you should have on your cheat sheet would be the pmf/pdf, moment generating function and probability generating function formulas for the special distributions, approximation formulas for functions of a random variable and proofs you can't remember.

I've truly enjoyed the MAST20005 Probability learning experience, and I hope the same goes to you. All the best with your study and scoring that exemption!

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 Damjan Vukcevic
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., & Zimmerman, D. (2015). *Probability and Statistical Inference* (9th ed.). Boston, US: Pearson Education. This subject is based on Chapters 6–9. The lecture notes are quite standalone and covered everything. I didn't need to consult the textbook, however I would recommend it if you want additional questions and more in-depth proofs. Copies are available in the ERC High Use.
Lecture capture	Full (both audio and video).
Year and semester reviewed	2017 Semester 2

Comments

MAST20005 Statistics was an enjoyable subject. It served as a good introduction to the basics of statistical modelling, data analysis and various statistical computations.

Let's cut to the chase. Stats is not a difficult subject; as usual, if you work hard, you will do well. Unfortunately, there are a lot of black boxes in this subject, we were merely taught how to take certain inputs and produce some outputs. Personally, this made the subject less satisfying, but easy to grasp. The subject itself is crammable (although would not recommend) — don't stress too much if you fall behind.

The Good: Supportive teaching staff. Despite this is Damjan's first time lecturing, he looked after us in every way possible. Damjan was very active on the subject discussion forum, answering students' questions on various topics. He also took time in lectures to clarify assignment questions and spent the last week of lectures doing revision.

Subject discussion forum. The maths faculty is trialling a new platform for students to work collaboratively and get help from the teaching staff more easily. Most of the class discussion was conducted on Ed, which is pretty much the Online Tutor but done better; tutors actually gave meaningful responses and fellow students can also answer questions and start a discussion. I enjoyed using Ed. It was fast and easy to use, I can access it from any device, plus you can also type nicely formatted maths equations :)

The Bad: Errors! Nothing sucks more than finding out that complicated formula from the lecture slide is wrong. In this subject, we rarely derived any formulas or proved theorems. Most of the time, you are told to trust the lecture slides and accept what is given. It is problematic and frustrating when there are typos/errors in almost any given lecture. This isn't entirely Damjan's fault, but the legacy of the last lecturer for this subject, as Damjan has been reusing the previous

lecturer's slides to keep the subject content consistent. I just wished Damjan could have been more active in correcting these typos and notifying the students of them. This means, unfortunately, you have might to keep your skeptical hat on; don't immediately trust the lecture slides, solutions etc. If in doubt, ask.

The Ugly: Many thought the exam was a curveball, it was vastly different in style compared to previous exams that we were given. However, this is to be expected as Damjan is a new lecturer and did not write the past papers. As such, if you happen to get a new lecturer for a subject, don't fall into the trap of revising from past exam papers, try to focus on assessments written by the current lecturer, such as tutorial questions.

Falling behind. I am atrocious when it comes to staying up to date with content. I fell behind with Stats (and all my other subjects) not long into the semester, and struggled to catch up. Disclaimer, this is not saying that you are likely to fall behind. Most of us will be taking Stats in our penultimate year, and that means we will also be spending a lot of time and energy outside of studying looking to secure a summer internship! During this stressful time of writing online applications and preparing for interviews, if you ever find yourself far behind in a subject, this is not when you give up and say I will catch up during mid-sem break!

Try to keep track of all your deadlines, make sure you know when things are due and focus on your important tasks. Things that are urgent but not important can wait. Additionally, make use of every bit of free time you have to finish assignments and study for tests; for me this meant doing the stats assignment at the airport the night before it was due. Okay, that probably wasn't a good example, but the point is: don't stress if you fall behind, prioritise.

Subject Content

- Module 1: Review of probability
- Module 2: Descriptive statistics
- Module 3: Point estimation
- Module 4: Interval estimation
- Module 5: Linear Regression
- Module 6: Hypothesis testing (including distribution-free methods)
- Module 7: Order statistics, quantiles & resampling
- Module 8: Bayesian methods
- Module 9: Asymptotic distributions, sufficient statistics & optimal tests

Lectures

People like to ask if lectures are worth going to. For me, the answer is, it depends. I won't be recommending that you attend or not attend these lectures. I pretty much took Statistics as an online course, part of the reason is that I found myself unable to absorb much information during the lecture. As a slow learner, I prefer to have the option to pause, write down notes and google any details Damjan might have rushed over. From personal experience, lecture recordings were sufficient.

Tutorial

Statistics tutorials are what you would expect of standard maths tutorials. A set of tutorial questions will be released each week for you to work on during the tutorial. During the tutorial, we broke into groups of 3-4 students and worked together

to solve the set of questions on whiteboards.

Computer Labs

Following the one-hour tutorial each week, there is another hour of computer lab on R. These labs are important as you will be tested on your ability to use R. Each week, you will be given new a lab sheet to work on, the content will be related to the previous week's lectures. On surface, you will be doing a lot of copying the R commands from the lab sheets and pasting them into your R console. But please try to understand the logic behind all these R commands, experiment with different parameters, don't just regurgitate what's printed on the lab sheets.

Assignments

Assignments were not too difficult, had a good balance of theoretical and application questions. You are encouraged to use R for the assignments, which can make tedious computations much faster.

Lab Test

A practise lab test was given. The content of the test is very similar what you have done in the labs. You are allowed to bring in all of the lab sheets and annotate them to whatever degree you so desire. The test was not difficult. Just go through all the lab sheets beforehand.

Good luck!

MGMT20001 Organisational Behaviour [SM1]

Exemption status	None.
Lecturer(s)	Professor Graham Sewell (Subject coordinator) Dr Victoria Roberts (Head tutor) Dr Karthyeni Sridaran
Weekly contact hours	1 × 1-hour lecture 1 × 1-hour tutorial
Assessments	Tutorial attendance & participation and completion of online tutorial 10% Individual assignment, due in Week 4 10% Group assignment, due in Week 9 30% 2-hour end-of-semester exam 50%
Textbook recommendation	McShane et al. (2016). *Organisational Behaviour: Emerging Knowledge. Global Insights*. Australia: McGraw-Hill. Students were required to draw references from the textbook in the individual assignment. However, the textbook is mostly a supplementary aide to the lectures. It is a useful tool to expand on content glossed-over in lectures, but it certainly not exhaustive and often too broad.
Lecture capture	Full (both audio and video).
Year and semester reviewed	2017 Semester 1

Comments

Subject Content & Lectures

Throughout the semester, there were twelve lectures covering the following topics:

- Contrasting management approaches
- **Micro Topics**
  - Teams & leadership (online)
  - Perception, attribution & decision making
  - Values, attitudes & behaviour
  - Motivation
  - Conflict & negotiation
- **Macro Topics — (with case studies)**
  - Organisational change — Sanrizz
  - Organisational communication (online) — Enron
  - Organisational culture (online) — Solaris & Supernova
  - Organisational power — Automakers of Australia
  - Organisational strategy — Apple
  - Organisational structure — Apple

This review was previously published in the 2017 mid-year edition of the *Actuarial Students' Society Subject Review*.

Lectures were delivered through two methods: traditional lectures delivered in a theatre, and online lectures. In weeks with traditional lectures, there were three streams. Graham delivered the "micro" lectures and Vicky delivered the "macro" lectures in the first two streams, whilst Karthyeni delivered both "micro" and "macro" lectures throughout the semester in the third stream. I only attended lectures by Graham and Vicky.

Traditional lectures generally consisted of approximately 30 slides, delivered in a 1-hour timeframe. Slides were generally released the day before the lectures. Since shortening the lectures from 2-hours a couple of years ago, it appears that the lecturers have yet to optimise their pace to match the new time-frame. More often than not, they would spend too long on some slides and then rush through the last few slides.

Both lecturers had highly distinctive examples. Graham opted to use clips from The Simpsons, whilst Vicky drew on her experiences as a former Olympic rower. Whilst entertaining, they were perhaps at most a memory tool, as we would not be able to draw on such examples in our final exam. I felt that at times lecturers did not go into enough depth. For instance it was mentioned on the slides that there were three types of conflict: structural, communication and interpersonal; but these were not explained in the lecture delivery or in the textbook.

Online lectures were released through Vimeo on the LMS. The lecture on teams & leadership was delivered by Graham with his face superimposed on the slides; pretty much mimicking his normal lecturing style. However, the two macro online lectures were delivered by other lecturers against a backdrop of an "OBTV" animation, along with several examples from The Office UK. These lectures were quite informative and entertaining, however at times the delivery was slightly cringeworthy. There were accompanying slides in the style of the other macro lectures, however these were not directly referenced in the lectures; perhaps these slides predated the online lectures.

Tutorials

There were two main components to tutorials during semester — online tutorials and physical tutorials.

Online tutorials were essentially a weekly Qualtrics survey containing multiple questions including review of lecture content, reflection on group assignment progress and case analysis. Students were expected to complete these the day before their tutorial each week and bring their responses to their tutorial, with suggestions that it should take no more than 1-hour. I made the mistake of failing to complete the task before the first tutorial (in the first week) and found that some of these took longer than an hour to complete. It is impossible to know how these are used by tutors, but it is my assumption that the mere completion of the task suffices to receive the participation marks. The questions in the online tutorial were highly pertinent to the micro topics, as questions were drawn directly from the survey. Although, in the macro tutorials, these were less useful as questions were relatively different to those in the survey.

In-class tutorials began with a "get-to-know-each-other" session in the first week with questions drawn directly from the online tutorials. In the third week, groups were assigned. The fourth tutorial was an opportunity for groups to meet with tutors, with no material covered. From then on, tutorials were split based on assignment groups. Each group would work on a different question or topic, and share at the end of the tutorial. With the tutorials structured in such a way, there was ample opportunity for students to participate in tutorials. At the end of week six, tutors provided students with some mid-semester feedback — an indicative tutorial grade. However, it is not apparent how they deduced this grade as my tutor did not seem to remember many names in the class. Some tutorials also had take-home notes, which were generally dot points based on discussion in tutorials. These were not too helpful, as they were pretty much a pre-prepared summary of points discussed.

Overall, the macro tutorials seemed much more informative as they were more collaborative. They did not focus so much on the online tutorial work students had already completed.

Online tutor was available during the semester. It was run by Vicky. However, it did not seem to gain much traction among students. Also, consultations with tutors were only by appointment, even during SWOTVAC, which may have also explained low consultation attendance.

Readings

As aforementioned, the usefulness of the textbook varied. It was a new textbook this year, as opposed to the course reader used by previous cohorts. There were certain topics where the textbook did not contain much detail, such as Waterman, Peters & Phillips' 7S framework and the Beer & Eisenstat's Six Silent Killers. Thankfully, these were covered in the required readings. On the other hand, the textbook sometimes deviated quite significantly from the course content, particularly in the chapter on Organisational Communication.

Alongside the textbook, each lecture had accompanying readings. Micro topics had required and supplementary readings; however, these were generally not necessary besides when pertinent to the individual or group assignment. On the other hand, macro topics generally only contained required readings, which were highly useful in performing case analyses. The only topic that seemed to lack proper reading material was Organisational Communication — whilst reading touched on the metaphors used in organisations, there was no material that explained Lasswell's communication theory and the meaning-centred communication theory adequately. Perhaps it would have been wise to book a consultation or request extra reading material on these topics.

Assignments

Throughout the semester, there were two assignments: an individual assignment and a group assignment.

The individual assignment was due in week 4. The individual assignment was based on a semi-fictitious case on Malcolm, Tony and Liberal Inc. Students were required to answer four questions relating the case to the topics covered in Week 1 — contrasting the human relations approach and the scientific approach to management. This assignment was relatively straightforward, although it seemed like tutors were looking for specific points in our analyses. For instance, I was marked down for a failure to state that a change in circumstances was the impetus for a change in managerial approach. Whilst there are only 1,000 words to play with for this assignment, students should aim to cover as many bases as possible whilst still being succinct.

There was a skill-building workshop for the individual assignment in week 2. This covered three main topics: analysing the question, academic writing and research skills. The first two were relatively generic, although the latter was quite useful. The librarian ran students through searching online journals and several methods for allowing greater generality of searches. This was recorded.

The group assignment was available early in the course. The group assignment was based upon a case of a robotics engineering team which suffered from conflict and had stalled. Groups were required to write a 5,000 word report on issues with leadership, group development and group structure in the case, as well as recommendations to rectify these. There was a relatively conscious effort from the subject coordinators to help students plan their time. Groups were assigned in tutorial 3 based on an online "survey". This survey contained questions about gender, local/international status, major, key skills (i.e. research, leadership), preferred time and day to work on assignments, and a cognitive style based on the Myers Briggs indicator. Whilst students generally will talk about how they "rigged" the system by falsifying their local/international status or selecting an ungodly hour for meeting, in my opinion, this is not a guaranteed avenue for success. The best way to guarantee a strong group is through attempting to stack a tutorial with as many friends as possible. Of course, with

the first-in-best-dressed timetabling system at the University of Melbourne, this is not always an option and there will be inevitable salt amongst friends who miss out.

In week 4, groups were required to present a "team contract" in a meeting with their tutor. The team contract contained information about member personalities, roles, obligations, procedures, conflict resolution, aims and a schedule. Whilst this was supposed to set a framework for groups, many ended up disregarding its contents (despite signing it) following its submission as it did not count towards the overall grade. It sufficed for many to merely create the contract based on the two sample contracts provided. Certainly, I treated it as a bit of fun; attempting to tie in legalese into the document.

In week 6, students were required to submit a structured plan. This was stipulated in the lecture schedule, but students were not alerted to it until the week before it was due. The staff provided a template that contained several dot-points to be filled in. Once again, as this did not count towards the grade, many students did not put much effort into it, and many final reports deviated significantly from the initial 'plan'.

In my opinion, the first thing students should do is assess their group composition. Put bluntly, each group is only assessed on what is submitted. Thus, it is sometimes inevitable that decisions that may jeopardise team dynamics and equality will need to be made. For instance, quality of expression is paramount in this assignment. If members have varying levels of command of the English language, it may be better to delegate the writing to the members with superior writing abilities. Often correcting work is much harder than re-writing it.

The required readings for the case were only pertinent to group development. This meant that students had to conduct their own research for the other topics.

The criteria must be considered when writing or editing assignments. A common pitfall was issues with referencing, particularly incorrect format. Whilst using generated references from online journal databases, it is imperative that students check them to make sure that there are no errors. References are only worth 10% of assignments, but they are marks that are there to be taken. Another issue that several teams had was a failure to "critique" the theories in the assignment.

The assignment was structured as a report, beginning with an executive summary and introduction preceding the body content and conclusion.

Overall, the group assignment was a substantial piece of work. It is advised that students do not underestimate the time it takes to edit the assignment. It is best to start this a few days before it is due. Most groups seemed to attain a score between 70-80.

End of Semester Exam

The final examination was a two-hour written exam consisting of two parts: micro and macro. In 2017, there were five questions, each worth 20 marks. One question was related to micro theories, whilst the rest were related to macro theories.

The micro question was essentially a reflection on interactions between group members during the group assignment. Of the five possible micro topics, one was 'eliminated' in week 12, essentially leaving students with only four topics to revise. Of course, the examiners are unaware of what interactions may or may not have occurred in groups, so it is a perfectly viable option to fabricate events during discussion. Personally, I felt comfortable with teams & leadership as this was a core topic in the group assignment. However, the topic on conflict & negotiation was less familiar to me, and of course by Murphy's law that happened to be the topic on the exam.

Macro topics revolved around cases studied in tutorials, with strategy and structure counting as one macro topic. Likewise, one case and one topic were eliminated in week 12. Moreover, the combinations listed above were eliminated as they were already covered in tutorials. In 2017, Automakers of Australia and culture were eliminated. This left a total of twelve

possible assessable combinations. In the exam, one topic and one case (provided) was selected. Whilst all four questions related to the topic (organisational change) and case (Solaris & Supernova), there was scope to bring in theories from other macro topics, such as the 7S model. The primary source of revision for these questions should be understanding the theory. If there is still time during semester, it may be wise to perform sample case analyses on all the potential combinations alone or with friends. Whilst it is not advised to memorise these, it will at least make analysis faster during the exam.

During the exam, annotation during reading time was allowed, as was the use of dictionaries.

Third-Year Subjects

Contents

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	1 × Set of online videos (adding up to roughly 1 hour) 1 × 1-hour workshop 1 × 1-hour tutorial
Assessments	50 minute mid-semester test, held in Week 8 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. The textbook is ✗ not necessary as all required material is provided in the slides. However a few chapters are relevant to this subject and provide some extra reading.
Lecture capture	Online lecture is recorded with video. However, workshops are not recorded.
Year and semester reviewed	2017 Semester 1

Comments

Subject content

Actuarial Modelling I covers a number of models that may be used in actuarial work in order to estimate the probability of policyholders becoming temporarily/permanently ill or dying. The subject is split into six sections, where each successive section draws upon the techniques and ideas of the section before.

1. Modelling Mortality; future lifetime as a random variable, life tables, expectation of life, laws of mortality and fractional age assumptions. This section works with probability functions.
2. Non-parametric methods; Kaplan-Meier estimation, Nelson-Aalen estimation and Proportional Hazards model.
3. Estimating Mortality rates; Two-state Markov model, The Binomial Model, The Poisson Model as well as the comparison of these models.
4. Multiple State Models; Looks at using models with more than two states, for example, healthy-ill-dead, to estimate the probability of transition from one state to the other. This process involves solving linear ordinary differential equations.
5. The Poisson Process; Looks at the mathematical properties of the Poisson process and its application.
6. Simulation; Looks at the theory of simulating values using random numbers as well as application of simulation under discrete and continuous distributions.

This review was previously published in the 2017 mid-year edition of the *Actuarial Students' Society Subject Review*.

Lectures

Since the previous iteration of the subject, David Dickson had changed the delivery of this subject. He uploaded a pre-recorded lecture online as well as the relevant notes, which students were expected to watch and study, prior to the workshop. In the workshop, David drew upon the material of the recorded lecture and provides a number of questions on the document camera for students to attempt. He then works through the solution step by step, encouraging students to assist in solving the problem, making it more collaborative and engaging.

I found the pre-recorded lectures to be a great initiative as David works through the slides one by one, allowing students to follow at their own pace. His explanations are clear and concise, covering every single step in a mathematical proof or using visuals such as timelines to help students interpret mathematical results. Additionally, given it is online, if students have difficulty understanding a certain concept, students can immediately rewind this section and watch it again, which definitely helps whilst this is fresh in one's mind.

The workshops were extremely helpful in seeing the application of the material. I sometimes found myself unsure of how to apply the concepts covered in the lectures when answering questions. Nevertheless, this is exactly what the workshop entailed. The problems covered in this workshop are generally of exam standard and is great practice in grasping concepts as well as preparing for the end of semester exam. David asks students to attempt the question themselves before he works through the solution. As mentioned earlier, these workshops are not recorded. I cannot stress the importance of attending these workshops to better understand lecture material.

Tutorials

David posts Problem Sets each week for students to attempt prior to tutorials. The solutions to problem sets are released every two weeks. In tutorials, a new set of problems are provided which are not posted online, however, their solutions are. This is put in place to encourage students to attend tutorials, which I too believe was very important in understanding the subject material.

In the tutorials, students work in groups on the whiteboards to answer the tutorial questions. As the tutorial sheet contains several questions, each group is allocated one or two problems. The groups are then expected to tackle the allocated questions and provide a fully worked solution on the board. One member of each group will then present the answers to the rest of the class. The tutor will make comments on the solution and work through any mistakes on the board, with the whole class. Therefore it is important to then attempt all the tutorial questions by yourself as you won't always answer all the questions in class, to make sure you fully grasp the concepts discussed in the tutorial.

Tutorials also provide an opportunity to ask any other additional questions you may have regarding concepts covered in lectures. The tutors can provide a very good alternative viewpoint to answering certain questions, as certain problems can be solved in many ways.

Assignments

In 2017, there was one assignment that was to be completed in groups that were allocated by David. The assignments in this subject are known to be somewhat open ended and can therefore be difficult. For example, our assignment was rather qualitative, where we were told to find the correct and incorrect aspects of number of hypothetical student responses to an exam question, as well as providing a mark out of ten for the provided answer and then justifying this mark. Whilst not computational, this requires judgement which can still be difficult.

I recommend attempting the assignment by yourself before collaborating with your group members, just so this provides you another opportunity to practice answering questions and to test whether you fully understand the lecture material. During collaboration, you can then discuss answers and potentially observe different and perhaps more efficient approaches to achieve the same mathematical results.

Mid-Semester Test

The mid-semester test was held after the mid-semester break and was based on the first two sections of the course, worth 10% of the final grade. In 2017, we had 50 minutes writing time for 25 marks. Whilst this may seem doable on face value, taking too much time on a question can really set you back in finishing the paper. The test was fairly computational in nature.

As practice, David uploads two past mid-semester tests and their solutions. These are generally good indications of the length and difficulty you will face.

End-of-Semester Exam

The end of semester exam was a 2 hour exam worth 60 marks. However, the exam is weighted heavily, worth 80%. This means that each mark lost has a relatively big impact on your mark. Therefore I cannot stress the importance of avoiding "silly" mistakes such as misreading questions, or making careless errors, such as copying a number onto your page from the calculator incorrectly, or dropping a number or a sign through your working out, as this can heavily impact your marks.

David provides one specimen exam as preparation for the exam. I felt that the specimen exam was indicative of the length of the exam and the nature of questions that could appear from each topic. However, the actual end of semester exam was relatively harder than the specimen exam.

Whilst you may think that one specimen exam is insufficient, this is actually plentiful given the accumulation of questions you will receive throughout the semester. Come week twelve, you will have all the problem sheets, tutorial sheets, workshop questions, previous mid-semester tests and lecture examples which can be redone as practice for the exam. On top of this you have the specimen exam and even past CT4 exams if you have the time or feel like you need the extra preparation. Completing all this material and ensuring you understand the concepts, approach and techniques to answering different questions, should ensure that the exam is manageable.

Concluding Remarks

David constantly tells students not to rote learn and I agree. This subject will expose you if you endeavour to rote learn your way through the semester as the exam is about applying what you have learnt, not regurgitating information that you know. If you understand concepts the first time David explains them, brilliant. If you take a little longer, like myself, do not be disheartened. I genuinely think the hours spent in understanding concepts is worth it.

In addition, there are several proofs in this subject. I would recommend that you derive these mathematical results by yourself as these not only assist your understanding, but the mid-semester and end of semester exam might ask you to derive a result, or show a mathematical proof that has been studied during the semester. Once the concepts and proofs are understood, most questions, if not all, are doable and make sense as you work through to the solution step by step.

Whilst challenging, I genuinely enjoyed this subject and believe that it is one of the most interesting subjects I have completed to date.

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	1 × Set of online videos (adding up to roughly 1 hour) 1 × 1-hour workshop 1 × 1-hour tutorial
Assessments	50 minute mid-semester test, held in Week 8 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. The contents of the textbook are not quite similar to what is provided in the lecture notes. Purchasing the textbook for additional study resources is thus ✗ not recommended (More in section on Lectures).
Lecture capture	Online lectures are uploaded well in advance. Workshops are not recorded.
Year and semester reviewed	2017 Semester 1

Comments

Subject content

Actuarial Modelling I builds on the basic survival/mortality functions you may have been exposed to in ACTL10001. You will learn the basics of modelling future lifetimes as a probability function, before proceeding to estimate mortality rates, finally building various insurance/mortality models, and simulating random outcomes in said models. Below is a summary of the six sections which this subject is divided into (Lecture notes are divided to reflect this structure).

- **Modelling Mortality**
  Future lifetime as a random variable, life tables, expectation(s) of life, laws of mortality and fractional age assumptions. This section is largely independent of the rest of the subject, and is examined as such, with the exception of fractional age assumptions.
- **Non-Parametric Methods (Estimation)**
  This section aims to teach you non-parametric approaches to estimating mortality rates. You will learn the assumptions and necessary conditions which underpin the Kaplan–Meier and Nelson–Aalen methods of estimation, their derivations (very mathematically intensive), the relationship between the two, and estimate likelihoods based on both methods. The section ends with proportional hazards.
- **Estimating Mortality Rates**
  This section takes the alternative approach to the previous method, using familiar probabilistic models to estimate the likelihoods of death. You will learn 3 models: Two-State Markov, Binomial and Poisson. The content of this

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module relies on knowledge of fractional age assumptions (Section 1). It is important to be able to understand and apply different fractional age assumptions to each model, and understand the difference between the 3 models (assumptions, information used, practicality, results etc.)

- **Multiple State Models**
  Up to this point, the subject has been restricting possible states to {alive, dead}. As the name suggests, this section explores the possibility of illness, disability, etc. as alternative states. In modelling movements between multiple states, we encounter problems in the form of ordinary differential equations. This section is challenging.
- **The Poisson Process**
  A new concept. This section will draw on knowledge from MAST20004 *Probability* (MGFs, PGFs, properties of select distributions)
- **Simulation**
  Similar to the simulation covered in ACTL20002, this section revisits simulating from discrete and continuous distributions, applying the theory to the models in sections 4 and 5.

Lectures/Workshops

Lectures in this subject are fully online. You will get roughly 8 short videos of lengths between 2-10 minutes per week, each video corresponding to a set of 1 or 2 slides. These videos will help you to understand the lecture notes, which on their own are not particularly straightforward (occasionally hard to follow the maths). On your screen, you will see either Professor David Dickson, or the slide(s) you should be looking at.

I personally found this method of delivery great, for multiple reasons. Firstly, it makes for easy watching/re-watching of sections you are having trouble with. Secondly, you know exactly where to go whenever you wish to revise a certain topic. Lastly, for many, there isn't a speed adjuster, which means you have to watch it at 1x speed, which is better for you.

Whilst the notes and lectures were comprehensive and well written, any subject involving maths will benefit from additional resources which provide an alternative method/perspective on proofs, solutions and applications of mathematical theory. As mentioned earlier, the textbook is only marginally different to the content provided in slides. A set of notes which had alternative approaches I found very helpful can be downloaded online. The content is not exactly the same as what we cover in this course, but many of the topics are the same. The mathematics in this set of notes is quite comprehensive, and often different to what you get in the lecture notes, which is good for understanding. Google "*Survival Models UU*" and see the first pdf result.

Attendance at tutorials and workshops are not compulsory/marked. As someone who did not attend either, I can attest that whilst both tutorials and workshops provide worked solutions, the tutorial material was relatively easier to work through independently. On the other hand, attempting to learn the workshop material without attending the workshops took significantly longer, and was not a good investment of my time. I would recommend attending workshops, and ideally tutorials too.

Mid-Semester Exam

The mid-semester exam is based on the first two sections of the course. Professor Dickson is very fair in his assessments, and provides ample practice material (2 past exams). As with all 50 minute assessments, time management is key.

Assignments

You will typically be allocated groups based vaguely on your marks (which subject marks and exactly how they are calculated are unknown). The nature of the assignment has been quite different to the rest of the course. For example, in 2017 we were asked to evaluate responses written by (presumably) students. The question was qualitative in nature, discussing the various models in section 3. As is inherent in completing this style of assessments, there is no limit (apart from the 1000 word limit) to how comprehensive you can be. Many will take the task to be simple at face value, to their detriment. To do well in this assignment, you have to understand the importance of wording. In this assignment, correct wording is analogous to correct mathematical notation. Recognising poorly written responses which appear to be correct is a differentiating factor, as is good wording in your own submission.

End of Semester Exam

The end of semester exam, much like the mid-semester exam, is usually a very fair assessment. The paper is weighted slightly heavier toward sections 3 through 6.

There is only one practice exam uploaded, which I would recommend completing last. However, there is an abundance of practice material which you should have (tutorial solutions, workshop notes, problem sheets, Actuaries Institute papers).

It's a two hour exam, with questions usually split into parts (a, b, c, etc.). You will find that there will be several questions of which you will complete a, b, c and struggle with d. For this reason, it is easy to score in the middle of the pack, but hard to beat the curve. As you might expect, no amount of ROTE learning will allow you to get the tougher questions, as that is how they are designed. You will need to study broadly, learn the underlying concepts, work through the proofs yourself etc.

Concluding Remarks

ACTL30001 is a fantastic application of life insurance mathematics. It is taught very well, with plenty of resources, and is overall a very enjoyable subject, particularly for those who enjoy the study of probability and statistics. That being said, it goes without saying that as an ACTL3#### subject, trying to cram/ROTE learn will not end well for you.

ACTL30002 Actuarial Modelling II

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 Xueyuan (Shane) Wu
Weekly contact hours	2 × 1-hour lectures 1 × 1-hour tutorial
Assessments	Mid-semester exam 10% Group assignment 10% 2-hour end-of-semester exam 80%
Textbook recommendation	Lecture Notes for Actuarial Modelling 2 (AMII). This is purchasable at the Co-op store, and is simply a printed set of lecture notes. The textbook is mandatory, as all tutorial questions, progress check questions and practice exam are located within and are unobtainable anywhere else. There is literally no other material for this subject elsewhere, so not having the book makes it almost impossible to study.
Lecture capture	Full (both audio and video).
Year and semester reviewed	2017 Semester 1

Comments

This subject has overlaps with ACTL30001 *Actuarial Modelling 1*. Whereas in AMI we focus on proofs and computation, AMII is centred on real-world uses of the concepts from AMI. In light of this, AMII comes with a set of its own tough challenges which require a lot of time, effort and repetitive replication of solutions to fully grasp.

The subject is split into four significantly uneven units (in terms of difficulty):

- **Unit 1** focuses on exposed to risk calculations, by applying census and deaths data to calculate exact and approximated figures. This is definitely the most difficult unit in the entirety of the subject.
- **Unit 2** is similar to MAST20005 *Statistics*, whereby students are given a set of tests that are simply applied for different data sets. Unlike *Statistics*, students can also be asked to develop their own tests and should know the strengths/weaknesses of the tests.
- **Unit 3** covers methods of graduation. Assuming we have a set of observed data points (e.g. number of deaths over 2 years for a population of 1,000 people), we can take the crude rates and graduate them to remove sampling bias while smoothing them.
- **Unit 4** is mostly on matrices, teaching a method called 'first step analysis' to solve certain probabilities and expectations.

Unit 1 is hard due to the lack of material and practice questions. The most difficult questions in Unit 1 are not necessarily step-by-step mechanical calculations like in AMI, but are instead questions which should be considered on a case-by-case

This review was previously published in the 2017 mid-year edition of the *Actuarial Students' Society Subject Review*.

basis. When calculating exposed to risk estimates, deaths and population data may have different definitions (e.g. age labels are recorded age x last birthday for deaths data, and age x next birthday for population data).

Depending on the definitions, students are required to adjust population data in order to fit the deaths data. Imagine what happens when the definitions are significantly different, or is one you have not seen before.

Ultimately, many students had a different way of reaching the same answer. One way to learn quickly from this subject is to ask a friend who has mastered a method of estimating exposed to risk, and develop an understanding of how it works, before coming up with a way that works for you individually.

Units 2 and 3 are inter-connected, as after graduating crude rates, it is normal to apply statistical tests on them to test their strength and validity.

Unit 4 seems like an outlier, a new direction after spending so much time on graduation and hypothesis testing.

Lectures

Lectures generally went by quite quickly, probably due to the limited amount of content. The bound booklet of notes is necessary for following the lecture content, as lecture slides are uploaded after lectures. I would have liked to have seen slightly better formatting on the textbook; the lecture notes booklet could have headings that reflect the headings in the lecture slides — this would make the notes easier to follow.

Shane had the difficult job of teaching Unit 1 to us students, and although he did put a lot of effort in, the content in Unit 1 is extremely frustrating, a lot of time is required to process, break down and understand the key ideas from Unit 1.

It is highly recommended that students spend a lot of time grinding out Unit 1, trying out different methods until one finally works for them.

Tutorials

Tutorials were not compulsory, however it is recommended that students still attend, as tutors will generally go through answers in detail, which is especially important for Unit 1. It is advisable to ask tutors as many questions as possible during Unit 1, to fully prepare for the mid-semester exam.

Tutorials consisted of going through the textbook questions after having a short period of time to attempt each one.

Group assignment

Pretty straightforward, teams were randomly allocated.

It was an Excel task where we just had to perform statistical tests on a set of graduated rates against crude rates. Cross-check with other group members and submit a final, group copy and nothing can possibly go wrong.

There is a written component which can be completed using Microsoft Word or LaTeX, it is simply answering questions and submitting them online.

Mid-semester exam

The mid-semester exam covered Units 1 and 2. As Unit 1 is significantly harder than Unit 2, time should be spent preparing mostly for Unit 1.

Shane put some extremely difficult multiple choice questions on our mid-semester exam. The median result was 11/20, and a 'surprised' Shane exclaimed that we had done better than expected. Apparently he was expecting the median score to be 10 or less.

The multiple choice questions were related to Unit 1. Given the lack of materials available to study for Unit 1, it is no surprise the questions were difficult.

End of Semester Exam

The exam had a total of seven questions. A few questions were directly ripped off from the CT exams.

Seven questions in two hours sounds manageable, however it quickly became apparent in the exam that the biggest issue was not the difficulty of the questions, but instead how time-consuming they were to finish.

Rather than grinding out each individual answer, it is more efficient to focus on what you are familiar with; it is almost guaranteed that students will be time-pressed during the exam.

While the questions themselves were not directly challenging, it was all about speed and efficiency; someone who could save seconds would be able to squeeze out a little more time for other questions.

Concluding Statements

AMII is a subject that requires a lot of time and effort initially. Once you begin to grasp the concepts, it becomes a lot easier to apply your knowledge to unseen questions. However, while the subject is not the most theoretically difficult, time is required to get more efficient and faster at answering questions.

ACTL30003 Contingencies (1)

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	*ACTL30003 Contingencies* workbook ✓ The workbook is essential. All lecture notes, tutorials problems and specimen exam are available in the workbook.
Lecture capture	Full (both audio and video).
Year and semester reviewed	2017 Semester 2

Comments

Finally, the big double subject you have waited for has arrived! As Ping states in her first lecture, this subject is essentially a combination of probability theory and compound interest. Contingencies brings together the knowledge and skills gained from studying subjects such as ACTL20001 *Financial Mathematics I* and ACTL30001 *Actuarial Modelling I*.

Contingencies is one of the most challenging subjects in the entire degree. Nevertheless, if you invest enough time understanding concepts and derivations, you will quickly see the rather repetitive nature of this subject — with more time invested into Contingencies, the large number of formulas will hopefully become second nature. Consequently, this subject may become less daunting than what it initially seems.

Subject Content

Contingencies considers the present value of cash flows and the probability of whether such cash flows will take place. Using this idea, this subject looks at pricing different insurance products. The subject is broken into several sections:

- **Life Insurance Mathematics (4 weeks)** — This section explores various types of life insurance products such as annuities and death benefits. Different formulae are derived for the sum assured, premium and provisions held for these products.
- **Joint Life Theory (2 weeks)** — Here, the focus is on insurance contracts which are dependent on two lives. This is arguably the most challenging section of the course. Whilst the first four weeks is rather tedious and formulaic, this section of the course requires more thinking and can be conceptually difficult.
- **Multiple Decrement Models (1 week)** — Initially, we looked at how benefits are payable on death, which was the single decrement. In reality, a benefit may be payable due to a number of different decrements. Here, we look at

how single decrement models relate to multiple decrement models and how conversions can take place between the two models.

- **Pension Funds (1 week)** — This is an application of life insurance mathematics and multiple decrement models. We observe different cases under a superannuation scheme to derive expected present values of benefits payable. The summations for these expected present values are quite long, so it is crucial to understand the purpose of each term within the summation.
- **Demography (1 week)** — Very similar to the content in the demography section of ACTL10001 *Introduction to Actuarial Studies*, this is one of the more straight forward sections of this subject. In addition, various types of selection that are used to create homogenous groups are also looked at in detail.
- **Discounted Emerging Cost Techniques (1 week)** — This topic looks at the way in which insurance companies calculate the expected present value of their insurance products and how this affects their profit. This section draws upon basic accounting skills and requires understanding of which cash flow goes where. Additionally, the concept of profit testing is delved into, as well as various summary measures of profit.

In regards to all the units studied in this course, it is important to understand the derivations of the formulas to see relationships and reoccurring ideas between formulas. Additionally, adopting techniques such as drawing timelines to see when deaths could take place during various time intervals is very useful in approaching questions, especially in the joint life section.

Lectures

This year, Dr Ping Chen took all the lectures for the subject. I thoroughly enjoyed Ping's lectures, as she went into great depth when concepts were more difficult or abstract. The slower pace of Ping's lectures allowed students to follow the material relatively comfortably without feeling rushed.

Ping's use of diagrams and summaries throughout the course were vital to seeing the intuition and links between formulas. I strongly recommend attending lectures. I did find it quite tough in the first few weeks to pay attention for two hours straight, especially when the content can be dry and difficult to follow. Nevertheless, Ping is aware of this and gives students a small break to regather momentum.

Lectures are recorded with full audio and video. However, I would not recommend watching lectures online as a habit. Being a double subject, the sheer amount of content to understand is a challenge itself. But falling behind and trying to catch up on several two hour lectures is asking for trouble.

Note that there are no content lectures in week 11 and week 12. In week 11, Ping kindly arranged past students who were working in different industries to share their experiences as young actuaries. In week 12, students were to present their findings from the group assignment — more on this later.

Tutorials

Each week there are two one-hour tutorials. At the start of the semester, Ping provided a sheet on the LMS outlining the tutorial questions that should be completed prior to the particular tute. These were a few questions selected from a vast number of exercises located within the workbook. I strongly recommend doing the set tutorial problems as a **minimum**. The ideal situation would be to complete the set tutorial problems as well as the other relevant exercises in the workbook each week. However, this is easier said than done with the workload from other subjects.

During each tutorial, the tutor will go through the methodology for the set tutorial problems for that tute. Whilst there aren't many set questions each week, these questions are deceivingly long and can take quite a while to complete.

Tutors may summarise each week's lecture content, providing tips and tricks on how to understand certain ideas. At the end of each class, tutors provided a set of worked solutions. Ping also provides a set of solutions to the relevant exercises at the end of each week, placed on the LMS. Nevertheless, these solutions are not as comprehensive as the worked solutions provided in class.

Tutorials commence in week 2 and finish in week 11. In week 12 there is no traditional tutorial but is instead a consultation time with the tutor.

Group Assignment

In 2017, the assignment was directly linked to superannuation. We were to provide the preliminary costings of converting a number of members of a defined benefit (DB) fund to defined contribution (DC) arrangements. The project is quite heavily weighted, with the report being worth 25% and the presentation being worth 5%. Much like other third year actuarial subjects, the groups were allocated by Ping, based on students' prior performance and capabilities.

The assignment was comprised of three parts. The first part was a relatively straight forward research component. The second part involved building the actual model to determine employer contribution rates when converting from DB to DC. In the final part, groups had to use the results of part two, to provide recommendations on whether members should be converted on a voluntary or compulsory basis and the ease/cost of doing so. Finally, each group had to provide their findings in a report and then present their recommendations in a 10 minute presentation to Ping in week 12.

The project definitely felt realistic and is similar to some of the work in the superannuation industry. However, it was quite stressful to complete in the latter weeks of semester, as the assignment took up quite a substantial amount of time. Even with what I thought was effective time management, some of my group members and I did have a few sleepless nights in completing the project.

Hence, I cannot stress the importance of starting early. There is an information session held, which you should attend to ask any questions, because there aren't many opportunities to ask following this session. Whilst I found the project very interesting, I felt it did not really assist me in studying for the subject other than having some crossover with the Pension Funds section of the course.

End-of-Semester Exam

The end of semester exam was a 3 hour exam worth 80 marks. The exam is weighted at 70%.

We faced our worst nightmare when our exam timetables showed that the Contingencies exam was to be held on the very first day of the exam period. This was quite tough as we were completing the project right up until the end of semester.

Nevertheless, Ping was understanding of this and decided to remove any excel related questions, and reduced the number of questions and marks on the exam, from what would usually be 90 marks, to 80 marks. Ping also said our exam would be relatively easier than last year's exam, which was notoriously difficult. However, don't expect this to be the same each year.

Our exam was not as difficult as what it could have been, nor was it easy. The difficulty of our exam was similar to that of the more tedious exercises in the workbook. I felt that the one specimen exam we were provided was not indicative of the

difficulty of the real exam, as the specimen exam was relatively easier than the actual exam. However, the specimen is a good indicator for the nature of questions you can expect.

Based on my experience and speaking to a number of people, during reading time, the exam looked quite doable. However, as I started the exam, I observed a few particular details in each question, making the exam deceivingly tedious and longer to complete than initially thought.

Concluding Remarks

From all the subjects I have completed, I found that Contingencies had the most amount of information to digest, when attempting a majority of the questions. To top this off, each question takes a considerable amount of time to complete, only adding to the frustration in an already tedious subject. A common and foolish mistake I made was using "ultimate mortality" when the question clearly stated to use "select mortality". There is no excuse for such mistakes. Don't make the subject any harder than it needs to be; pay attention to detail. Underline key words, draw timelines, diagrams or whatever it is that helps you; it will definitely help in saving time.

In terms of preparation, if you manage to finish all the provided questions with time to spare (if you do, hats off to you!) there are past CT5 exams that can be found online and can be completed as extra practice. Ping did not really recommend this but extra practice does not hurt. Nevertheless, if you understand the lecture content and are able to complete the lecture exercises and tutorial problems without much difficulty, the exam should be manageable.

I wish you all the very best in completing Contingencies!

ACTL30003 Contingencies (2)

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	Workbook purchased from Coop. This contains lecture notes, tutorials and one specimen exam.
Lecture capture	Full (both audio and video).
Year and semester reviewed	2017 Semester 2

Comments

Put simply contingencies is the combination ACTL20001 *Financial Mathematics 1* and ACTL30001 *Actuarial Modelling I* . This subject teaches you how price and value insurance policies using probabilities and the time value of money. Conceptually this subject is very similar to ACTL10001 *Introduction to Actuarial Studies* where you also learnt how to price simple insurance policies.

Compared to other third year subjects, this subject is very procedural and not conceptually challenging. However, this subject is very tedious and requires you to consider a lot of intricate details.

You can do well by solely doing a lot of questions and getting used to the nuances of this subject, such as the actuarial notation, the recursive relationship between insurance/annuity types and shortcuts to derive certain equations from others.

Subject content

Life Insurance / Superannuation mathematics — The first 4 weeks of this course considers the pricing, reserving and profit reporting of term, endowment and whole life insurance products. Pricing refers to the calculation of a premium for an insurance contract using the principle of equivalence (same concept from ACTL10001), reserving considers the study of provisions the insurer needs to hold for policy holders and profit reporting concerns the incremental profit to the insurer if a policy holder is to die or suffer a decrement (mortality profit).

As an extension of the discrete case for premium and benefit payments: continuous, increasing, decreasing cash flows are considered along with reversionary (with bonus) contracts and adjusted mortality rates which consider selection. There are nuances in the calculations and techniques to approach each question regarding different assumptions and insurance types. The best way to get used to it is just to repeat exercises until it becomes intuitive.

Joint life theory — The next 2 weeks studies insurance policies applied to 2 or more lives where benefits are paid out on either a first-to-die or a second-to-die basis. The pricing of a joint life contract is similar to a normal contract. The main

consideration in this topic is when premiums/benefits may come in and out and how to show it via standardised actuarial notation. Questions about this topic are very ad hoc and require some judgement. Exam questions about joint life are conceptually harder than the first topic in this subject but are a bit less tedious in nature.

Multi-decrement models — This topic considers the combination of decrements such as withdrawals, injuries and death. This topic is very similar to the multi-state model topic from ACTL30001. You will learn how to derive multi-decrement models from single decrement models and vice versa. The considerations of independent and dependent decrements are also studied.

Pension funds — Pension funds are in nature very similar to life insurance. The formulas from this topic would be similar to the first four weeks of this course.

Demography — This topic is basically exactly the same as the demography section from ACTL10001. It is by far the easiest topic in this course and just requires knowing a few formulas/concepts in relation to birth, fertility and selection.

Discounted emerging cost techniques — This topic considers the profit signature of an insurance policy, the flow of profits throughout the life of an insurance contract. Multiple variables are considered such as unit linked policies and provisions to ensure that the profit signature is never negative.

Lectures and Tutorials

In general, lectures follow the content in the workbook very closely. The pace of Ping's lectures is very manageable and not too fast. The main benefit of going to lectures is that Ping tries to cover intuitive derivations of the formulas presented. As a lot of memorisation is involved, intuition will make it easier to relate the formulas to a specific context. Most of the time, you will have to review lecture notes afterwards due to the sheer amount of formulas presented.

As this is a double subject, there are two tutorials a week. There are pre-set tutorial questions from the workbook that the tutor would go through. It is recommended that you do the questions beforehand as there is no point going to the classes for answers. Most of the tutorial questions involve many steps and require a lot of patience and a focus on details to complete. The best tip is to treat each step of a question as a separate question instead of tackling the whole thing at once.

Assessment

In 2017, the assignment involved a conversion from a defined benefit to an accumulation superannuation plan. This assignment was a very good insight in terms of real actuarial work and Ping's effort to make the assignment realistic is appreciated. There was a lecture dedicated to asking assignment questions run by a working actuary which helped a lot.

In terms of doing the assignment, Excel and VBA skills are required. It is recommended to take some time to learn how to write macros before doing the assignment. This would most likely apply to future assignments as well.

Tips for Success

My main tip for success for this subject is to practice continuously and be patient when you are given a problem which is extremely tedious and time consuming. Compared to other actuarial subjects, Contingencies is the hardest to study when you have fallen behind due to the sheer amount of work. Put it first on the priority list.

ACTL30004 Actuarial Statistics (1)

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	50-minute mid-semester exam in week 7 10% Group assignment due in week 12 10% 2-hour end-of-semester exam 80%
Textbook recommendation	ACTL30004 Actuarial Statistics workbook can be purchased from Co-op. It is also available on the LMS if you choose to print it. ✓ Getting the workbook is essential. All lecture notes, tutorial problems and the specimen exam are contained within this book.
Lecture capture	Full (both audio and video)
Year and semester reviewed	2017 Semester 2

Comments

This subject is one of the most practical subjects in your degree and discusses R and GLMs, both being crucial tools not only as an actuary but also in a variety of other careers.

Subject Content

This subject introduces a number of statistical models and actuarial tools. Its content is divided into seven units which are outlined below.

- Unit One — Introduction to R

  Most of the content in this unit will be familiar from MAST20005 *Statistics*. Some things are covered in slightly more detail such as writing a function, finding roots and maximum likelihood estimation. It is important to have a good understanding as questions do appear in exams and assignments that may ask you to write code.

- Unit Two — Likelihood Theory

  Again, should be familiar from MAST20005 *Statistics*. A number of important theorems are proved and then the new concept of Fisher Scoring is introduced.

- Unit Three — Generalised Linear Models (GLMs)

  The most lengthy and important chapter in the course. You will learn the definitions of a GLM then methods to parameter estimation. Additionally, being able to use R to model using a GLM is covered. The unit concludes with tests to compare and assess models. It is a very interesting chapter but I would recommend exploring different

families and link functions then plotting your GLMs in R as I got quite lost to what was actually going on in the mountains of algebra.

- Unit Four — Simulation

  Parts of this unit will have been covered at the end of ACTL30001 *Actuarial Modelling I* such as simulation using the inverse transform method for discrete and continuous distributions. However, for those distributions without an inverse function, the acceptance-rejection method is introduced. The unit then introduces some ways to simulate from a normal distribution.

- Unit Five — Outstanding Claims Provisions

  A number of methods are introduced to measure how claims will develop into the future. A method useful in General Insurance.

- Unit Six — Experience Rating Systems

  An application of Markov Chains which would have been covered multiple times in your prior study. Should be relatively straightforward unit.

- Unit Seven — Time Series Analysis

  As the name suggestions, a time series models a variable over time. Concepts like autocovariance and autocorrelation functions are covered. The ARMA(p,q) process and the application of causality and invertibility are covered. I found the slides of this chapter to be a poorly organised with the main idea being lost in the mountains of algebra, as such I would recommend looking through the textbook.

Lectures

Lectures in this subject are quite standard. Enrique delivers them well and most of them are quite clear to follow. It is up to you whether to attend in person or watch online. If you find his accent too strong, it may be good to watch online at a slower speed.

Tutorials

The tutorials for this subject are standard but I found them useful. I switched between different tutorials and both classes had excellent tutors. A brief recap of topics studied was provided before going into tutorial questions. The quality of tutorials will depend heavily on tutors.

Mid-Semester Test

I found the MST very painful. It covered the first two units and the beginning of the third unit. Questions were very algebraic and lengthy. As we were the first cohort to have a MST, there was no specimen provided. Particularly frustrating was the question relating to finding the exponential form of a distribution. It was not in the style of a 'show that' question, as such, pretty much all marks would be lost further in the question if you were unable to find the form. Especially when there is no fixed method to find the exponential form, these questions can sometimes feel like complete luck and I felt were a poor assessment of a student's knowledge.

Assignment

The assignment groups were allocated based on MST marks. It is released towards the end of semester and due in the final week. It is crucial to be able to use R well. Although possible to do the questions in Excel, it will take much longer. As assignments for all third year second semester actuarial subjects are towards the end of the semester, getting started early, working well as a team and managing your time well is crucial.

End-of-Semester Exam

The exam was challenging but a fair exam. We received the 2016 exam and along with the specimen exam, both are good indications of the standard of the exam. If you've made it this far in the degree, you will have hopefully established your own study methods which work for you so I won't repeat the advice of redoing tutorial questions and being precise.

Concluding Remarks

This subject had some fascinating areas and introduced some useful topics which will be important in your careers not only if you become an actuary but in other areas too. The content was not overly complicated but assessment was quite challenging. As with most actuarial subjects, I would have liked more practical application of the content. Especially with GLMs, there was so much algebra which I found to be mind-numbingly boring. This made me focus on formulas and derivations rather than the exciting applications of the method which I would have liked to see more of. Overall, the subject was well delivered, with Enrique being a knowledgeable lecturer.

ACTL30004 Actuarial Statistics (2)

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	50-minute mid-semester exam in week 7 10% Group assignment due in week 12 10% 2-hour end-of-semester exam 80%
Textbook recommendation	ACTL30004 Actuarial Statistics workbook can be purchased from Co-op. It is also available on the LMS if you choose to print it. ✓ Getting the workbook is essential. All lecture notes, tutorial problems and the specimen exam are contained within this book.
Lecture capture	Full (both audio and video)
Year and semester reviewed	2017 Semester 2

Comments

This subject is generally an extension of content covered in MAST20005 *Statistics* and ACTL30002 *Actuarial Modelling II*, but also introduces a number of new interesting actuarial techniques that are mainly applied in a general insurance context. This is a very practical subject, providing you a great opportunity to learn lots of useful skills for any quantitative work. It covers content that are applicable in many other fields rather than just actuarial industry.

Subject Content

This subject introduces a number of statistical models and actuarial tools. Its content is divided into seven units which are outlined below.

- Unit One — Introduction to R

  In this course, R has been chosen as a statistical software for effectively studying the following units. This unit gives a brief introduction for the programming language of R.

- Unit Two — Likelihood Theory

  Likelihood theory is commonly used for estimating unknown parameters associated with a random variable. This extends upon knowledge learnt from MAST20005 *Statistics* However, there will be something new with the Fisher Scoring algorithm.

- Unit Three — Generalised Linear Models (GLMs)

  Generalised Linear Model is an extension of the linear model covered in MAST20005 *Statistics*. This is often used in a general insurance context for premium determination. We know some response variables are not normally

distributed. This is when we need GLMs, which model the mean of non-normally distributed response variables as a linear function of covariates.

- Unit Four — Simulation

  For those more complicated models that are unable to be examined theoretically, the method of simulation is needed. It is usually undertaken to determine the value of some quantity θ associated with a particular stochastic model. Questions we consider are normally how many simulations are needed and what the confidence interval is for a certain level of significance.

- Unit Five — Outstanding Claims Provisions

  This is a very practical methodology commonly used in general insurance contexts. Run-off triangles are introduced for calculating the amount of money to be held for future claim payments. There are several methods available dependent on the information given.

- Unit Six — Experience Rating Systems

  This is a very short unit that only takes one week to finish. It applies Markov Chains to "No Claim Discount (NCD)" systems, where good insurance risks are rewarded by offering a lower premium price.

- Unit Seven — Time Series Analysis

  A random variable measured over time in sequential order is considered instead of at a single time point. This unit explores the pattern followed by the variable observed over time, where a number of stochastic processes are discussed. Particularly, autoregressive and moving average processes from ACTL20002 *Financial Mathematics II* are further developed and, at the same time, a new process — ARMA(p,q) is introduced.

Lectures

As a lecturer, Dr Enrique is quite experienced in ACTL30004 *Actuarial Statistics*. This is not an extremely hard subject but still a challenging one. Enrique's way of delivering lectures aims to make it easier for us to understand the statistical concepts.

Students are expected to follow along with Enrique in their workbooks. Unfortunately, there is normally not enough time to copy down detailed solutions for all in-lecture exercises. However, lecture slides are normally available on the LMS after finishing each unit. While the textbook covers most of the content, slides do provide additional information, in particular, the solution for lecture exercises.

Even though lectures are recorded with full audio and video available, I do recommend that you attend lectures in person. Enrique regularly asked questions to keep us focused and help us better understand the concepts. You will lose the opportunity to interact with the lecturer if you just watch the recording. Also once you are behind, it becomes harder and harder to catch up.

Tutorials

Each week there is a one-hour tutorial, which generally consisted of two parts — revision of content from last week's lectures and solutions for tutorial problems. If you find it difficult to understand material from lectures, then the tutorial is a great opportunity for you to catch up. My tutor actually gave a very clear summary each week at the start of the tutorial.

Although tutorial attendance is not monitored, it is strongly recommended to attend. Since no solution will be posted on the LMS, you need to go to tutorials to get a hard copy.

Occasionally, there are times when tutorial questions require content that have not been covered in lectures yet. Do not worry. As tutors are generally aware of this issue, they normally just save these for the following week.

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

Assessments

This is the first year we had a mid-semester exam for this subject. It is a 50-minute exam worth 10% of the final result. It took place in week 7 and covered material from week 1 to week 5; that is Unit 1 to the first half of Unit 3. As we were the first year to have a mid-semester test, we were not given any past exams or practice exams. So for preparation, lecture slides, tutorial questions and the workbook are the main resources. The time was a bit tight for the exam and the level of difficulty was higher than expected. But overall it was doable.

Similar to first semester actuarial modelling subjects, students are placed into groups of four (or three for leftover students, which is what happened to me) for the group assignment. The assignment is released near the end of semester, normally around week 9 to week 10 and due by the end of week 12. It generally covered content from Unit 3 and Unit 4. Tasks included calculating the maximum likelihood estimates, applying the Fisher-Scoring algorithm, and using simulation to perform a statistical test. It will be a huge struggle to get through the assignment without using R. However, it is possible to finish the assignment just by using Excel. Just be aware this normally takes longer. In addition, since assignments for all three subjects in the last semester are generally due on similar dates, the importance of getting started early has to be emphasised. It is essential for you to manage your time wisely and plan ahead.

End-of-Semester Exam

The end-of-semester exam was a 3-hour exam being weighted at 80% of your final result.

For revision, the workbook is your first source. It contains all the content from lectures, tutorial problems as well as the specimen exam, which provides a good indication of the difficulty of the questions in the exam. It should be noted that there is a checklist at the end of the workbook, listing the expectations related to each unit. This will help you find out the emphasis of the exam. In addition to the specimen exam, one past exam from 2016 was provided to us, which also assisted preparation for the final exam.

It is highly recommended to redo all tutorial questions at least once and repeat questions that you got wrong the first time if you have more time. Moreover, speed is very important in the exam. Silly mistakes are much easier to occur when you do questions fast. Practicing more will not only help you increase your speed, but also reduces the possibility to make mistakes.

One strategy essential in the exam is making good use of the reading time, during which you should consider the order of answering questions. You are strongly recommended to attempt easy questions first then hard ones if you have more time. Do not assume you cannot do part b without doing part a.

Concluding Remarks

Overall this is a relatively practical but challenging subject. Simply memorising formulae is far from enough. To achieve a satisfactory performance in this subject, you need to understand the derivation of formulae as well as the idea behind it. A bit of background knowledge in programming will definitely help a lot with assignments and some tutorial problems. So take your time in first week and try to learn as much as you can for R. As said before, silly mistakes do appear in the exam, especially when in a rush. Therefore, more practice is always encouraged.

CT6 exams are definitely another good resource. However, as it covers both ACTL30004 *Actuarial Statistics* and ACTL40002 *Risk Theory I*, not all questions are helpful for preparation for this subject.

I wish you all the best in completing Actuarial Statistics!

ACTL30005 Models for Insurance and Finance (1)

Exemption status	Not an exemption subject, but is a prerequisite for ACTL40004 *Advanced Financial Mathematics I* (CT8 *Financial Economics* subject).
Lecturer(s)	Mr Jackson Kwok
Weekly contact hours	3 × 1-hour lectures Every other week, one of the lectures was replaced with a tutorial instead.
Assessments	50-minute mid-semester test in Week 7 10% Group Assignment due in Week 12 10% 2-hour end-of-semester exam 80%
Textbook recommendation	None.
Lecture capture	Full (both audio and video).
Year and semester reviewed	2017 Semester 2

Comments

Despite what the name might suggest, Models for Insurance and Finance (MIF) has surprisingly little to do with Insurance and Finance. Its content is far closer to that of a mathematics subject. From other actuarial subjects, you are probably used to having to apply lecture concepts to real world problems; MIF is quite different in this regard. Given the difficulty, questions don't tend to extend beyond the simplest of the real-world cases; it more comes down to memorizing coursework and applying various theorems and concepts.

You might have heard the stigma attached to MIF as being the hardest subject in the degree, however, this should not be a major concern going into the course. For our cohort (and from my knowledge of past cohorts) lecturers have an understanding of the difficulty of the subject. This means that they (1) set relatively easy assessments and (2) tend to mark leniently. To paraphrase Jackson, students should not be, and are not, penalised for taking a more difficult subject.

The key takeaway of this is that you should not be afraid of MIF. Do, however, be prepared to work hard to get a good mark. Unlike many other subjects, you are not expected fully understand the course content. You can still do well with a surface level understanding of the course (i.e. cramming). The key to success is repetition, especially of tutorial and problem set questions.

When doing questions, your focus should not so much be about the final answer, but about being rigorous in your working. The latter is the far more important of the two and is where you will get your marks in assessments.

Subject Content

MIF is divided into four key sections:

1. The first half of the semester formalises some of the aspects of probability theory that have been taken for granted in the past. It better defines concepts such as sets, probability measures, inverses, random variables, expectations and conditioning. It is without doubt the hardest unit of the course.

You will find the first two weeks to be a breeze – a simple refresher of your work in MAST20004 *Probability*. By about week 4 you are looking at far more complex material than what you have ever seen in the past. New concepts including measurable spaces and the Lebesgue Integral allow us to consider probability in a new light and give us the tools to solve more complex problems.

This unit is very important. The content itself is seemingly random, however, it is highly relevant moving into Units 3 and 4. Thus it is vital that you build solid foundations. Additionally, this is the basis of content for the mid-semester test, so make sure you understand this section.

2. The second section is a short look at some of the more complicated probabilistic concepts and theorems that you have used (possibly without proof) in previous years. It discusses and proves famous results such as convergence of random variables, the Law of Large Numbers and the Central Limit Theorem.
3. The third section considers martingales, their definition and you will discuss their applications to the real world. It is the first of the two major topics around which MIF revolves. A martingale, in its simplest form, is a stochastic process whose expected value is given by its most recently known value. The main application of this unit is to be able to show that, given a fair game, no playing strategy can achieve abnormal returns in the long run.
4. The last part of the course introduces Brownian Motion, the continuous analogue of the random walk. You begin looking at simple problems which then progress into its applications (e.g. modelling stock prices over time). You are then briefly introduced to a highly abstract mathematical concept called Itô's integral, a tool used to solve stochastic differential equations which incorporate Brownian motion. Despite this, you will have no idea what the integral actually means, merely a basic understanding of its use (and I think this is well reflected in my explanation).

Lectures

This was Jackson's first year lecturing and I think that I speak on behalf of the whole cohort when I say that he did a brilliant job of teaching the subject. He was highly knowledgeable and incredibly patient, especially given the difficulty of the work.

Primarily he used a separate notepad to run through examples whilst following the pre-set lecture content that he had released in advance. For me, examples were key to understanding the subject. Often definitions were confusing or very similar to one another. I effectively copied word-for-word his hand-written notes and this gave me a sufficiently good understanding of the subject to succeed.

A former student named Ben Locke produced a highly in depth set of MIF notes which closely follows the course content. Jackson provided this to us at the beginning of the course. During the first half of the semester I made the mistake of using this as a sole reference for this subject. I then proceeded to fail the mid-sem. Honestly, I wouldn't bother with this document as it goes into far more detail than is necessary and can end up being more confusing than helpful. Maybe use it if there is a specific topic you are struggling with. Otherwise, as a whole document, I did not find it to be a very helpful resource.

Lastly, during the semester, Jackson took two lectures to teach us some simple R coding. Although not originally part of the course, it was an excellent addition to the content. He showed us how we could use R code to simulate stock prices and portfolio values. This was incorporated into the martingale section. It also came up on the assignment.

Tutorials

Tutorials are very different to what you have experienced in the past. They run once every two weeks in place of one of the lectures. Jackson released the questions in advance and went through the solutions in class. These tended to be very challenging, especially since he went through them at Jackson-pace after having already completed them 3+ times in advance.

It is important to attend/watch these tutorials. You will find that most questions have an easy way and a hard way. Given the importance of time in the final exam, you want to expose yourself to as many problem-solving methods as you can. You will learn tricks and shortcuts that are relevant to solving other MIF problems as well.

When you attempt these questions beforehand, there is a good chance that you will get nowhere. Don't sweat it too much if you can't crack them on the first try. If you attempt them again a few days after the tutorial you'll find them far more doable and it will consolidate the methods used to solve them.

Problem Sets

A set of questions will be released each week with solutions. Nothing special about this. Just make sure you attempt them as they will go a long way to helping you with assessments.

Mid-semester Test

For us, this covered the whole of Unit 1. It was worth 10% of the final mark. It was very reasonable and was effectively the same as the work done during lectures and tutorials. No reason you shouldn't get a decent mark in this. Questions are very much like those in tutorials, problem sets and lecture examples. Follow these closely when preparing for this assessment.

Assignment

This was a group assignment due in week 12 worth 10%. We were able to choose the groups ourselves. Unsurprisingly the assignment was the most difficult assessment throughout the semester.

The assignment comprised of a few difficult proofs which used methods from the first unit, as well as some martingale and Brownian motion theory from the latter half of the course. Lastly there was a coding question which was (intentionally) almost a line for line copy of the code Jackson had covered in class.

Pro tip: If you are struggling with proofs in this assignment, try the internet.

End-of-Semester Exam

The exam makes up 80% of your final grade. As with the mid-semester test, questions are very similar to that of tutorials, problem sets and lecture examples. Personally, the best way to study was to attempt and reattempt the given questions. Often, whilst the exam questions won't be exactly the same, they use similar tricks and steps to solve the problem. More practice will make it far easier to complete.

We were provided with a single practice paper. Past papers were not relevant as Jackson had changed the course significantly from previous years. Solutions were released a few days before the exam. Despite this, you don't really need solutions. The good thing about this subject is that you'll tend to know whether you've gotten a question right or not.

The exam was of reasonable length and difficulty and focused mostly on questions we had seen before rather than challenging new ones.

Conclusion

Don't be fooled, MIF is not an easy subject. But with a sufficient amount of work (either persistent study or cramming) you can certainly achieve a decent mark. All the best!

ACTL30005 Models for Insurance and Finance (2)

Exemption status	Not an exemption subject, but is a prerequisite for ACTL40004 *Advanced Financial Mathematics I* (CT8 *Financial Economics* subject).
Lecturer(s)	Mr Jackson Kwok
Weekly contact hours	3 × 1-hour lectures Every other week, one of the lectures was replaced with a tutorial instead.
Assessments	50-minute mid-semester test in Week 7 10% Group Assignment due in Week 12 10% 2-hour end-of-semester exam 80%
Textbook recommendation	None. Lecture notes and a detailed subject summary are provided on the LMS.
Lecture capture	Full (both audio and video).
Year and semester reviewed	2017 Semester 2

Comments

This subject is quite theory-based, as there's a lot of definitions and properties to remember. Being able to use the theory to approach a question and justify your steps makes for a key part of the subject; it's important to be thorough and diligent in your approach. Hence, it's helpful to go through all the lecture examples, tutorials and problem set questions to understand when to apply certain concepts to what sort of problems, and hopefully improve your comprehension of the material in the process.

Study groups are insanely useful for this subject, and strongly encouraged. Talking through your understanding of the content can fill in any gaps in your knowledge while bringing up a lot of new points or questions you hadn't previously thought of. Often the same parts of the subject would be difficult to understand for everyone, so consultations were quite popular and you could learn a lot from other students' questions.

The amount of actual content in this subject is quite moderate, but it's difficult to understand conceptually. You often need time to stew over certain concepts and actually understand what you're meant to be doing. Therefore, it's important to keep up with the lectures, even if you're not fully comprehending the material.

Subject Content

1. Counting and Limits

   This was a very short topic with relatively simple concepts, which made it a good introduction to the style of the subject. The main content is expanding what we know about counting and limits to infinite sets, and introducing the peculiarities of infinite sets.

2. Probability spaces (sample spaces, σ-algebra, probability measures)

We've worked with probability before, but this subject explores the theoretical aspects in detail and puts a completely new perspective on what we've learnt before. Sample spaces will be familiar from previous studies, but this topic introduces the 2 other components of a probability space: σ-algebra, and probability measures. You also get introduced to the concept of 'measurable functions', which is another way of looking at random variables. Initially, it just sounds like a lot of jargon and it's difficult to make sense of the big picture, but it slowly starts to come together and you realise the point of learning it (hopefully). This topic contains several key definitions and properties to remember, which form the basis of much of the later material.

3. Integration, expectation, conditional expectation

   This topic is a continuation of the previous one, in which you learn how to integrate measurable functions, and hence apply expectation and conditional expectation to them. It can be quite confusing to get your head around the specifics of the approaches, but going through the lecture examples is very helpful in understanding how it works.

4. Selected topics in classical probability theory

   This topic is relatively short and quite theory-based, and looks at key results relating to convergence and limits. Familiar theorems are covered, such as the Law of Large Numbers and Central Limit Theorem, with the addition of proofs and extensions.

5. Martingales

   In this topic, you're introduced martingales, which are stochastic processes that represent a 'fair game'. You cover the definitions, properties and various examples of martingales, and learn how to determine if a process is a martingale. You also learn important concepts such as 'stopping time' and key theorems which you use to solve many of the problems posed for this topic. Like with most of the subject, the theory by itself can seem endless and overwhelming, but working through examples helps you in figuring out when to apply a concept/theorem, and what you should be doing in general.

6. Brownian Motion

   Brownian motions are the continuous extension of random walks. Through this topic, you learn several types of Brownian motions and their properties, including some proofs relating to first and second variation. This topic was more straightforward to understand, and mainly involved applying results to solve various problems.

7. Ito Calculus

   This topic introduces many concepts owned by Ito: Ito integrals, Ito processes, and Ito's lemma. By this point in the subject, you have generally accepted that there will be complicated concepts with practical applications you do not comprehend. This topic is one of them, and mainly involves applying formulae, so lack of actual understanding won't impede your ability to solve problems.

8. Stochastic Differential Equations

   In this topic, you learn the approach to solving SDEs of various forms and finding their distributions. There was more to the topic that we didn't have time to cover, so overall it was a short and relatively simple end to the subject.

Lectures

Jackson was a very engaging lecturer, which really helped make the subject enjoyable. He didn't stay strictly to the lecture notes, and often covered some additional extensions or examples. There is a fair amount of note-taking involved during the lectures, so it's helpful to have additional paper/notebooks.

The tutorials took place during a lecture every fortnight. Although some of the questions were difficult to approach/solve, I would still recommend attempting them before the tutorial.

Mid-Semester Test

The mid-semester test covered the topics up until conditional expectation. It was quite straightforward, and several of the questions were quite similar to lecture examples or tutorial questions; hence it was a good indicator of how you were keeping up with the subject and the material.

We didn't get any example tests to complete beforehand, however there was a 'playground' app with questions related to the material that we could try.

Assignment

The assignment was given in Week 10 and due at the end of Week 12. Unlike most other third year actuarial subjects, we formed our own groups of 3-5 people. Most of it was pretty straightforward, with questions based on the lecture content.

The more time-consuming aspect was creating a model of a particular stock strategy, and coming up with further extensions to add to the model. Jackson ran through an R coding workshop during a couple of lectures, which you could base your model on.

End-of-Semester Exam

The exam was difficult, but fair; the exam-checker allegedly removed the toughest parts of the exam. We were given a specimen exam which helped in understanding what sort of questions may be asked. Jackson was also super helpful in specifying the relevant tutorial and problem set questions for the exam, which helped narrow down the content to study for.

Concluding Remarks

You don't have to be a professional swimmer to tread water and stay afloat; a similar philosophy applies to this subject.

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 Additionally, there is possibly an additional lecture, depending on content progress/public holidays.
Assessments	Mid semester exam 10% Individual assignment, due in Week 10 10% 2-hour end-of-semester exam (hurdle requirement) 80%
Textbook recommendation	Joshi, M. S., & Paterson, J. M. (2013). *Introduction to Mathematical Portfolio Theory*. Cambridge, UK: Cambridge University Press. The textbook is very similar to the slides, but it has some additional examples and theory. However, only lecture slide content is examinable. It is a costly book at over $100 but ✓ I would highly recommend purchasing it as it provides another source of clarification and a majority of tutorial questions are drawn from it.
Lecture capture	Full (both audio and video).
Year and semester reviewed	2017 Semester 1

Comments

Subject Content

Financial Mathematics III introduces portfolio theory — the ideas behind choosing the best investments given a set of assumptions. The main topics that the subject covers are:

- **Mean Variance Analysis** — Some concepts will be familiar from *Principles of Finance* but it will be covered in significantly greater detail and with more mathematics.
- **Utility Theory** — Modelling investor behaviour and using mathematical functions to determine how they choose investments based on their risk profile.
- **Capital Asset Pricing Model / Arbitrage Pricing Theory** — Modelling expected returns based on placing assumptions on investors (CAPM) or using the principle of no arbitrage (APT).
- **Market Efficiency and Rationality** — Looks into Strong, Semi-Strong and Weak market efficiency and examples that support and refute these theories.

This review was previously published in the 2017 mid-year edition of the *Actuarial Students' Society Subject Review*.

- **Risk Measures** — Before this, measures of risk were mostly related to variance. Different measures will be introduced such as VAR and Conditional Expected Shortfall.
- **Wilkie Model** — Introduction to a stochastic model that can be used to model long term performance of assets and associated liabilities.

There is a huge amount of content in the subject with the slide deck being over 500 slides long. It is absolutely crucial to keep as up to date as possible. It will also be very beneficial to brush up on your linear algebra, especially row reduction.

Lectures

Attendance at lectures is highly recommended. Similar to *Financial Mathematics II*, this subject will require you to fill in blanks in the slide deck. Dr Paterson's lecture style is excellent with very clear explanations of concepts. Slides were provided in 4 blocks throughout the semester. It is very important to go through lectures again slowly in your own time as some lectures can be very lengthy. It is also crucial not to underestimate the theoretical areas of the subject.

In 2017, the extra lectures were primarily used to make up for lost lectures due to multiple public holidays. An additional lecture was held in the days leading up to the exam to answer any questions students had.

Tutorials

Tutorials were highly enjoyable. However, the quality of tutors is highly variable. My initial tutor was rather terrible. After promptly switching out of that tutorial, the other tutor was excellent. They were incredibly knowledgeable and extended my understanding of the concepts being studied.

The tutorial questions will mostly be from the textbook. They provide a preliminary standard of questions and are used to practice the basics. The exam will not be simple calculations like the majority of the questions in the textbook. However, it is still important to do these each week and not be complacent, as they are a good starting point to help understand and explore the concepts being studied. While you do these questions, do not just switch your mind off and compute the numbers. In some sections, questions may appear similar but in fact reveal something that may not be immediately apparent.

Several 'Additional Questions' were also provided. These were mostly exam style questions. I felt they were extremely useful. I would highly recommend understanding all these questions as they will be the best indication of exam standard questions during the semester.

Mid-Semester Test

In 2017, the MST was quite straightforward and involved solely mean variance analysis. This certainly does not mean they will always be easy in the future.

Assignment

The assignment style is similar to FM2. It was an individual assignment where we were asked to use Excel to output investment decisions based on a set of assumptions placed on investors. I like the Excel aspects to the course, so I

enjoyed the assignment.

End of Semester Exam

The exam is not a pleasant one to study for. Once you see some past papers, it will be apparent that pretty much everything in the slides will be fair game.

The exam will be a combination of calculations and theory. As I'm sure will be the case for many actuarial students, the calculations should not be the biggest issue but instead, remembering all the theory will be rather tedious. Most exams will be a combination of calculations, possibly a proof seen in the slides and a theory question which will require an extended, formal written response.

Dr Paterson provided us with 5 previous exam papers of varying difficulty. Beware that not all papers were written by Dr Paterson, but nonetheless they were all a good taste of the style of questions to expect. Exam questions are not formulaic at all so it is crucial to start revision as early as possible. There is simply so much content.

Conclusion

I found FM3 a very interesting and challenging subject. Dr Paterson's manner was very pleasant and lectures were interesting. Tutorials were excellent but will depend on your tutor. Although the amount of content is rather overwhelming come exam time, it is very rewarding subject. As someone who was not very into the life insurance topics covered in the other 3rd year subjects, FM3 was definitely the highlight of the semester.

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 Additionally, there is possibly an additional lecture, depending on content progress/public holidays.
Assessments	Mid semester exam 10% Individual assignment, due in Week 10 10% 2-hour end-of-semester exam (hurdle requirement) 80%
Textbook recommendation	Joshi, M. S., & Paterson, J. M. (2013). *Introduction to Mathematical Portfolio Theory*. Cambridge, UK: Cambridge University Press. The content of the textbook is almost identical to the slides and any additional textbook information will not be examined. I only recommend getting the textbook for the questions (they are aimed to introduce the topic and are a lot easier than exam questions). Tutorial questions are mostly taken from the textbook.
Lecture capture	Full (both audio and video).
Year and semester reviewed	2017 Semester 1

Comments

Subject Content

This subject basically focuses on portfolio theory — calculations to inform investment decisions given a set of assumptions on the returns distribution and/or investor behaviour. Each new topic you do will introduce you to a different set of assumptions on returns and investor preferences, giving you a different perspective on how you could view investment choices.

The assumptions and perspective on each topic is the most important thing in the course. Even though the assessments are calculation based, understanding the theory is the most important thing in this subject.

Below is a list of all topics you will learn and their return/investor assumptions

- **Mean-variance analysis** — The investor will only look at the mean and variance of an investment.
- **Utility theory** — Investors will place a value dependent on what their expected wealth would be (as opposed to just returns). The value they place will be based on some function (and its assumptions).

This review was previously published in the 2017 mid-year edition of the *Actuarial Students' Society Subject Review*.

- **Geometric means** — Investors only care about how much money they will have in the long term.
- **Stochastic dominance** — Some investments would be distributed to be "always better" than another. By "always better" it may not mean they will always return more, there are some assumptions around this.
- **CAPM (capital asset pricing model)** — Assume everyone holds a portfolio of the market.
- **APT (arbitrage pricing theory)** — Assume no arbitrage in the market and no undiversifiable risk in assets.
- **Market efficiency** — Discussion of how efficiency is defined and whether or not markets are really efficient/rational.
- **Stock price models over time** — Additional return distributions such as log-normal, Wilkie model for long term asset/liability management etc.

Lectures

Lectures are very important to attend as slides would have gaps in them for you to fill. This includes missing proofs, derivations and results. There is a lot of content (slides) in a lecture so if you fall behind there would be a lot of reading and understanding to catch up. Lectures cover a wide range of skills from doing the actual calculations to talking about how the topic relates in real life markets.

There is an additional lecture used to catch up from public holidays/mid-semesters etc. This slot may also be used for revision classes before the mid-semester and end of semester exams.

My main tip for lectures is not to expect to understand things straight away. There is a lot of content to cover and some lectures may be an information overload. Just make sure you are patient and have a through look the slides once you get home.

Tutorials

Tutorials questions in the textbook are very computational and often quiet dry. I recommend trying to go further than just doing the questions and understanding why you are doing these calculations. For example, think about the assumptions that you are making — Are they strong/weak assumptions? How realistic are they? Does any investment just look better intuitively? (e.g. would I rather get a certain return of 1% or an uncertain return of 0% or 2% with a 50/50 probability?)

Additional tutorial problems are given some weeks and they are much harder, being similar in difficulty to the final exam. Some questions may rely on *Accelerated Mathematics 1* knowledge like matrix operations/invertible matrices. Don't worry if you forget things from first year, just go back and briefly revise.

Mid-semester exam

The mid-semester exam in 2017 was based only on mean-variance analysis. It was fairly easy and involved doing a few matrix operations. The mid-semester is not an indication of the final exam.

Assignments

The assignment was an excel task that tests your understanding of the lecture topics in a more realistic way. It involved the lecturer giving a set of investments and investor behaviours and you have to analyse what option the investor should best take. My advice is to make sure you consider extreme outcomes in order to make sure your excel model holds well.

End of semester exam

The exam is very theoretical and may present questions in a way which you have either not seen before or have seen maybe once. This is why I think the subject is hard.

As a minimum requirement to get the exemption, you would need to know how to do every type of calculation shown in the lecture slides. The proofs in the slides are for your reference and most likely will not come up.

In order to do well, you need to go beyond the calculations and think about what they mean and whether the answer shows common sense/intuition.

The exam may include writing a small essay about what you think of a theory and its real life usefulness. You can memorise these in advance to prepare but I advise you to be curious and just think about whether the content you learn applies in real life markets.

Concluding tips/remarks

FM3 is a very challenging subject but it is very rewarding. The skills you learn from this subject can be applied to many areas in finance outside traditional actuarial work.

My main tip is to do the tutorial questions as a minimum, and to try to think about why you are learning each topic as you go.

Honours and Masters Subjects

Contents

ACTL40002 / ACTL90004 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*.
Lecturer(s)	Dr Xueyuan (Shane) Wu
Weekly contact hours	3 × 1-hour lectures
Assessments	50-minute mid-semester exam 20% Individual assignment, due Week 12 10% 2-hour end-of-semester exam 70%
Textbook recommendation	Dickson, D. C. M. (2005). *Insurance Risk and Ruin*. Cambridge, UK: Cambridge University Press. ✓ It is recommended that students get their hands on a copy as some problem sheet questions come out of this textbook. The book will also be used in Risk Theory II/Insurance Risk Models II.
Lecture capture	Full (both audio and video)
Year and semester reviewed	2017 Semester 1

Comments

Overall, this subject is quite computational and proof heavy. There are lots of formulas and proofs taught throughout the semester, and students are expected to be able to reproduce most of them under exam conditions. Having said this, Shane emphasised on numerous occasions throughout semester that rote learning the content would not be a good approach to studying this subject due to the amount of content. Indeed, some exam questions will test a variation of a proof discussed in lectures so understanding the techniques involved is far more important than learning the result itself. Ultimately, whilst this subject is not as conceptually challenging as some of the other actuarial subjects, a solid amount of time and effort is still required to gain a solid understanding of the material.

Subject Content

Distributions in Non-Life Insurance — 2 weeks

This first chapter is essentially a toolkit that will be used throughout the other four topics throughout semester. Topics covered here include: common distribution functions (both discrete and continuous), distributions of proportional and excess of loss reinsurance arrangements, probability and moment generating functions, maximum likelihood estimation, and Bayesian estimation. Fear not if you become overwhelmed by the number of distributions explored in this chapter — an information sheet with the pdfs, expectations, variances, mgf's etc. is provided in the end of semester exam and midsem exam!

The Collective Risk Model — 3 weeks

This review was previously published in the 2017 mid-year edition of the *Actuarial Students' Society Subject Review*.

This chapter is the longest one of the subject, and can be quite algebra heavy towards the middle of the chapter. There is one major proof (Panjer's Recursion) in this chapter, and variations of the result are discussed. Knowing the steps in proving the result is very important, otherwise deriving the varied cases can be challenging. It is also worthwhile to memorise the results for the moments of the Compound Poisson distribution as this distribution is used in many of the later topics.

The Individual Risk Model — 2 weeks

The assumptions and set up of individual risk models took a little getting used to, as they were very similar to Collective Risk Models. Having understood the set up of the model, this chapter is quite proof-heavy (one of the proofs is very long!) so it is important not to get lost amidst all the proofs, and to remember the idea behind what we are trying to achieve.

Introduction to Ruin Theory — 2 weeks

This chapter introduces ruin theory, and is a relatively short, and more straightforward chapter. There are a few key results and their respective proofs, which are all examinable. Due to the introductory nature of this chapter, the types of exam questions on this part of the course are more predictable than other chapters. However, this chapter contains more algebra since a lot of the questions ultimately involve solving equations (think back to having to expand equations then factorise them). As a result, it can be easy to make mistakes, and care must be taken.

Credibility Theory — 3 weeks

This chapter starts off relatively light discussing concepts like Bayesian estimation. However, very quickly it started to become a blur when empirical models were discussed. All results were proved, and the proofs themselves were long and tedious. This made it easy to lose sight of the result itself, and how the result would be used. It may be useful to have a summary note of the key assumptions and key results to see the bigger picture before delving into the proofs. After you can see the bigger picture, the calculations are relatively straightforward to apply.

Lectures

Having Shane again brings back memories of the good old days in first year! At the start of semester, a timeline of what slides will be covered in which lecture is uploaded. Whilst most of what Shane discusses in lectures is recorded, there will be occasional times when he writes on the whiteboard, and these small notes will not be recorded.

Overall, lectures are clear and at a reasonable pace. There are a few long and tedious proofs which sometimes took an entire lecture or the majority of a lecture to discuss, and these were sometimes a bit dry. However, this is purely due to the nature of the course, and not reflective of Shane as a lecturer (don't think many people could make a 2-3 page proof that interesting).

Tutorials

There are no official tutorials for this subject (as is the norm for any honours/masters subjects). However, after every chapter is finished, tutorial questions will be uploaded, and discussed in a lecture. Solutions to the tutorial questions, as well as the lecturer's notes will then be uploaded onto LMS. Every week, there is also a problem sheet that is provided, with solutions uploaded later on. Overall, attempting the problem sheets and tutorial questions is vital for success in the subject. Some questions can be very long and tedious to calculate, so if you are unfamiliar with the process, you may find yourself pressed for time in the exam or mid-sem.

Assessments

Assignment

The assignment was provided in week 10, and was due in week 12. It required students to perform recursive calculations in R, excel or any other software of choice, applying a key formula we had learnt. Both our write up and code needed to be submitted. LaTeX is recommended for the write up of the assignment, although not compulsory.

Overall, the assignment was relatively short and a suitable difficulty for stressed out students facing the struggles of the end of semester approaching (Thanks Shane!).

Mid Semester Exam

The mid-semester exam was held the week before mid-semester break, and was one hour long (*how much reading time you have is up to you, so long as you deduct it from the one hour writing time*). Everything up to and including week 4 was examinable. No specimen mid semester is provided.

Overall, the mid semester exam was quite pressed for time, but a fair exam. There were about three to four questions, with a few sub questions. One of the questions was a proof of one of the results discussed in lectures. Performance was reasonable, and the average was roughly 11/20.

End of Semester Exam

The exam is 2 hours, with 15 minutes reading time. A specimen exam is provided. Of the people the writer has talked to, many found the specimen exam to be quite challenging. Our exam however, was not very similar to the specimen, and in fact contained few typical questions we expected. This was especially the case when EBCT models were not tested at all in the exam. There were also lots of questions where the parameter of the distribution was itself a parameter, and relatively speaking, fewer number crunching questions than we'd expected.

Overall, the exam was less pressed for time than the mid semester exam, however, that did not mean we could cruise along either. Compared to the specimen, the difficulty of the exam was slightly easier, however, this subject is one where exam difficulty can vary immensely and students should be prepared for the worst.

ACTL40003 / ACTL90014 Insurance Risk Models II

Exemption status N/A; this subject does not constitute any exemption requirement but is instead an elective upon satisfactory completion of ACTL90004 *Insurance Risk Models* (which comprises part of the exemption requirement for CT6 *Statistical Methods*).

Lecturer(s) Dr Enrique Calderin

Contact hours 3 × 1-hour lectures

Assessments

	Honours	Masters
Mid-Semester Exam (Week 8)	20%	20%
Individual Assignment due in Week 12	—	10%
2-hour Final Exam	80%	70%

Textbook recommendation Dickson, D. C. M. (2005). *Insurance Risk and Ruin*. Cambridge, UK: Cambridge University Press.

The textbook is not essential. However, the textbook is extremely good at explaining some of the more complex concepts should you refer to it throughout the semester.

Lecture capture None

Year and semester reviewed 2017 Semester 2

Comments

Between the two optional postgraduate Actuarial subjects, this is far and away the more popular choice, as conceptually *Risk Theory* is a lot easier to digest than the crazy martingale stuff of *Financial Mathematics*. That does not mean this subject is easy by any means — welcome to what is likely to be the last numerical actuarial subject of your long arduous journey.

Subject content

The precursor to this subject (ACTL90004 *Insurance Risk Models*) deals with models for a general insurance company, taking into account the random nature of both the claim size and the claim numbers. Rather than modelling the claims paid by an insurance company, the majority of Insurance Risk Models II is concerned with the decisions made by the Insurer in a variety of contexts. The subject content is split into 4 distinct units:

Unit 1 — Utility Theory makes its return from ACTL30006 *Financial Mathematics III*. In a nutshell, Utility Theory assumes that entities make decisions based on a function of the amount of wealth they will have (you can think of it as some sort of "satisfaction level"). Calculations on the minimum and/or maximum premium amount that should be charged for a given risk and utility function are the focus of this unit.

Unit 2 — Premium Principles — Utility theory is just one way to calculate an appropriate premium for a given risk. Additionally, you have already dealt with calculating a *Fair Premium* (from ACTL30003 *Contingencies*). This unit explores

a wide range of methods to calculate premiums, taking into account various features of the distribution of the risk (e.g. its variance, or distribution function).

Unit 3 — Optimal Reinsurance Arrangements is where the subject starts to get a bit hairy. Suppose an insurer is thinking about reinsuring its business; what type of reinsurance arrangement should it take (e.g. Excess of Loss, Proportional)? Depending on the goals of the insurer, the optimal reinsurance arrangement is different. Here you will cover an onslaught of theorems to **rigorously** prove the optimality of these arrangements. This is arguably the hardest part of the course.

Unit 4 — Ruin Theory — in my opinion the most interesting part of the subject. Insurers are always at risk of becoming ruined (i.e. having no more money). Assuming that claims paid follow a compound counting process, we are interested in the probability that this actually occurs over both finite and infinite time intervals. Interestingly, the answer is not always 1 in the infinite time case. Lundberg's inequality for the probability of ruin (which you may remember from IRM) is derived, as well as finding analytic solutions for the ruin probability (assuming certain distributions) using various calculus techniques, and deriving approximations to the ruin probability.

Despite being a "sequel" to IRM, I didn't feel like there was much connection between the two subjects. From memory, the only bit of overlap was ruin theory and knowing how to calculate the moments of a compound distribution.

Lectures

Much like in IRM, slides are released in units with the exception of Unit 4, which was released on a rolling basis. However, the style of slides were very different (not that it affected much).

Enrique would go through each slide, filling in any blank space with proofs and examples as they appeared. Being Enrique's first time, sometimes the proofs were a bit hard to follow or had errors which students were quick to point out. However, I imagine most of these would be rectified in the next iteration of the subject.

Occasionally, a tutorial would be held in place of a lecture in which Enrique would work through a problem. Tutorial sheets would often contain up to 10 questions. However, only around 4 or 5 were covered in the lecture, with the remaining questions left as an exercise for the student.

Mid-Semester Exam

As is standard in Actuarial subjects, a mid-semester exam is held in Week 7. Plenty of past mid-semester papers were provided as practice. In 2017, due to timing issues, the only units that were examinable were Units 1 and 2, though parts of Unit 3 were examinable in the past.

Questions on the paper ranged from theoretical questions ("Give the mathematical definition of ...") to computational questions ("Calculate the premium under such and such principle") and even proof questions ("Prove that ABC satisfies XYZ").

Nothing in the mid-semester exam was too difficult to answer, considering the strong set of mathematical tools that the undergraduate course should have equipped you with. In fact, all you really needed were skills in probability and integration. Much like in every integration question, your biggest downfall will be silly mistakes (or missing a minus sign... whoops :S). Answers had to be extremely thorough to get full marks, with the highest mark being 37.5/40.

Assignment

The assignment is only given to Masters students, presumably to give Honours students a bit more time to spend on their research project/essay.

Questions on the assignment primarily related to Unit 3, with one (unassessed) question on Unit 4. It was a very long assignment, with 8 lengthy questions. None of the questions were too difficult, though the use of numerical approximation techniques were required.

Many students did not keep up with the subject, and the assignment did an extremely good job at forcing them to finish studying the course by the time SWOTVAC came around.

End-of-Semester Exam

Enrique was kind enough to provide 3 past exams. You will quickly notice that these exams each have a fairly common style and format. The 2017 paper had a very similar style, but the difficulty of the questions was much harder. Solutions were not provided for these papers — deal with that however you need to (e.g. forming study groups or doing research).

Much like all actuarial exams, questions focused more on conceptual understanding than grinding out the correct method for specific questions. For example, while the majority of questions about utility theory throughout the semester will be in an insurance context, a question on the exam asked about one in a gambling context instead.

There were 7 questions on the end-of-semester exam, with more of a focus on Units 3 and 4. Many of the questions were quite accessible. Questions ranged from "Calculate how much an individual would be willing to pay to make a decision under utility theory", "Prove that a reinsurance arrangement is optimal" and "Explain intuitively what this mathematical expression means". One of the trickier questions involved proving an inequality was true for all values of a parameter M.

Tips for Success

IRM2 will not be as conceptually challenging as many of the subjects you will have taken in the past (e.g. the *Financial Mathematics* pentalogy is conceptually much harder), so many of your mistakes will be silly mistakes.

You will want to brush up on your proof skills if you want to excel in this subject. The questions that differentiate between those that do okay and those that do amazing are likely to be the ones that require you to prove something. There is usually a long way and a short way of answering all of the proof questions — it should be obvious which one you will want to use in an exam setting.

While there might appear to be a lot of tedious memorisation that is required, taking a step back from the slides and just thinking about what the big idea is will really reduce the burden of memorisation. For example, one of the approximations to the ruin probability involves solving a system of linear equations for which an ugly analytic solution is provided. In essence, you are really just approximating a random variable using a zero-inflated gamma distribution and matching moments.

Honestly, if you have made it this far into your degree, it should not be too hard to do decently well in this subject — you should focus more on your exemption subjects *Actuarial Practice and Control II* (and *III* if you are an Honours student). Best of luck!

ACTL40004 / ACTL90003 Mathematics of Finance III

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	3 × 1-hour lectures
Assessments	Individual assignment, due around Week 8 10% 1-hour mid-semester test in Week 8 20% 2-hour end-of-semester exam 70%
Textbook recommendation	Joshi, M. S. (2008). *The Concepts and Practice of Mathematical Finance* (2nd ed.). Cambridge, UK: Cambridge University Press. It is difficult to reconcile lecture content with the textbook, and the textbook goes a lot deeper than lectures. It is not necessary, but may help flesh out some of the trickier concepts.
Lecture capture	Full (both audio and video)
Year and semester reviewed	2017 Semester 1

Comments

You've managed to get through your three-year undergraduate course. You've survived *Financial Mathematics I*, *II* and *III*. However, ACTL90003 Mathematics of Finance III is arguably the toughest (compulsory) subject you will take in the actuarial course, at least conceptually.

Subject content

Mathematics of Finance III deals with the pricing of derivatives contracts — a class of financial products whose ultimate pay off depends on some other asset. For example, a contract that lets you buy a stock for $100 at some time in the future. The value you get as an investor depends on the value of the stock at the time set out in the agreement. The content is loosely categorised as follows.

- **Binomial Trees / Two Step Models** — After a brief review of the principle of no arbitrage and the law of one price, you learn to price derivative contracts using binomial trees — a basic model where the stock can only take 2 possible values in successive time frames.
- **Martingales and Brownian Motion** — is familiar territory for those who did ACTL30005 *Models for Insurance and Finance*. A martingale is typically used to model a "fair game", and Brownian motion is an incredibly important stochastic process that is involved in pretty much everything in this subject. It would do you good to become familiar with these concepts ASAP.

This review was previously published in the 2017 mid-year edition of the *Actuarial Students' Society Subject Review*.

- **Stochastic Differential Equations** — more familiar territory from MIF. Imagine differential equations, but applying them to stochastic processes. Many ideas from MIF are revisited, as well as some discussion on techniques to solve some SDEs.
- **Black–Scholes Model** — is the key part of MoF3. 2 weeks of the subject are dedicated to deriving the Black–Scholes Equation, deriving the prices of common derivatives, and discussing limitations of the model. This is followed by a discussion of "the Greeks", a way of measuring how sensitive your portfolio is to small changes in various parameters.
- **Interest-Rate Derivatives** — a number of derivatives are dependent on the interest rate in the future. This topic covers how to price some "simple interest rate derivatives", before introducing you to a slew of "exotic interest rate derivatives". There is some discussion on simulation as well.
- **Credit Risk Models** — Suppose there was a contract that pays out if a company fails to pay its debt to another company. How exactly do we price this contract?

While there is some overlap with FNCE30007 *Derivative Securities*, it will not really help you much in this subject — most things in DS are covered in much more depth in MoF3, so you are much better off using your free elective to learn something else. Indeed, a friend of mine who did do DS still struggled in this subject as much as students that didn't.

It is extremely easy to get lost in the content for Mathematics of Finance III. While it may not have as much breadth as *Financial Mathematics III*, it is conceptually much harder. Bring your A-game.

Lectures

Although each week has two topics, there are actually 3 lecture slots. Due to the way topics are structured, this was a non-issue, as the overarching topic would remain the same within each week, meaning there was no sudden change in lecture content when the cross-over occurs.

Throughout semester, it was extremely easy to become lost during lectures, so unfortunately a lot of Zhuo's comments flew right over my head. However, upon revisiting the lecture recordings during SWOTVAC (and after I had started understanding all the content), I found Zhuo's comments very interesting, as in addition to explaining the key ideas, derivations and formulae, they provided some context and history behind the models being discussed, fuelling the motivation to study each concept.

Each "part" would have a set of theory and general questions near the end, which acted as the tutorial questions for the subject. If there was time at the end of the week, Zhuo would cover some of the questions. Zhuo would commonly use the whiteboard to discuss examples as well as writing notes on the document camera. This meant that watchers from home would at times be missing out on some crucial information. More on this in the "End of Semester Exam" section.

Assignment

As is typically the case for *Financial Mathematics* subjects, the assignment put you in the shoes of a financial analyst, and required you to do some task in excel. In 2017, we were required to price a number of options using various methods introduced in lectures, from vanilla options (e.g. "European Call Options" and "American Put Options") to others that were a bit more complicated.

Unlike past assignments, this one allowed the use of VBA for Excel. I would probably say that unless the scenarios that Zhuo tested were very limited, the use of VBA was essential to scoring well on the assignment, so brush up on those programming skills and do some reading on VBA!

Mid-Semester Exam

The mid-semester exam was held just after the mid-semester break in week 8. It covered all topics up until the start of the Black–Scholes Model. Questions ranged from 'price this option' (computational) to 'what are the assumptions of such and such model' (theoretical).

No practice papers were provided. However, I would say that the practice problems in slides was sufficient for preparation, as the exam did not deviate much from these. The paper, as well as its solution, was uploaded shortly after the exam after marking was complete, along with some feedback. The mid-semester exam was out of 20. In 2017, the average mark was 14.1, with a maximum of 18.5 and a minimum of 8.5.

End of Semester Exam

If the mid-semester exam had instilled a bit of confidence in your grasp of MoF3, then prepare to have that confidence ripped to shreds during SWOTVAC.

As the mid-semester exam had already covered the first half of the subject, the end-of-semester exam would primarily focus on the latter half. Unfortunately, the latter half of the subject is also the hardest part of the subject. Be prepared to deal with situations that you have not really dealt with before (much like most other financial mathematics subjects up to this point). Due to the lack of practice problems, you will not have much of a choice but to fully understand the concepts and ideas, otherwise you are doomed to not do well.

In 2017, there were 7 questions, each worth 10 marks. Questions ranged from "price such and such contract" to "find the expectation and variance of this expression". A trickier question on the exam involved using a stock as a numeraire, which is not explicitly taught until *Mathematics of Finance IV*. However, with the techniques in MoF3, the question was more than doable.

There was also a question about finding the "expected recovery rate" in a specific model. Coincidentally, Zhuo spent a good majority of the last lecture covering exactly how to go about answering this question, using the whiteboard in the process to the dismay of waggers. Additionally, a key result in one of the slide questions was discussed extensively in one of Zhuo's lectures. Basically, go to lectures.

Two specimen papers are provided. However, one is extremely easy, so don't fall into the trap of becoming complacent after finishing that one. The other one was a good indication of the actual exam. Overall, I would say the end-of-semester exam was fair and doable, despite the foreign nature of most of the questions.

Tips for Success

Be patient with the subject. It will take a while to fully understand everything in the subject, and trying to rush through everything will just leave you frustrated. In your own time, hold discussions with your peers in an attempt to clear up anything that is unclear in slides.

Take some time to revise (pretty much) everything in ACTL30005 *Models for Insurance and Finance*, as that will best prepare you for not only the martingale, Brownian motion and stochastic differential equations sections, but everything after that, as Black–Scholes Model, Interest Rate Derivatives and Credit Risk models builds upon those three topics. Basically, if you have a solid understanding of the content in MIF, then you will have an easier time in MoF3. Otherwise it will be a struggle.

ACTL40005 / ACTL90013 Actuarial Studies Projects

Exemption status	None.	
Lecturer(s)	Xueyuan (Shane) Wu Shuanming Li Mark Joshi	
Contact hours	3 × 1-hour consultations per project	
Assessments	Project 1 (Semester 1 — Weeks 1–8)	25%
	Project 2 (Semester 1 Week 9–Semester 2 Week 8)	35%
	Project 3 (Semester 2 — Weeks 5–12)	40%
Year and semester reviewed	2017 All Year	

Comments

Mark Joshi: What did you think of your previous projects?
Student: I was surprised we had to do so much research!
Mark Joshi: [laughs] You know, this subject is called *research* projects for a reason.

Welcome to the world of research, and be prepared to have your limits (and stress levels) stretched to new highs by this subject. So far in our actuarial journey, we have rarely had to research too much on our own, or use too much judgement. Following instructions generally ensured a good outcome. However, this subject really pushes you to think, decide, and execute on your own as significantly less guidance is provided.

At the beginning of each project, the project supervisor delivers the project, outlining expectations and tasks. For every project, you will get three consultations with the project supervisor. Questions regarding the projects will only be answered in these three sessions, and will not be answered via email at other times. Each project goes for 8 weeks (with the second project stretching over the winter break), and requires an academic paper style report and usually the code or spreadsheets used in performing the required tasks. All projects require some degree of coding, so this subject is also very valuable in the sense that your programming skills are put to practice.

Project 1

The first project was delivered by Shane, and focused on investigating two aggregate claims models for insurance with dependence. The project consisted of two main tasks: deriving theoretical results for two models such as the mean, variance and covariance, and then using monte–carlo simulation to further compare and contrast the two models.

Looking back at the projects, this project was perfect at easing our way into the subject, and tied in well with our *Risk Theory I* studies since some techniques learnt in *Risk Theory I* needed to be applied. This project was more structured in that the tasks required were clearly outlined, but there was enough room to use our judgement and initiative such as choosing which probability distributions to use, and what sorts of tests to perform when comparing the two models.

Project 2

This project was delivered by Shuanming, and similar to Project 1, had an overall *Risk Theory* focus. Nonetheless, immediately from the outset of the project, it was apparent that a lot more research would be required for this project. The focus of the entire project was on copulas (a method to model dependent random variables), and none of us had ever heard of these before! Hence, before we were able to even start the tasks, extensive research went into understanding what they were. The remaining parts of the project focused on fitting various data to bivariate distributions using common distributions and copulas, ultimately leading to a comparison of the methods and fit.

Project 3

The final project was delivered by Mark Joshi. Very much like his financial mathematics assignments, the project started with a similar background story where we were an analyst and our boss required us to complete a task. For our project, the task was to create two models (one basic and one enhanced) that would calculate the price of an exotic basket option called the *South Guarantee* (a product which prevents your investment from going south) and compute the Greeks. Six test cases were provided, and we were expected to perform our own tests as well. Sound straightforward? The catch was that our bonus (i.e our project mark) would depend on how quickly our enhanced model could run compared to our basic model. Mark warned us that he would be very unimpressed if we purposely made our basic model exceptionally inefficient.

Compared to the other projects, this project was the most open ended, and really challenged us to develop some programming skills and think about how we could make the model more efficient. At the same time, we were expected to be able to understand and explain how the techniques used to accelerate our code worked, so the project had a good balance between theory and application.

Tips for Success

Looking back over the year, the biggest factor that determines how successful you are, and how well you manage your stress is how early you start the projects. Often, many students would not start them until three or four weeks into the project which would lead to cram sessions in the final week that the project was due. Often such cramming led to sky–high stress levels and the need to skip other lectures, which is not recommended.

When writing up the report, the look and way the report is written also carries more weight than what you might first expect. Hence, time should be taken to proof-read and think about how the report will be structured. LaTeX is preferred, and it is rumoured that a mark is deducted for every two typos. Finally, a reminder that initiative will be rewarded and the more you put into the projects, the more you will get back — both in the form of being more work ready, and your subject mark.

Whilst the projects are tedious to complete throughout semester, there is no doubt that we will look back later and realise that the projects have taught us many skills that are transferrable when we enter the workforce. Good luck, and start the projects early!

ACTL40006 / ACTL90010 Actuarial Practice and Control I

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 Peter Worcester — 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 not essential.
Lecture capture	Full (both audio and video).
Year and semester reviewed	2017 Semester 1

Comments

This subject is very different to any subject we have done so far! As such, a different way of thinking and approach to studying is required. The ability to think from other people's points of view, and differentiate between significant and insignificant information is important for this subject.

Subject content

Rather than being based on topics or chapters, this subject is based on 9 aims. When applicable, each aim is discussed in a life insurance/general insurance/superannuation context. Broadly speaking, the aims are:

- The Actuarial Control Cycle
- Professionalism
- The life insurance, superannuation, life insurance and investments environments
- Regulation
- Features of products
- Enterprise Risk Management
- Risks of products
- Product design
- Models

This review was previously published in the 2017 mid-year edition of the *Actuarial Students' Society Subject Review*.

Some aims are shorter than others, and a bigger focus is placed on features, risks and product design.

At the start of the semester, fundamental documents covering life insurance, general insurance and superannuation were provided. Students were expected to read through them to gain a basic understanding of each of the industries.

Lectures

Overall, lectures were engaging and student participation was expected. The lecturers were all very experienced in their respective fields. They understood that we lacked knowledge of the life insurance, general insurance, superannuation and investments industries, so they started off the semester with the basics. Having said that, as it was presumably Peter's first time taking this subject, he seemed to assume that students knew the basics (when we unfortunately didn't), and skipped over a lot of the introductory material.

Throughout semester, it was also hard to see how everything fit together as the lectures seemed to jump around all over the place. For example, one lecture might have a super focus, and then another few lectures might pass before we see the same lecturer. When they then started by saying something along the lines of "continuing on from last time", it was sometimes difficult to remember what had been discussed in the last lecture taken by that lecturer. Although, the apparent randomness of the lectures makes sense if you consider the order of the lectures from an aims point of view.

For those students who prefer to listen to the recordings, it is noted that most lectures are interactive, and the answers from students are often not recorded. Whilst the lecturers try their best to repeat what they hear from students, they inevitably forget at times.

Tutorials

There are no official tutorials for this subject (as is the norm for any honours/masters subjects). Throughout semester, there were about two tutorials where case-study-type questions were discussed. These were very useful as they allowed us to get a feel for what the exam questions might be like, and where our weaknesses were. However, it would have been nice to have more tutorials throughout semester, as it was often hard to see how the concepts learnt could be applied on a whole instead of being siloed concepts.

Assessments

Assignments

The assignment was a multi-part group assignment where we were consultants completing a project for a client. We were first expected to write a scope letter to the client, then submit a draft report. After feedback was provided by the client, we were then required to submit the final report.

When approaching the project, it was important to consider things from the clients' point of view. Thus, an academic paper style report was not what was expected. Taking on board the client's feedback was also integral when submitting the final report.

In terms of timing, the draft report was due around mid-semester break. Unfortunately, this was the same time as the mid semester exams for other subjects, so being organised was very important to avoid needing to cram. The assignment groups are assigned by the lecturers.

End of Semester Exam

The exam was 3 hours, with 15 minutes reading time. It was also an open book exam. During SWOTVAC, there was one specimen exam provided.

Overall, the specimen was similar in format to the final exam. However, compared to the specimen, the questions in the exam seemed to be more open ended, and at times more vague. The question on investments was also somewhat unexpected as the phenomenon we were asked to explain was unfortunately glossed over in lectures. In terms of timing, the exam was not extremely pressed for time, but was not so comfortable that you are able to flick through notes extensively. In preparation for the exam, it is suggested to think about how the different aims relate to each other, and practice hand writing out solutions (as actuarial students in general don't do a lot of writing).

One additional thing to note is that there was a multiple choice section. However, these are the hardest multiple choice questions you will have ever taken, as out of the 5 options, multiple can be correct, and you must select all of the correct options to attain your one mark. Sometimes, none of them are correct, and you must explicitly state that.

Tips for Success

Students should walk into this subject with an open mind, and not expect to get by through rote learning the subject. Understanding the main industries and products is very important, so it is worthwhile taking time at the start of semester to go through the fundamentals documents. Some of the documents are quite long, but this time spent will definitely pay off later. For those who prefer to 'see' actual products, it may also be worthwhile to search up a few product disclosure statements.

If you ever feel lost as the semester progresses, referring to the syllabus (aims) may provide some direction. Forming a study group to discuss concepts, or taking down your own notes throughout semester may be an efficient way to study for the subject. Nonetheless, regardless of how you choose to study for this subject, it is imperative to practise communicating concepts and ideas as how we communicate is a direct reflection of our understanding. This might mean that you hand write some of your notes so your hand doesn't cramp up in the exam from having not written essays in a while! Good luck!

ACTL40007 / ACTL90011 Actuarial Practice and Control II

Exemption status	Part IIA *The Actuarial Control Cycle* and Part IIB *Investment and Asset Modelling*, in conjunction with ACTL90010 *Actuarial Practice and Control I* and ACTL90009 *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 Andrew Gale — Health Insurance
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 not essential.
Lecture capture	Full (both audio and video).
Year and semester reviewed	2017 Semester 2

Comments

ACTL90011 Actuarial Practice and Control II continues on from where APC1 left off. APC focuses more on the qualitative side of being an Actuary, where judgment and context is absolutely key to a wide range of decisions that must be made. APC2 is ever so slightly more technical than its sibling.

Subject content

APC1 and APC2 both cover 16 aims laid out by the Actuaries Institute. APC1 covers the first 9 aims, and APC2 covers the rest. The remaining aims are:

Aim 10 — Capital: defined as the "excess of assets over liabilities" (at least in an insurance context). The purpose of capital, how capital is acquired and how different levels of capital affect different stakeholders is discussed.

Aim 11 — Liabilities: insurance companies are in the business of uncertainty, and valuing liabilities is not always the most straightforward thing; it is an "uncertain measurement of an uncertain process". The economic assumptions and financial assumptions that are incorporated into liability valuation, and how they affect the ultimate figure are discussed in great detail.

Aim 12 — Pricing: how much should an insurance company charge for insurance coverage? What risks can arise? Does the premium take into account all of these risks?

Aim 13 — Solvency: an insurance company is always at risk of becoming insolvent (i.e. unable to pay their obligations as they fall due). How can an insurance company help maximise the probability of remaining solvent?

Aim 14 — Profit: not much is covered for this aim. The matching principle from accounting says that revenue should only be recognised as services are performed. In the context of an insurance company, where premiums are paid in advance, this is very important, especially considering the uncertain nature of the liabilities that are paid out for each policy.

Aim 15 — Monitoring & Aim 16 — Managing: the final two aims are what makes the control cycle a "cycle". After a decision is made, the impact of that decision must be monitored so that the actuary can respond to any favourable and unfavourable outcomes in a timely and appropriate manner.

In the midst of this, a couple of lectures about Health Insurance are covered, focusing mainly on Community Rating (i.e. everyone is charged the same premium regardless of individual characteristics), Risk Equalisation and Demutualisation.

You will want to retain as much knowledge from APC1 as possible (I sincerely hope this was obvious to you).

Lectures

Much like its sibling, lectures are held late afternoon on Tuesdays and Thursdays (and I don't see this changing in the future). 2017's cohort was (un)lucky enough to have Tuesday lectures start at 5:15pm instead of the usual 4:15pm. I hope for your sake you don't have to go through the same thing (though apparently it's better for the lecturers).

Lectures were very engaging, as they were delivered by current working actuaries in a wide range of industries. Each lecturer from APC1 (apart from the Investments lecturer) returns with their distinct style which made attending lectures enjoyable despite the incredibly late timing — David Heath would often bring up recent events affecting General Insurers, Andrew Brown would often talk about the future of the actuarial profession, and Donald Campbell would often bring up amusing stories from his time as a superannuation actuary. Andrew Gale was the "guest lecturer" of the semester, taking two lectures focusing on Health Insurance, with the majority of the second lecture being an interactive Health Fund game, where groups competed to create the most profit across several rounds.

Very often, lecturers would ask questions to keep us on our toes, and students were encouraged to ask questions throughout the lecture. However, the microphone did not do a very good job at picking up what students say, and while the lecturers tried their best to remember to repeat what students say, they often wouldnt. For this reason I would recommend attending lectures, even if it means staying back at university until 7 at night; grab a coffee and do whatever you need to do to stay awake.

Assignment

Much like in APC1, the assignment placed you in the shoes of an actuarial consulting firm, and required you to do some "client work". A draft report and a final report was to be submitted; there was no scope letter that needed to be submitted (which was the case in APC1).

In APC2, the assignment was more technical in nature, requiring groups to perform a valuation. Just over a week after the draft report was submitted, feedback was provided for you to incorporate into your final report.

The assignment is not considered for Part II exemptions, so don't stress too much about it and take it more as a learning experience. The assignment will only determine your subject score at the end of the semester.

End-of-Semester Exam

Luckily, this is an open-book exam — you can bring anything that is not prohibited (...David's words, not mine). You can bring all your annotated lecture slides, the textbook, your own bound reference, and even a magazine to read if you finish early (a joke from David).

The exam had 15 minutes reading time followed by 3 hours of writing. Despite being a qualitative subject, you were encouraged to write in dot points. Clear and concise responses are essential to making sure you answer all the questions, as many students found themselves rushed for time.

Exam questions would usually provide a paragraph or two, providing some context before asking a question. Questions ranged from "Explain the concept of ...", "What should be considered for ...", and "What impact will this have on ...". Evidently, a holistic view on all of the issues discussed throughout semester is required to perform successfully in this subject.

Each of the lecturers would stress the intent of why things are done, and if you understand these intentions and are able to explain it clearly and concisely, the exam should come naturally to you. Alternatively you can chuck everything into a 100 page bound reference and use that in the exam.

Tips for Success

Forming study groups is the most effective way to study for the APC trio. Being a qualitative subject, discussion is very important, and talking through lecture content, even if no one really has a firm understanding of the content, will ultimately benefit everyone involved.

Retaining as much knowledge from APC1 is essential — don't treat the two subjects as isolated cases. Think about how each Aim links to each other (across both APC1 and APC2), as ultimately the Control Cycle should be thought of as a whole unit rather than a collection of disjoint sub-units. For example, when coming up with a premium for insurance products, you should consider the regulations that govern your line of business, and what your competitors are doing (plus a myriad of other things); focusing solely on making a profit will not always work out. Mindmaps are invaluable here.

Also don't be afraid to answer some of the questions in lectures.

ACTL40008 / ACTL90015 Mathematics of Finance IV

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

Dr Dan Zhu (Mark's former PhD student) took the last 3 lectures due to Mark's passing

Weekly contact hours 2 × 1.5-hour lectures

Assessments

	Honours	Masters
Mid-Semester Exam (Week 7)	20%	20%
Group Assignment due in Week 7	—	10%
2-hour Final Exam	80%	70%

Textbook recommendation Joshi, M. S. (2008). *The Concepts and Practice of Mathematical Finance* (2nd ed.). Cambridge, UK: Cambridge University Press.

✓ The textbook is essential, as exercises are taken from there.

Lecture capture Full (both audio and video).

Year and semester reviewed 2017 Semester 2

Comments

***Disclaimer**: Note that all the comments in this review pertain to the subject when it was delivered by Professor Mark Joshi, who has unfortunately passed away.*

Mathematics of Finance IV is the pinnacle of financial mathematics subjects offered by the University of Melbourne. While the *Financial Mathematics* pentalogy has been relatively theoretical, MoF4 also gets into how each of the concepts are actually applied in practice. Get ready for the most rewarding subject that the Actuarial Department has to offer.

Subject content

MoF4 extends on the content covered in MoF3. There is no official breakdown of overarching topics, but the content can be loosely categorised as follows:

No Arbitrage and Binomial Trees — The principle of no arbitrage is introduced once again, as well as a slew of other theorems that follow as a consequence. An in-depth discussion of trees follows, talking about different types of trees (including one where the stock is used as numeraire), and a number of techniques that are used to "accelerate" computations using trees.

Continuous Time Martingale Pricing — All the content from *Models for Insurance and Finance* and MoF3 is very briefly revised. We learn how to price options through stochastic differential equations when the stock is used as the numeraire instead of the bond, before learning the analytic formula for the price of a barrier option — an option that only pays off if

the stock reaches (or does not reach) a certain value before the option's expiry. In MoF3, you would have learnt that you can change the drift of a Brownian motion when passing through another measure. Here you learn exactly how that is achieved through the use of the Radon-Nikodym derivative.

Multiple Sources of Risk — up until now, the only source of randomness included in a model was a single Brownian motion (or a single random variable per step in the discrete case). Here, a model which incorporates a multidimensional Brownian motion is introduced, allowing us to price more complicated options (such as one that allows us to trade two stocks at some future point in time). *Linear Algebra* starts to become a huge part of the course from this point moving forward, so brush up on your first year mathematics notes.

Interest Rate Derivatives and Market Models is an extremely large topic of the subject, consisting of 7 of the 22 "content" lectures. Some derivatives depend on a set of interest rates in the future. This topic focuses on how we can use Monte-Carlo to price these derivatives. Among other things, the drifts of the forward rates in a variety of martingale measures is derived, before a very lengthy discussion on how the implement a market model.

Jump Diffusion Models — In history, there have been a number of crashes in the market, causing jumps in the prices of stocks. All models studied up to this point have assumed that such jumps don't occur. Jump Diffusion Models attempt to model these jumps through the use of a (compound) Poisson process. What impact does including this possibility have on the price of an option?

While it initially starts off as a theoretical maths-y subject, the Market Models lectures starts blurring the lines between a maths subject and a computing subject, where *computational complexity* (i.e. how the length of time it takes for a program to run something scales in relation to the number of inputs) becomes a heavy focus. Any programming experience would be a huge boon for this subject.

Lectures

Slides are released in quarterly chunks, and lectures are delivered as two 1.5-hour lectures in a week. One of the lectures is replaced with a mid-semester test (held in week 7), and there is only 1 lecture in the final week (or at least that was what was initially planned).

Lectures would usually consist of going through slides, and proving any results that were in slides on the whiteboard. This meant that listening to lecture recordings was not very helpful at all, as most of the stuff not on slides was not recorded. Mark expected lecture participation from students, and even went out of his way to include students who didn't usually contribute in lectures.

On the second lecture of each week, the final 30 or so minutes was dedicated to working through problems that students wanted to go through.

Mid-semester exam

As is standard in Actuarial Subjects, a mid-semester exam is held in week 7. Only one past mid-semester test was provided.

2017's mid-semester test was a lot more computational than I had expected to come from Mark. In hindsight, none of the questions were too hard. However, time was a huge issue due to the computational nature of some of the questions asked.

A common pitfall students made was trying to be overly clever and "simplifying an expression" before applying a certain technique, which actually made it more complicated instead, and failing to divide the payoff of the derivative by the numeraire.

Assignment

A group assignment was released at about Week 5. It involved simulating a hedging strategy on a stock, varying the hedging strategy as well as the model volatility of the stock. Students were required to make observations on how the trading strategy in relation to the model volatility affected the profit (or loss) made by the trader.

It goes without saying that programming was essential to the assignment. The "answers" (i.e. which scenarios resulted in profits and losses) was made apparent in lectures, so it was simply a matter of making your code produce results that match the results shown in lectures. One interesting thing to note is that the write-up required concepts that were taught in MoF3 rather than MoF4.

I believe all groups scored full marks for the assignment.

End-of-semester exam

Two past exams were provided with solutions. The format of the past exams were very similar: 6 questions each worth 10 marks regardless of difficulty/time required. There was always an essay question.

Our exam changed the formula up a bit, and was consequently a lot harder that previous exams. 7 questions were on the exam, each worth 10 marks. Instead of a single question dedicated to essay writing, there were about 3 sub-questions spread throughout the exam that required students to write either a proof for a result shown in lectures, or an explanation of how to implement or accelerate a certain algorithm.

No question on the exam was a "free mark", as is typically the case in every other exam. In hindsight, the most important thing to know for the exam was the **black formula**, and how exactly to use it to answer questions.

The exam was heavily scaled upwards.

Tips for Success

A lot of what is taught in MoF3 is very computational, so the best way to learn about the content is to actually implement them in a programming language. Most students are familiar with R, but you can use whatever language you want, as long as you are implementing what is taught in lectures. This topic is especially true for the Market Models topic — even if you don't implement it correctly, being able to see the general structure of how it would be coded will help immensely.

Closing Remarks

Unfortunately, due to the passing of Mark, I'm not entirely sure if this subject will even be offered in 2018, which is a huge shame. However, I sincerely hope that it continues to be taught. The lecturer that takes it will have huge shoes to fill, and if they are even half as good as Mark was, then I am confident that it will be taught well.

Rest in Peace Mark — you will be missed...

ACTL40009 / ACTL90009 Actuarial Practice and Control III [SM2]

Exemption status	Part IIA *The Actuarial Control Cycle* and Part IIB *Investment and Asset Modelling*, in conjunction with ACTL40006 *Actuarial Practice and Control I* and ACTL40007 *Actuarial Practice and Control II*. Satisfactory performance in all three subjects' end-of-semester exams will lead to exemption from both Part IIA and Part IIB.
Lecturer(s)	Dr Kevin Fergusson
Contact hours	1 × 1-hour workshop 1 × 2-hour lecture discussion
Assessments	Individual Assignment due in Week 11 20% 3-hour end-of-semester exam 80%
Textbook recommendation	Investment Bridging Course Notes, Course Texts & Extracts, and Student Course Notes Investment Bridging Course Notes is uploaded onto the LMS. This reading is not absolutely necessary, but provides good background knowledge for any unfamiliar topics. The other two readings are available at Co-op, and ✓ are recommended.
Lecture capture	N/A
Year and semester reviewed	2017 Semester 2

Comments

This subject is very different to any subject we have done so far! Sounds familiar doesn't it? However, APC3 is yet again different to even APC1 and 2. It might take a few lectures, or weeks, or possibly even until very late into the semester before you realise what the subject is trying to convey. Rest assured that this is not your problem, and just the way the course material is designed and delivered. The climax of the subject is the last two lectures where everything should come together.

Unlike APC1 and 2 where the course content is based on aims, APC3's content seems very scattered at first, much like individual siloed topics. Broadly speaking, the course can be broken down in the following way:

- Introduction which challenges the way we think about investments, models, and asset return estimation. Essentially, is what we often use/think up until now actually justified?
- Toolkit where the characteristics of various asset classes (debt, property, equity) are discussed. Models and their arguments for and against are further discussed.
- Climax where we think of ourselves as senior actuaries estimating the long-term asset returns

Lectures

Overall, Kevin's lectures varied in clarity. Some lectures were very easy to understand; however, key concepts were often difficult to identify in many lectures. He also seemed to assume that we had more knowledge than we did. Certainly, many of us will have learnt about basic investment ratios in ARA, however, it is unlikely that many of us really retained much of that knowledge. It also did not help that lecture slides were very bare, often being heavily abbreviated. The first few

lectures were especially difficult to follow due to the amount of investment jargon used. As a result, many students found it useful in these first few lectures to refer to readings as a way of identifying key points before then revising the lecture notes again. Some also found that the first few lectures only really made sense after the entire semester's material was taught and revised. Having said so, Kevin is very receptive to students' feedback, and is very willing to take onboard feedback throughout semester, and this was much appreciated.

For our semester, Kevin included specimen exam questions at the end of each lecture to give us an idea of the type of questions that could be asked in the exam. Sometimes these questions were attempted in class, and Kevin gave us feedback for our answers.

Workshops

Every week, there is also a workshop (unlike other honours/masters subjects). The workshop questions are contained in one of the reading packs, and answers were uploaded onto the LMS following the workshop. Overall, many of the workshop problems are very fluffy and open ended. Consequently, the answers were often also wishy washy and could be whatever you wanted it to be as long as you could justify your reasoning. Attempting the workshop problems is highly recommended as it gives you practise at forming your own opinions and justifying your reasoning. Having said that, since many of the lectures were very confusing, some students found the workshop problems hard to access at first, so try to give it your best shot!

Assignment

The assignment was an individual assignment where we were required to provide a buy/sell/hold recommendation for an allocated stock and other peer stocks after researching the company's financial position and performing fundamental analysis. This assignment is only compulsory for honours and masters students, and is optional for distance education students. Having said that, this assignment provided excellent practice for calculating the key yardsticks learnt in earlier lectures, and really helps one familiarise themselves with commonly used investment jargon. Since we were required to consider financial reports, we were also challenged to see all the possible areas where judgement was required, and how fundamental analysis is itself also an art, and not exact science. The assignment also allowed us to appreciate some of the points made in the first few lectures.

In terms of timing, the assignment was due towards the end of semester, which coincided with the deadline for the APC2 assignment (and IRM2 assignment for masters students). The assignment was uploaded before the mid semester break, so using your mid sem break wisely is a promising idea.

End-of-Semester Exam

The exam is 3 hours, with 15 minutes reading time. It is a closed book exam, unlike the other APC subjects. Since it is closed book, it is recommended (and expected) that you have a basic idea of market rates such as the overnight cash rate, 10–year bond rates, swap rates etc. During SWOTVAC, there is one specimen exam provided, and the rates you are expected to know is also provided.

Overall, the specimen is similar in format to the final exam, however, the length of the specimen was relatively shorter. To our surprise, the specimen was a compilation of the specimen exam questions provided at the end of each lecture and some workshop problems. In terms of the final exam, it was very long (14 questions with sub questions as well), and most

students did not finish. In preparation for the exam, re-attempting tutorial questions and specimen exam questions seems promising. The exam was a similar difficulty and style to these questions. Be prepared to justify your answer as there was often no one correct answer.

Tips for Success

Students should walk into this subject with an open mind, and not expect to rote learn the subject. Understanding what investments there are, and how the investment markets work is helpful, so it may be worthwhile taking time at the start of semester to consider these fundamentals.

If you ever feel lost as the semester progresses, referring to the readings may provide some direction. Forming a study group to discuss concepts, or taking down your own notes throughout semester could also be an efficient way to study for the subject. Nonetheless, regardless of how you choose to study for this subject, it is imperative to practise communicating and justifying ideas. It is important to realise that this subject is one where there is no right answer. Also remember that investment assumptions will depend on the objective and timeframe. Good luck!

ACTL90001 Mathematics of Finance I

Exemption status	CT1 *Financial Mathematics*. Satisfactory performance in the mid-semester test and end-of-semester exam of this subject required.
Lecturer(s)	Dr Zhuo Jin
Weekly contact hours	2 × 1-hour lectures 1 × 1-hour tutorial
Assessments	Group Excel assignment, due in Week 11 10% 1-hour mid-semester test (topics 1-3) in Week 10 20% 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. ✓ I highly recommend buying this textbook.
Lecture capture	Full (both audio and video)
Year and semester reviewed	2017 Semester 1

Comments

I loved this subject. This was my first subject from the actuarial studies department and it was the perfect introduction. Although there were many formulas to memorise, the applications later in the semester was interesting. In addition, many of the mathematical proofs were elegant and satisfying to see.

Subject Content

The content from this subject is equivalent to the undergraduate subjects ACTL20001 *Financial Mathematics I* and ACTL20002 *Financial Mathematics II*.

The first topic was an introduction to interest. We covered all the various types of interest such as simple interest, compound interest, nominal and effective rates of interest, the force of interest and varying interest rates.

The second chapter was on valuing cash flows. We looked at discrete and continuous annuities, increasing and decreasing payments and briefly covered solving equations of value.

The third chapter was on different loan types and their repayment schedules. We also covered financial evaluation of projects and focused on the five evaluation criteria; the net present value, the internal rate of return, the payback period, the discounted payback period and the accumulated profit of the project. This chapter also touched on allowing for inflation.

The fourth chapter was an overview on different investment classes such as shares, discount securities, fixed coupon securities, indexed bonds and derivatives. This section was very theory heavy compared to the other chapters that were more problem solving. We spent most of our time on futures, options and understanding long and short positions.

The fifth chapter was applying the formulae learnt in the first two chapters in asset markets. We looked at measuring investment performance by calculating the money weighted rate of return, time weighted rate of return, linked internal rate

of return and Hardy's approximation. In this section, we also forayed into some more actuary specific content such as the idea of immunisation.

The final chapter was taking the content from previous chapters and applying probability theory. We looked at how to calculate expected present values and how to solve problems where the interest rate was a random variable. This chapter also introduced independent and dependent lognormal models.

Lectures

The lectures were all recorded with full audio and video. Zhuo provided notes on the LMS and during our lectures he used the document projector, often writing notes on the slides. He drew a number of diagrams to explain the different of annuity formulas. I found his lecture style extremely engaging and enjoyed his way of teaching. Zhou was also very receptive to students asking questions after class and always had time to go over concepts with individual students when needed.

Group Excel Assignment

For our spreadsheet assignment, we were required to evaluate four projects according to the five criteria introduced in chapter three. Not only did we have to provide our spreadsheet, but we also needed to write a summary explaining how our spreadsheet was set up and answer some short questions on which projects we would recommend.

This was a good introduction to Excel and to learning some graphing and linear interpolation techniques.

Mid-Semester Exam

The mid semester exam was an in class exam that covered chapters one to three. The questions were of a similar style to the ones from the textbook and the tutorials. There was nothing surprising or overly difficult on the MST.

For most of the cohort, the main problem was time management as the exam was long and everyone was writing until the last minute. There was basically no time to check over work or even to stop and think about the problem. The best way to do well in the exam was to do the questions from the tutorials and the textbook over and over again until the formulae were imprinted in your memory and the steps to follow for different types of questions was second nature. Before the mid semester exam, I had done all the questions from the book three times and so while I found the exam challenging, it was definitely doable and there were no surprises.

In our exam, there were no proof questions or deriving formulas from first principles. We were also provided with a small formula sheet with a limited number of formulae but I recommend memorising them rather than relying on the sheet.

End-of-Semester Exam

The end of year exam was a two hour exam in the last week of the exam period. The exam was incredibly long and covered everything from chapters one to six. There were a small number of theory questions but no proof or derivation questions. The questions in the exam were of a similar style to questions from the book as well as the few sample exams Zhuo provided.

Similar to the mid semester exam, there were no surprising questions, just a high volume of questions. While studying for the exam, it was tempting to look over the complex annuity questions that had increasing or decreasing payments and different interest rates and just say you know how to do it, but it was super important to actually sit down and do those long questions over and over again until the steps are engrained.

For the final exam, no cheat sheet was provided and it was important to keep all the formulas from the start of the semester in chapters one and two fresh in your mind.

Textbook

I highly recommend buying the textbook. It is relatively cheap and you can probably buy the textbook from a third year student. It covers the content in more depth than the lecture notes and has some background reading options as well.

Additional Study

For more practise questions, you can look at the past exams for CT1 from the Institute. A few students did that this semester for additional practise.

End-of-Semester Exam

This subject was the perfect introduction to actuarial studies. The mathematics was elegant and there were plenty of problems to practise. Neither exams had any surprises but they were both extremely long. The content was interesting and well taught.

ACTL90002 Mathematics of Finance II

Exemption status	CT8 *Financial Economics*, in conjunction with ACTL90003 *Mathematics of Finance III*. 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 ACTL90003 *Mathematics of Finance III* are required.
Lecturer(s)	Dr Jane Joshi
Weekly contact hours	2 × 1-hour lectures 1 × 1-hour tutorial
Assessments	Individual assignment, due in Week 11 10% 1-hour mid-semester test (topics 1-6) in Week 10 20% 2-hour end-of-semester exam 70%
Textbook recommendation	Joshi, M. S., & Paterson, J. M. (2013). *Introduction to Mathematical Portfolio Theory*. Cambridge, UK: Cambridge University Press. This is a required textbook, however there are a number of copies in the library available for short term loans.
Lecture capture	Full (both audio and video)
Year and semester reviewed	2017 Semester 2

Comments

Overall Mathematics of Finance II was well taught and the content was interesting. The spreadsheet assignment was fun. The mid semester exam had nothing unexpected. The end of year exam was hell.

Subject Content

- Definition of risk and return
- Efficient Portfolios
- Portfolios with a risk-free asset
- Finding the efficient frontier
- Single-factor models
- Multi-factor models
- Introducing Utility
- Utility and risk aversion
- Foundations of utility theory
- Maximising long term growth
- Stochastic dominance
- Risk measures
- The Capital Asset Pricing Model
- The arbitrage pricing model

- Market efficiency and rationality
- Brownian motion and stock price models across time

Lectures

The lectures were all recorded with full audio and video. In the notes printed off the LMS, some sections were left blank for us to fill out during the lectures. Personally, I found the lecture pace slow but the content was well taught and explained clearly.

The first half of the semester concentrated on mean variance investors and we covered a lot of theory and content in depth. It's extremely important to be able to solve matrices quickly using row reduction techniques learnt in MAST10006 *Linear Algebra* (or MAST10008 *Accelerated Mathematics 1*).

Tutorials

Tutorial attendance is, of course, highly recommended. It is a great chance to ask Jane questions and clarify subject material. There are not many worked solutions in the lectures so the tutorials are a great way to do more problem solving. Jane assigned select questions from each chapter to do before the tutorial and they took an hour or so to do each week, so not very long at all. During the tutorials, we usually did not go over the solutions to the set problems from the book unless there were particularly difficult ones. Instead, we worked through the additional exam style questions she provided at the beginning of the week.

Assessments

I really enjoyed the spreadsheet assignment. I have no experience at all with spreadsheets and it was a great introduction to excel. We were required to create an active workbook that found the weights of five assets to form an efficient portfolio. The question was based on a multi-factor model with two indices and Jane varied the parameters and the lending & borrowing rates to check our outputs. Using the same model, we also had to find the weights for a given mean and another for a given standard deviation. Jane marked the assignments in a way that if we scored less than 8, she allowed us to resubmit the assignment to get a new mark out of 8 if we wished.

The mid semester exam covered topics 1 to 6. We had 3 questions for our exam and the longest one worth the most marks was using Gaussian elimination to find the minimum variance portfolio, and the composition of two efficient portfolios; one for a given mean and another for a given standard deviation. The questions were reasonable and not unexpected. We were given enough time to complete the paper provided we worked consistently. All questions were problem solving rather than theory based although Jane hinted throughout our lectures that we should know our definitions well. Doing the questions at the end of each chapter as well as learning all the formulae in the lectures was enough to do well in the exam.

The end of semester exam was challenging. Jane had provided a number of past exams and sample exams that were a reasonable indication of the length but not of the difficulty. The exam consisted of a mix of theory questions, such as defining Brownian motion, as well as practical questions and proof questions. In the exam, there were a few practical questions in a style that we had not encountered at all during the semester. It was important to understand the differences between APT and CAPM and when to apply each. To do well in the exam, it was crucial to understand all the theories and concepts rather than just rote learning how to solve the questions in the book and the sample exams. To study for the exam, a few of us also memorised some of the proofs of the various theorems covered during the semester. Time

management was another issue in the exam and I found that the time spent on solving matrices to find an efficient portfolio did not correspond to the number of points the question was worth. You may consider starting with the shorter questions first before going onto the easy but longer questions

Textbook

Although I bought the textbook, I feel it was not necessary. The lecture slides that you can print from LMS were practically identical to the textbook. The only material you need from the textbook are the questions at the end of each chapter and there were a number of copies in the library you can borrow before a tutorial to see the questions.

Closing Remarks

In summary, MoF2 was a challenging but rewarding subject. The content is manageable and interesting. The most important thing is to understand the content thoroughly and not rely too heavily on the questions in the book or the sample exam questions when studying for the final exam.

ACTL90009 Actuarial Practice and Control III [SM1]

Exemption status	Part IIA *The Actuarial Control Cycle* and Part IIB *Investment and Asset Modelling*, in conjunction with ACTL90010 *Actuarial Practice and Control I* and ACTL90011 *Actuarial Practice and Control II*. Satisfactory performance in all three subjects' end-of-semester exams will lead to exemption from both Part IIA and Part IIB.
Lecturer(s)	Dr Kevin Fergusson
Contact hours	1 × 2-hour lecture 1 × 1-hour workshop
Assessments	Individual Assignment 20% 3-hour end-of-semester exam 80%
Textbook recommendation	Investment Bridging Course Notes (IAAust) — made available online Course Texts and Extracts — available from Coop, contains extracts from BluePrint for Investment (Fitzherbert), Investment Principles for Actuaries (Fitzherbert) and Compound Interest and its Applications (Fitzerbert & Pitt) Course Notes — available from Coop, contains various readings and also the workshop problems for the course
Lecture capture	Full (both audio and video). Caters for both university and distance education students.
Year and semester reviewed	2017 Semester 1

Comments

Subject Content

APC3, or alternatively Part IIB, is now the only compulsory investment subject in the FIAA pathway. It is intended to provide students with the investment education needed to discharge statutory investment duties in an actuarial role (e.g. for setting pricing and valuation assumptions), and not investment advice of a more general nature.

Students in their Honours/Masters year may have already realised how different APC1 is to their previous subjects during their undergraduate years, where the emphasis has gone from learning the tools for analysis, to understanding how the tools may be used in a much broader, real life context. However, in APC3, the differences are even greater, as it takes an often philosophical point of view, and questions much of the investment theories which you will have learnt in your Part 1 subjects. So be prepared to be challenged, to think broadly and deeply about various aspects of these theories, understanding both sides of the argument, and most importantly, to keep an open mind.

The course begins on a philosophical note, introducing students to the difference between a "law of nature" and a "historical regularity", which ends up being one of the very first question you should ask when presented with a new theory based on empirical evidence. There are also key issues addressed in the introduction, and some of these revolve around human behaviour and their tendency to brush off genuine counter examples as anomalies, as well as some common fallacies in statistical tests.

This review was previously published in the 2017 mid-year edition of the *Actuarial Students' Society Subject Review*.

Subsequently, students are introduced to the history of technical and fundamental analysis (and how this stands against the efficient market hypothesis) and speculative bubbles (particularly on whether they can only be recognised in hindsight). There are two accompanying case studies examined. The first is the collapse of Long Term Capital Management and the second looks at US mutual funds in the mid-1990s.

It then goes on to give an overview of the three major investment types — debt, property and equity — and a small discussion of derivatives, and many of the non-market risks that investors seem to ignore or not fully understand. There is also a section on the impact of inflation, which is extended later in the course with viewpoints from various commentators.

Finally, the course goes on to critically evaluate various investment theories like CAPM and the efficient market hypothesis and discusses portfolio selection and investment forecasting.

Overall, throughout the course, there is a strong emphasis on critical evaluation of various theories and understanding different arguments for different theories. For example, whether equity can really protect against inflation is a topic that is discussed several times throughout the course, but there is a strong focus on understanding the various arguments that exist and the supporting or contradictory empirical evidence for each argument.

Lectures

The lectures for this subject were fairly standard, with a 2 hour in person attendance and full recordings. However, the lectures were more around 1 hour in length. I believe the attendance was particularly low during this semester, as there were only about 5-10 university students (and most classes actually had no one at all), and that meant there was not much discussion during the lectures. The lectures were dense with content, and even with lecture capture often requires multiple pausing and re-watching over certain parts. With that in mind, the 1 hour of recording time probably meant at least 2 hours of lecture time.

The slides were posted up at the start of every week, and these are quite brief and concise, and requires a lot of note-taking to supplement the slide contents.

Workshops

The workshop problems for the subject can be found in the "workshop slides" that Kevin posts up along with the lectures, and in one of the course workbooks that need to be purchased from Co-op at the start of the semester. Each week, the workshop has around 3-6 questions covering topics from the lectures from the week before.

During the 1 hour workshops, Kevin goes through the questions and posts up the slides afterwards. Sometimes the slides have extensive commentary, but other times not so much and requires some form of note-taking. Again, I believe attendance was low and as such there was not much (if any) actual discussion between students and lecturer.

In terms of the workshop questions itself, make sure you attempt them fully before looking at answers (especially if you are a few weeks behind), as they are often more difficult than they might seem at first, and requires further thought before answering. A lot of the time, you may need to consider both sides of the issue, and even then you may realise that there may not a clear cut answer. This is what APC3 teaches you: there is often no right or wrong answers, but what is important is to consider both sides of the situation and formulate your opinion based on what you believe is most right and back it up with legitimate reasoning or causal explanations (historical regularities are not).

Discussions

This seems rather different to Richard Fitzherbert's classes in previous years, where lectures and workshops were pre-recorded, and in person meetings tended to be much more discussion based. I believe this is mainly due to the low attendance of classes, and also the fact that Kevin has decided to use the scheduled lecture times to teach rather than pre-record everything as Richard did.

Assignments

There was one individual assignment for the semester, with 4 different parts. The first 3 parts involved summaries on fundamental analysis, Hemsted's model, and speculative bubbles. The final part required some research of an allocated company listed on the ASX, performing fundamental analysis (e.g. calculating ratios) using company reports and publicly available data, comparing with a few peer stocks, and ultimately providing a recommendation as to whether an institutional investor should buy, hold or sell this particular company's shares.

End of Semester Exam

The exam is a three hour closed book exam unlike the other two APC subjects. There was no specimen exam or any additional practice questions to your workbooks whatsoever.

As Kevin puts it, the final exam is a "fair" test of the course. Some questions on the exam feel very familiar to workshop problems, but others are completely new and unseen and require a bit of extra thought. Just before the exam, Kevin will mention a few figures you should have a rough idea of, such as the ASX 200 dividend yield, 90 day bank bill rate, etc. However, the final exam is still very much qualitative and more a matter of justifying your assumptions and choices rather than knowing the correct figures.

Concluding Comments

Overall, APC3 was a very enjoyable subject, and it was quite refreshing to do something that was not as quantitatively based as some of the CT subjects. Whilst it does not provide students with the ability to pick stocks and to provide investment advice of a general nature, it definitely equips students with the ability to critically evaluate some incumbent valuation methods in the investment world which are often used without much thought (e.g. CAPM). It is also a subject that teaches you to consider from multiple viewpoints, and along with APC1 and APC2, makes students aware of the fact there is often no single correct answer. The subject begins in a philosophical note, which may put you off initially, but very soon you will realise how these concepts come into play, particularly when you look at some empirical evidence and how supporters and contrarians of various financial theories go up against each other.

Breadths and Electives

Contents

CHIN20026 Advanced Chinese Translation

Exemption status	None.
Lecturer(s)	Dr Luo Yongxian
Weekly contact hours	1 × 1-hour lectures 1 × 2-hour seminar
Assessments	1000-1500 word translation, due in Week 8 — 30% Short In-Class Test, held in Week 11 — 15% 2000-2500 word translation, due at the end of SWOTVAC — 55% There is also a hurdle requirement for weekly class participation (Min. 75% attendance)
Textbook recommendation	No textbook, but reading packages for this subject are provided by the coordinator through LMS.
Lecture capture	None.
Year and semester reviewed	2016 Semester 2

Comments

Advanced Chinese Translation has a great combination of theory and practice throughout the lectures, tutorials and assessments. For those who are interested in English–Chinese translation, and are seeking to improve their understanding and application of both languages, this is the subject for you. I should also point out early that the subject mainly focuses on Chinese to English translation rather than the other way round. In addition, as a translation subject its tutorial work and assessments involve a lot of reading and editing — i.e. articulation of word choices and sentence structures. If you don't enjoy English writing or editing, this will not be the most ideal breadth.

As for dictionaries, the coordinator has recommended some in the subject guide. Whether you purchase any is greatly up to you, as most assessments are done outside of class, which means you'll have access to any electronic dictionaries online and library reference books. Even with the only in class test, electronic devices with internet access is allowed.

In terms of workload, it highly depends on the individual. One may find it easy enough to pass the subject simply through the contact hours, while others may practice a lot on their own to achieve a higher mark. Reading the sample translations in the reading package and practicing on your own are beneficial but not a must to hitting H1 for the subject. Given most assessments are not under a time limit, one might get away with high levels of understanding and manipulation of both languages. However, I wouldn't say it's easy to boost your WAM through this subject without hard work because to be fully capable of applying various translation techniques, it is very much about reading, accumulating and practising.

Lectures

Lectures cover different translation techniques every week, which will gradually layout good theoretical foundations.

Lecture slides usually start with concise concept definitions, followed by comments from translators and academics that further explain the topic, and then an abundance of examples are extracted from various translation work to illustrate the

This review was previously published in the 2017 mid-year edition of the *Actuarial Students' Society Subject Review*.

Week 1	What is C–E translation?	Week 7	Attributive clauses
Week 2	Techniques: information packaging		Adverbial clauses
Week 3	"False friends"	Week 8	Cultural words/concepts
	Metaphors		Literature
Week 4	Techniques: Repetition	Week 9	Long sentences
	Techniques: Addition and omission	Week 10	Colour terms
Week 5	Empty words		Onomatopoeia
	Modal verbs	Week 11	Long sentences
Week 6	Passive constructions		Scientific works
	Noun clauses	Week 12	Course summary

concepts in practice. However, because each week there's a lot of information to cover in the slides, it leaves little time for the lecturer to insert any extra value-adding content. Hence, I don't find going to lectures particularly useful except consulting problems encountered with the lecturer, who has well-rounded experience, since there's no official office hours (You might be able to arrange one with him via email though). Having said that, it should be noted that lectures are not recorded, and based on my personal experience, the lecturer did do some random roll checks in certain weeks in the second half of the semester.

Seminars

The two-hour seminar each week usually comprises of phrases/sentence translation in first hour and followed by paragraph/article translation in the next hour. Students do have access to the seminar work on the LMS beforehand and it's encouraged to attempt it before going to the seminars, but tutors usually give enough time to complete the work in class.

The seminar itself is very interactive and I strongly encourage everyone to attend the seminar (there's no attendance marks but it is a hurdle to pass as stated above). For each practice in class the tutor will set up a webpage for everyone to post their version and discuss as a class. I find it particularly helpful as you get a chance to get some feedback for your own work (which is also anonymous), and you are able to see what others have, i.e. the good models you can learn from and some common mistakes you should avoid in the future.

For article/paragraph translation practices, you can choose to work in groups or work on your own. The teaching format is very similar to the one just discussed. I tend to find the second half's work more interesting than the that in the first hour as it has more context and tends to be more challenging, hence it's definitely worthy to stay.

Assessments

The subject is assignment-based, all of which are individual tasks and occur after mid semester.

For each of the two translation projects, you'll be given texts of different genres, i.e. from scientific article to prose, thus there should be one that you're comfortable with. From personal experience, most people found popular science articles relatively easy and chose them as their project, it is a safe choice, though it is harder for you stand out from the crowd.

The assessments are marked on accuracy, fluency, appropriateness of style, spelling and grammar. Unfortunately, the feedback given is pretty general, i.e. a rubric sheet that is marked with each level you're at for each criteria, but you might be able to contact your tutor for more specific comments.

In terms of the level of difficulty and time commitment, they vary from person to person. Although it certainly took me less time to finish up the final project than preparing for an exam, I have to come back to the project every one or two days to see if there are any better alternatives. Good news is that the final project is released pretty early and due before the exam period starts, so there is not so much overlap with preparation for the demanding exams.

For the in-class test, it's one-hour long and you'll be given 3 or 4 short texts and you choose 2 to translate from Chinese into English. Most people found it not so difficult as you're allowed to bring any device, and also have access to internet during the exam — you are just prohibited from using others' help. The purpose of the test is to help the staff ensure your performance is aligned with the level you showed in your previous and future assignments. Not much special preparation is required if you go to your tutorial regularly and actively attempt practice problems in class, since you'll be very used to translating under time pressure by that time.

Conclusion

Overall, I'd recommend CHIN20026 to anyone who are seeking better understanding in both English and Chinese. It is not so demanding and very enjoyable, especially with the high level of interaction in the seminars. It also gives a chance to meet new people outside the business faculty who bring different point of view to the class.

COMP20005 Engineering Computation [SM1]

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	Mid-semester test 10% Individual assignment 1 10% Individual assignment 2 20% 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. The textbook is written by Alistair Moffat, the lecturer for this subject for semester one. The lecture slides are merely summaries of selected chapters from the textbook. The textbook also provides an abundance of exercises and example code. It will be your holy bible for this subject. ✓ Get it!
Lecture capture	Full (both audio and video).
Year and semester reviewed	2017 Semester 1

Comments

If you are interested in learning how to code, further developing your problem-solving skills and looking for a non-level 1 breath to take, COMP20005 Engineering Computation might be the subject for you.

Eng Comp is normally taken by second-year electrical and mechanical engineering students (required for Masters program entry), and not often by students majoring in computing. As such, although a second year computing subject, Eng Comp does not require any prior knowledge or experience in programming, making this subject suitable to beginners.

On the other hand, if you are looking for a WAM booster, this may not be a suitable subject. COMP20005 is a challenging subject. Only 10% of the students received H1s (predominantly low 80s) in 2017 semester one. The final marks distribution for 2017 semester one published by Alistair is as follows:

```
428 values; min=0.0; max=98.0; mean=65.0; median=68.0; sd=17.8; 14.7% below 50
```

The prerequisites for this subject are two first year maths subjects, which our readers should easily satisfy. Please refer to the current handbook entry for details.

Try your best to stay on top of this subject and practise, practise, practise! Learning to code is like learning to drive, no one learns to drive by reading about it or hearing about it — you master it by doing it.

This review was previously published in the 2017 mid-year edition of the *Actuarial Students' Society Subject Review*.

The C Programming Language

The programming language taught in this subject is C. Many people's impression of C is that it is out-dated and obsolete (it was first used 45 years ago!). However, C still has a wide range of applications, much of the Unix operating system (Linux, Mac), Microsoft Windows, Mobile operating systems (iOS, Android, Windows Phone) are all written in C. Moreover, learning C forces you to think about what's happening under the hood and thus facilitates a richer and deeper understanding of computers and programming.

> C is a robust, standardized, portable, and widely available language suitable for a broad range of computing, engineering, and scientific calculations.
>
> Moffat, 2012

However, if your aspiration is being an actuary, you probably won't use or encounter C in your professional daily lives. Instead languages used for statistical analysis (e.g. SAS, R, Python) might be more prevalent.

A side note — if you are still able to take a level 1 breath, you might consider COMP10001 *Foundations of Computing*, in which you will predominantly study Python and take a brief glance at HTML and CSS.

Subject Content

The first eight weeks of the subject serves as an introduction on how to code and the syntax of C. The majority of the course is spent on developing knowledge of common features of most programming languages: data types (characters and numbers), functions, if statements, loops and data structures (arrays and structures). By the end of the first eight weeks, you will have tools to write programs that can solve numerical and computational problems. And this is what the rest of the subject entails.

It's now time for application. Topics covered include different algorithms for root-finding, including our familiar bisection method and Newton-Raphson method, algorithms for curve-fitting, numerical differentiation and integration. One down side about this section of the course is that it was tightly crammed. All these numerical problem solving techniques, over 20, were taught in the span of 3 weeks. Although crammed, the content wasn't rushed, Alistair took sufficient time to deliver the content in detail with example programs and real life application examples.

We learnt (maybe observed is more accurate here) how to

- simulate the orbit path of the earth around the sun,
- randomly generate the walking path of an intoxicated person on a bridge and when he/she will fall off,
- write programs can solve simultaneous equations and many more.

Overall, this subject is a comprehensive introduction to programming. We went from writing the classic `Hello World` program to developing a program to optimise the process of picking orders in warehouses, in just under 12 weeks. You will get to learn a lot in a relatively short amount of time.

Lectures

Programming is fun! Alistair's favourite phrase. This was definitely the takeaway he wants his students to have, and something he truly and deeply believes. Alistair's passion for programming, for C, really shows — he is one of the best educators

I've ever had. He was engaging and went above and beyond to ensure the students fully understood the specifications of the projects. If you are doing Eng Comp in semester one with Alistair, the lecture experience is unparalleled.

For this subject, lectures are a must-go! Only one screen will be recorded for lecture capture, and the lecturer normally displays the terminal (where the output of the program is shown) on one screen and the text editor (where code is written) on the other. Being able to see both screens at once, and where the lecturer is pointing at with the cursor (not recorded) is very beneficial.

Workshops

Two hour workshops run weekly, with one hour of classroom tutorial followed by one hour of computer lab. We start with some lecture revision and then the class will work on a few easier problems from the textbook together by hand. During the second hour, we worked on more exercises from the textbook, this time on computers. The tutor and a demonstrator will be there to help you if you run into any problems.

Workshops were extremely useful, go to as many as you can, hopefully all of them! The first few workshops might be a bit slow-paced and disengaging. However, as the content gets more and more difficult, attending workshops and being able to discuss the problems with your classmates and seek alternate explanations from your tutor will prove to be valuable.

Mid Semester Test

Please note, all written assessments in Eng Comp must be hand-written, that is you will be "coding" with pen (pencil is fine too) and paper.

For many, this might be the first time you have to do this and understandably you might get nervous during the test. My biggest advice is try to stay clam. The best way to prepare for the test is by doing the questions from the textbook and make sure you understand the sample solutions. Please note however, there are multiple ways to solve the same problem — the sample solution is only one of them.

Projects

Projects normally involve reading input data from the command line, manipulating them with accordance to the specification, and printing some output in the required format. Any discrepancy in the output will be penalised. My tip for the projects is try to format your code, write your comments in a similar style as the sample solution to a previous year project provided. Also, bonus marks are awarded for writing '`programming is fun`' in your program. It was also okay to show your code to your tutor and ask for their opinion. Start early!

Our first project required us to read in daily temperature data across multiple years, compute and compare yearly temperature averages, and produce visual representations. The ultimate aim of this program was to investigate the existence and progression of climate change.

Our second project similarly required us to read in input data of customer orders for a warehouse of a given dimension, sort the orders so they are in their picking order (e.g. items in column 1 before items in column 2), and ultimately advise on an efficient picking order to minimise walking distance.

End of Semester Exam

Please note, Alistair and the semester 2 lecturer have a very different style of assessments — it is rumoured that Alistair's exams are more challenging. The following may not apply for semester two.

The exam consists of five to six questions, the majority of questions requires you to write a function to solve a particular problem, always look for opportunities to write more than one function and avoid repetition of code. The rest will be short answer questions, something like, what's 76 in binary.

Alistair does a comprehensive exam information lecture, where he will walk you through the exact type of functions required for each question and a rough gauge of their difficulties.

The best way to prepare for this exam is similar to that of the MST. Do as many questions as you can, from the textbook, past exams etc. Also please study the sample solution to the projects, there will likely be a question based off it.

Don't neglect the readings and sample codes in the textbook. They can be tested. In my year, we were examined on bisection. Luckily for me, from all the calculator punching training in FM1, I knew exactly how the bisection method worked. However, some of my peers weren't so lucky.

Overall, the exam was fair and was my favourite exam this semester. I wasn't rushed for time and had a great sense of satisfaction when I wrote what I thought was a good solution to the problem.

Closing Remarks

All the best for COMP20005! If you are up for a challenge (already shown by your choice of the actuarial major), you won't regret your decision to take a programming subject. I hope you will love this subject as much as I did.

```
/* And remember, Programming is Fun! */
```

FNCE30007 Derivative Securities [SM1]

Exemption status	None.
Lecturer(s)	Professor Federico Nardari
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. I am yet to learn what the textbook looks like.
Lecture capture	Full (both audio and video).
Year and semester reviewed	2017 Semester 1

Comments

In this subject you learn will how to value options, futures and forwards, and how/when to use different trading strategies to hedge, speculate or arbitrage using these derivatives.

The content is quite useful in general if you are interesting in doing a bit of trading yourself or are considering a future in finance. Even if you are not considering a future in finance, this subject will give you the foundation to start thinking about the market yourself and allow you to read AFR articles with a better idea of what is going on and perhaps even generate insights of your own. I would recommend this subject even if you aren't planning to major in Finance.

In terms of comparing Finance subjects (including this one) with Actuarial subjects, the biggest difference is you won't be required to understand how to derive the theorems, formulas and models, but rather just understand what they do and the basis on which they work.

General Comments

Since the subject content shake-up, the subject has become a relatively easy level 3 subject for actuarial students, especially if you have already completed *Statistics*. Concepts are not particularly hard to understand nor mathematically difficult to comprehend. That being said, I feel like this is subject to change given how hard old Derivative Securities used to be. Moreover, there is still work you need to do to stay on top of this subject.

Lectures

Lectures can get a bit annoying as Federico uses some very far-fetched (tennis) analogies to describe financial instruments, which is why I always found it better watching them at home with the ability to pause the lecture whenever I needed to.

This review was previously published in the 2017 mid-year edition of the *Actuarial Students' Society Subject Review*.

Other than that the lectures are pretty comprehensive.

Tutorials

Tutorials are a must-go. Preferably you would have completed the weekly questions before you go to the tutorial. Here you will be given exam-like questions so learn how to answer these properly. I personally had an awesome tutor (Robert) who explained the more qualitative questions very well, so even if you don't have him as a tutor, go to his consultations if you need help.

Mid Semester Exam

The mid-semester exam is multiple choice only, and here attention to detail is KEY. Be careful of the pesky wording of questions which are designed to misdirect you towards the wrong answer. A formula sheet will be provided. Note that this is not the complete formula sheet you will receive at the end of year exam.

Final Exam

The final exam difficulty can fluctuate quite a bit according to those who have taken the subject in the past. Past papers are not readily available, so the best way to study is to read through the lectures and tutorials, and complete the end of chapter textbook questions which will be uploaded to the LMS. These questions will basically be your only practise, along with a sample exam, but it should be sufficient if you base your learning on understanding concepts rather than repetitive practice. You will be provided with a formula sheet and a normal distribution table. Be sure to be familiar with using these, though they won't be uploaded to the LMS until very late in the semester.

Conclusion

All in all this is a good useful subject that actuarial students should find enjoyable. Treat this as an easier actuarial subject which you can use to find some breathing room in your degree. Unless they make the exam harder — which is entirely possible.

MAST20022 Group Theory and Linear Algebra

Exemption status	None.
Lecturer(s)	Dr Alexandru (Alex) Ghitza
Weekly contact hours	3 × 1-hour lectures 1 × 1-hour tutorial
Assessments	3 individual assignments 20% 3-hour end-of-semester exam 80%
Textbook recommendation	No external texts required. A **very** comprehensive set of lecture notes is provided and is certainly sufficient.
Lecture capture	Full (both audio and video) — the document camera may not be used; please see below for more comments.
Year and semester reviewed	2016 Semester 2

Comments

Just what is *group theory*? Why am I learning linear algebra again? And why is it that every time I tell someone about this subject they think I'm talking about two subjects?

MAST20022 Group Theory and Linear Algebra is a second-year subject that is a prerequisite for third-year *Pure Mathematics* subjects. Pure mathematics, being the obscure field it is, is certainly no less obscure as a maths specialisation, which is probably why your general audience always assumes you are talking about two subjects.

Group theory is the study of a mathematical construct called *groups* (surprise surprise). Groups are best motivated by the observation that in mathematics, there are many types of sets that, when endowed with a certain operation (a rule of combining two elements in the set), satisfy some common properties, namely

1. associativity: $(a \cdot (b \cdot c) = (a \cdot b) \cdot c$; tersely, your order of evaluation is irrelevant);
2. identity: there is a "do nothing" element; and
3. invertibility: every element has an element that "undoes" it.

A common example would be the integers $\mathbf{Z}$ under addition: addition is associative, permits an identity element (namely 0), and naturally gives rise to an inverse for every integer (just negate the integer). Such properties seem like fairly simple properties to come about, and, indeed, in GTLA you will come across a variety of groups.

Group theory forms a natural foundation for the field of *abstract algebra*, which, loosely, is the study of the structure of sets in mathematics. In this sense, GTLA opens students to further studies in algebra at the university. Unfortunately, aside from MAST30005 *Algebra*, these subjects are taught at the graduate level. The field of algebra enjoys the reputation of being a rather beautiful field of mathematics, and this same sentiment manifests in the university environment: MAST30005 *Algebra* is widely reputed to be one of the most enjoyable undergraduate maths subjects. Personally I believe its beauty lies in the fact that groups are introduced with only the simple properties mentioned above, but as more structure (read: conditions and properties) is imposed on the groups, the results become increasingly rich and eye-opening (at least that happens to be my take on GTLA). If ever there was anything I would call "mathemagic", this would be it.

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

So far I have yet to mention linear algebra. Why exactly is this subject a combination of both group theory and linear algebra, and where is the relationship between them? The group theory and linear algebra topics in GTLA happen to be fairly disjoint; one could outright label each topic as either "group theory" or "linear algebra" without hesitation. However, there are a few parallels between the structures of vector spaces and groups, the most obvious of which is that a vector space over a field satisfies all the aforementioned properties of being a group! As you will see, there are more parallels (bases and generating sets, (normal) subgroups and linear subspaces, homomorphisms and linear transformations); some of these are mentioned, so rest assured that, despite the abstract nature of the group theory topics, many phenomena you have in fact encountered in earlier linear algebra studies. The only other connection that was obvious to me was that some of the groups we worked with directly involved matrices and their properties.

Being a pure maths subject, you might expect the content in GTLA (particularly the group theory topics) to be quite separated from "real world" applications. To an extent this is true (please do not enrol into the subject expecting the content to be as tangible as insurance mathematics often is in the ACTL major); however, Alex does present some highly intriguing applications of both group theory and linear algebra, such as in computer cryptography, special relativity, chemistry (brief mention), and even stochastic processes! Some of these have entire lectures dedicated to them (but are not examinable), in case a passing mention of applicability is not convincing enough.

I would say that students studying GTLA tended to be maths students (no surprise here) but also physics students who might be considering further studies in quantum physics. Quantum physics, to my knowledge, relies on the theory of metric spaces and Hilbert spaces (cue MAST30026 *Metric and Hilbert Spaces*, although it is not a prerequisite for the university subjects on quantum physics), which, in turn, relies on some of the content in GTLA.

The difficulty of GTLA lies in its breadth of content. The lectures are very proof-based, and there are many smaller results and properties presented aside from the main ones, some of which you will need to recall very quickly and use frequently. It is a style of mathematics rarely found outside pure maths and is understandably a struggle for students for which GTLA is a first exposure to pure maths beyond first-year linear algebra and real analysis. Alex takes a very structured approach to this subject (teaching theory and then giving **many** examples), and consequently it was far easier learning this subject than one might expect from its content.

Subject content

There are five major areas of discussion in the subject, and they are conveniently allocated (usually) one question in Part B of the examination (more on that later). These are:

1. the Jordan normal form;
2. an introductory discussion on groups with a slight focus on normal subgroups;
3. inner product spaces;
4. group actions; and
5. the Sylow theorems (or, more generally, classifying groups).

Introductory topics Alex begins with a short illustration on what sorts of problems motivate the study of abstract algebra. From this short lecture alone it was quite easy to see that this subject was going to be different from first-year maths subjects. With uses in studying symmetry, geometric properties, and number systems, the main theme was that abstract algebra is quite literally the abstraction of ideas that are present in various mathematical objects.

The first point of call (even before the Jordan normal form) is the discussion of the principle of mathematical induction (which should be familiar from MAST10008 *Accelerated Mathematics 1*) and something called the *well-ordering property*, which

states that a non-empty subset of the natural numbers $\mathbf{N}$ always has a smallest element. The principle of mathematical induction and the well-ordering property are shown in lectures to be equivalent.

At a glance it is probably unclear why the well-ordering property is important or even why it is a result on its own (it sounds "obvious"). Perhaps this is more an example of the fragility of mathematical logic: In AM1 you may have used the principle of mathematical induction several times without questioning its validity. It turns out that when setting up the theoretical environment for studying mathematics, either the principle of mathematical induction or the well-ordering property needs to be introduced as an *axiom*, that is, something accepted as true without proof. Once this is done, the other is immediately true due to their equivalence, and you can use them to your heart's desire.

This delicate and rigorous approach to logic is somewhat characteristic of studies in pure mathematics, and at various points throughout GTLA and further pure maths studies, you will probably come across proofs for things which you deemed intuitive or obvious.

Following this is some basic number theory and definitions of some types of groups. Number theory is the theory surrounding integers and investigates aspects such as divisibility or factorisation. Admittedly it is not a very prominent topic in GTLA; the areas discussed are the Euclidean algorithm (arising from the division algorithm), Bezout's identity, some properties regarding divisibility, some modular arithmetic, and the fundamental theorem of arithmetic. The results here are discussed in the context of the integers, but some generalise (to an extent) to other sets, such as the set of polynomials. In fact, you will encounter Bezout's identity applied to polynomials later on.

The $\mathbf{Z}/n\mathbf{Z}$ class of groups is carefully defined during the discussion of modular arithmetic (even though you have not been told what a group is). This class of groups reappears frequently in GTLA and is probably the type of group with which you will become most familiar.

Following the number theory topics, some types of groups are defined. Starting with the most general, these are:

1. rings,
2. commutative rings,
3. fields, and
4. algebraically closed fields.

All algebraically closed fields are fields, and all fields are commutative rings, and so on. The purpose of this short section is to define fields and algebraically closed fields, which is necessary to understand the next topic on the Jordan normal form, as they are mentioned in some definitions and results.

Properties specific to these types of groups are not really discussed in GTLA, but it is important to know what the definitions of these types of groups are. Admittedly it might be easier to revisit these definitions once you are taught the definition of a group (which is yet to take place at this point).

The Jordan normal form The first major topic, the Jordan normal form, essentially occupies the lectures in Weeks 3 to 6. The main result can be stated quite easily, but there is a myriad of intermediate results leading up to it. In fact, you do not even discuss all the intermediate results completely (an important one is left for MAST30005 *Algebra*).

The motivation behind studying the Jordan normal form is that many square matrices, when interpreted as linear transformations, are actually the "same" linear transformation but expressed with respect to a different basis. Equivalently, a linear transformation interpreted for different bases gives you many different matrix representations, but they are fundamentally really one and the same. Imagine, in $\mathbf{R}^3$

- a dilation by a factor of 2 from the x–y plane; and
- a dilation by a factor of 2 from the y–z plane.

These are really quite similar — they are the same linear transformation but for different bases.

The Jordan normal form of a matrix is the simplest square matrix among all those which can be said to be the same linear transformation as the original (the basis will generally be different). Notably, the Jordan normal form is unique up to permutation of the basis vectors, and its simplicity comes in the form of being almost diagonal.

This topic comes under linear algebra, and you will need to be familiar with first-year linear algebra content to understand this topic, as there is **very** little time for revision, and new ideas are introduced fairly quickly. Make sure you know what these are: subspaces, spans, bases, row reduction, the rank–nullity theorem, linear transformations, change of basis, eigenvalues, and eigenvectors. Alex includes thorough notes for these first-year topics, but they are hardly discussed in lectures.

The number of intermediate results for this topic is quite remarkable, and it will probably be overwhelming to be familiar with all of them. I would recommend being familiar with properties of *invariant subspaces* (subspaces which are invariant under a linear transformation), as they are most easily examined; there are quite a few tricks involved with the other intermediate results.

Overall this topic is a very involved and instructive exposure to the Jordan normal form; there are numerous defined stages, and the way it is delivered certainly feels like you are stepping through history (the stages are something like: square matrices → block diagonal matrices → upper triangular block diagonal matrices → almost diagonal matrices i.e. the Jordan normal form).

The topic concludes with lectures discussing applications of these results to special relativity and Markov chains.

Introduction to groups After 6 weeks of lectures, you are finally properly introduced to the foreign half of the namesake of this subject. Several definitions and properties are immediately thrown at you; as a completely new mathematical object, it is bound to be overwhelming at the offset.

My recommendation is to study these new definitions, properties, and concepts in the context of a single group. This is done in many examples in lectures, but if you find this to be insufficient in consolidating these concepts, then isolating a single group (maybe a dihedral group or $\mathbf{Z}/n\mathbf{Z}$) and studying all the discussed concepts (subgroups, orders, finding generators, finding homomorphisms to other groups, normal subgroups, applying the first isomorphism theorem, and so on) in the context of that group may help.

In becoming familiar with these concepts, I also found it invaluable linking group concepts with those in vector spaces. There are some very obvious parallels, and your greater familiarity with vector spaces may mean that drawing parallels allows you to grasp the group concepts more quickly.

There are several classes of groups appearing frequently throughout GTLA. You definitely need to know what these are by their symbolic representations, as they may not be defined in the questions that use them. These include

- $\mathbf{Z}/n\mathbf{Z}$ for natural n under addition (for $n > 1$ but especially prime n);
- the dihedral group D_n consisting of symmetries of a regular n-gon for $n > 2$;
- the symmetric group S_n consisting of permutations of n distinct elements;
- the general linear group $\mathrm{GL}_n(K)$ consisting of invertible $n \times n$ matrices with entries in a field K (with the operation being matrix multiplication); and
- the special linear group $\mathrm{SL}_n(K)$ consisting of $n \times n$ matrices with determinant 1 with entries in a field K (with the operation being matrix multiplication).

With algebra being the study of structures of sets, some concepts are introduced in this topic to study the structure of groups. The existence of a *homomorphism* between two groups means that their structures are similar (in the way that

elements interact with each other). The existence of an *isomorphism* between two groups means that their structures are identical.

The main result in this topic is the *first isomorphism theorem*, which gives a decomposition of a group's structure if there is a homomorphism with another group. For example, the non-zero complex numbers under multiplication is a group, and, using the first isomorphism theorem, one part of its structure can be identified as the structure of the positive real numbers under multiplication.

Another notion related to the decomposition of group structure is a *normal subgroup*. Together with the first isomorphism theorem (in which normal subgroups make an appearance anyway), they make up the majority of the methods used to study group structure in GTLA.

One of the other important sections in this topic is the theory on free groups. A *free group* is a type of group where elements have minimal properties (this is not a rigorous description). By imposing properties on certain elements, a free group assumes more structure. Free groups are introduced to discuss *group presentations*, which, given a particular group structure, are the ways of changing the structure of a free group to arrive at that particular group structure.

Group presentations are thus bare representations of group structure. They are not used heavily in GTLA, but it is good to know that there is a universal notation for talking about group structures. Sometimes Alex may use a group presentation to denote a group [structure] instead of using its common name, mostly for dihedral groups (the group presentations have the potential to be horrendous). There is also a small section on using group presentations to study homomorphisms between groups.

At the end of this topic is a short example relating group theory to RSA cryptography.

Inner product spaces After a decent exposure to group theory is a topic on inner product spaces, beginning at around Week 10.

Inner products are no stranger: you have encountered its definition in AM1.

An inner product space is simply a vector space endowed with an inner product. With an inner product, notions like distance, length, orthogonality, and angle come into existence. This topic is (probably) the most important in preparing for future studies in topology (MAST30026 *Metric and Hilbert Spaces*).

While inner products were largely studied in the context of real numbers in AM1, the treatment in GTLA is more general. This is important if you remember a part of the definition of an inner product as symmetry — this is not true outside the real numbers.

The Gram–Schmidt process makes a reappearance with the appropriate reassurance that it is indeed an algorithm for finite-dimensional inner product spaces.

The most important concept introduced is the *adjoint* of a linear transformation on an inner product space. Its inclusion seems somewhat arbitrary at first but is necessary in discussing the intermediate results leading up to the major result of this topic. Linear transformations can be classified as certain types if conditions involving itself and its adjoint are satisfied. The different ways of characterising these types of linear transformations is the focus of a few of the results in lectures and problems in the tutorials and exams — sometimes you will be asked to prove that two different characterisations are equivalent. This can be quite difficult because of the numerous characterisations (I certainly do not recommend memorising the proofs), but luckily in exam situations hints are given.

The *spectral theorem*, the main result of this topic, states the conditions under which matrices can be represented as a diagonal matrix with respect to an orthonormal basis. You may recall in AM1 that this was always possible for real

symmetric matrices; that was no coincidence, and the spectral theorem is the more general result.

Group actions This is a short topic which begins in the middle of Week 11.

A *group action* is a set of rules dictating how a group interacts with a general set. The set may even be a group itself, which makes for slightly richer results.

There is a bit of terminology to learn, particularly when discussing the *conjugation* group action (this is a type of group action on a group).

The main result here is the *orbit–stabiliser formula*, which relates the number of elements in the group involved in a group action to other characteristics of the group action. These characteristics of the group action happen to be relatively easy to determine (at least that is the case in GTLA), so the result is useful when the group is not completely known.

Sylow theorems This topic is even shorter than the topic on group actions is and only takes one or two lectures — in fact, it is included under the group actions section in the notes, even though the results themselves do not involve group actions. They are, however, a generalisation of Cauchy's theorem, the proof of which relies on group actions.

The Sylow (pronounced *sill-low*) theorems are results that assert the existence of subgroups of certain sizes in a group. More precisely, there are four results, and you will have to memorise these results, because their proofs are not discussed in GTLA (I gather they are probably far too difficult).

These theorems are the last major tool used to study the structure of groups in GTLA, and the relevant problems in the exam are usually also the harder ones.

The subject ends on a brief note of the massive mathematical work dedicated to classifying group structure. From 1955 to 2004, mathematicians collaborated to classify all *finite simple groups* — *finite* referring to the number of elements in the group and *simple* referring to the fact that the structure is monolithic and cannot be decomposed further. It was a work that required tens of thousands of pages and is just further proof that group theory, though founded on a novel three-part definition of a group, is certainly no simple matter.

Lectures

Alex produces a ridiculously comprehensive set of lectures notes, on which the lectures are based completely. These are incrementally provided on the subject's website at http://www.ms.unimelb.edu.au/~aghitza@unimelb/teaching/gtla/ (Alex really only used the LMS for some announcement emails). The set of notes is beautifully produced in LaTeX, with numbering and labelling of basically everything (such as Theorem 4.43, Lemma 3.22, or Example 4.9). The notes are even labelled with the dates on which content was discussed in lectures and some estimates of when future content will be covered.

That is not to say that lectures are unnecessary, but it is certainly a relief that basically everything discussed in lectures is written in mathematical prose.

The lectures themselves are of a high quality, and Alex consistently gives clear concise explanations for new concepts. Being an abstract subject, it was brilliant to see so many examples for everything. After introducing new concepts (or sometimes before the introduction, in order to clarify the motivation for studying them), Alex would discuss concrete examples and explain how parts of the definitions were satisfied, how the properties hold, how to apply an algorithm to this case, and so on. It was helpful to see all the theory in action in a lecture, and this made the subject far less intimidating.

Even putting aside the fantastic lecture quality, I would recommend going to lectures simply because Alex makes most of his announcements there. Unless you are stringent in regularly checking the subject website (or watching lecture recordings), it is possible you may be late in finding out important information. Sometimes tutorials also required content from the current week (more on that later), which means even lecture recordings are not timely enough.

Alex does not ask the students many questions during lectures, but keep in mind there is consistently quite a lot of material that needs to be covered, so opportunities for open brainstorming by students are few and far between.

On the note of the amount of content, I would say that in 2016 Semester 2 lectures were slightly behind, given that there was sometimes a bit of rushing at the end of lectures. All content was covered by the end, however.

Alex writes on the whiteboard during lectures, so it is ideal not to sit too far back. Technically both video (for the document camera) and audio are recorded, but the video is inherently not of much use. In 2016 Semester 2, Alex used the document camera for one of the lecturing venues because the students were seated too far from the whiteboard for it to be useful. I assume that this means the whiteboard will always be used unless it is physically infeasible during lectures.

Tutorials

Tutorials follow the traditional format for maths subjects. You are given a tutorial sheet at the start of the tutorial and form groups to solve the problems.

I would say that tutorial problems were generally hard, but this needs qualification: because of the new concepts and definitions that were consistently being introduced in lectures each week, unless you were consistently up to date with a good memory of all the definitions and results, you would not even be able to attempt the more basic problems on the tutorial sheets.

Realistically speaking, there were only ever one or two problems (out of seven or eight) that required innovative ideas or tricks; tutorial problems were by and large computational or simple applications of definitions or results. Sometimes a technique that was used in a proof in lectures would come in use, so it is important not only to know the content delivered in lectures, but also some of the methods and tricks employed in some of the delivered proofs, which Alex may not always explicitly point out. For example, if you are given that an inner product of certain elements in a vector space is always 0, then attempting to make both operands the same expression would mean that the operand has to equal 0 by the definition of an inner product. This is a technique used a few times in the inner product spaces topic.

Tutorial sheets are made available online on the subject's website, and at the end of the week solutions are also made available. The solutions contain fairly comprehensive working, so you should be able to understand solutions to all tutorial problems by the end of the semester.

I am not sure if this was intentional, but sometimes tutorial problems involved content which had only been delivered in lectures occurring in the same week as the tutorial. Older students will know that problem-based tutorials usually only have problems that need content covered up until the end of the previous week. I took this as a further sign that lectures were behind schedule, but even though my own tutorial was in the middle of the week, I never encountered problems in tutorials that needed content that was yet to be covered, so it is possible that the tutorials were deliberately scheduled to make this possible.

Assignments

There are three assignments throughout the semester, all uploaded on the subject's website (not the LMS). These are collectively worth 20% of your final grade; precise information about the breakdown was not provided.

Make sure you know when they are released, because assignment releases were not announced on the LMS; Alex points out in lectures when they are released, although this was sometimes one or two days after it was already available on the website (in case you are very keen).

Assignments are released before the required content has been fully covered, but it is still possible to complete some of it at the time of release. Students are given slightly more than two weeks to submit for each assignment.

Assignments are not very difficult and are fairly short; the difficulty is comparable to those on tutorial sheets, and most assignment problems are also direct computations or simple applications of results. In 2016, there was one question which introduced a new concept, but it was not mentioned again elsewhere.

Be careful to give full justification for everything; rigour is absolutely vital in pure maths.

End-of-semester exam

The exam is 3 hours long and is divided into Parts A and B. As with many maths subjects, it constitutes 80% of your final grade in GTLA. Historically, the exams that Alex has prepared have all been worth 100 marks each, with Parts A and B each worth 50 marks.

Part A is an act of mercy, honestly (given the difficulty of this subject): it consists purely of tutorial questions, many of which are reproduced verbatim, others of which may involve different numbers but otherwise can be dispensed with identically. This is announced by Alex to be the case, so this is not secret information or anything.

The message here is clearly that you should practise and be able to provide solutions to **every single** tutorial problem. This is not very far from knowing all the definitions and results fairly competently, but as mentioned earlier the more technique-based problems will require more attention. I am not recommending that you memorise solutions to all the tutorial problems; I am, however, advocating in favour of a good knowledge of all the definitions and results (no surprise here) and a reasonable familiarity with the techniques used in some of the harder tutorial problems.

Part A contributes a maximum of 40 to your final grade, so with a reasonable assignment performance, passing GTLA should not be an issue, even if you insist on rote-learning solutions to tutorial problems. Note that this is not a hurdle exam.

Part B is the more involved section of the paper, with a multi-part question dedicated to each of the topics outlined in the subject content above. Group actions and Sylow theorems are treated as one topic, so it is possible that one may not be tested in Part B.

The questions in this section are overall substantially harder than all tutorial problems (even the harder tutorial problems). The difficulty is mitigated in that marks are split between more parts, many of which are clues towards what may be useful in later parts. Sometimes hints are also explicitly included for harder questions.

There is nothing in Part B which requires the reproduction of a proof given in lectures, so there is no need to memorise those proofs. You may be required to prove a simpler version of results in lectures, however. For example, if a proof of the equivalence of statements A, B, and C was given in lectures by proving $A \Rightarrow B$, $B \Rightarrow C$, and $C \Rightarrow A$, you may be required to prove in Part B of the exam that A and C are equivalent, i.e. that $A \Rightarrow C$ and $C \Rightarrow A$, noting that $A \Rightarrow C$ is probably easier to prove than proving both $A \Rightarrow B$ and $B \Rightarrow C$.

Some of the question parts in Part B will require original arguments that you may not have encountered before. This is hit-and-miss from student to student, so do not fret about these parts. I found that the hardest question in Part B was usually a question regarding group actions or the Sylow theorems. In particular, classifying group structure with the Sylow theorems was not always very straightforward; Alex does some examples of these in lectures, but it is clear that there is no methodical approach that applies to all groups. (There is also the 50-year classification of finite simple groups in case you are not convinced.)

Occasionally you will be asked in Part B to write down a theorem statement. This is something you should do verbatim, as the wording of mathematical theorems is always very precise, so I recommend memorising all the statements of the major result from each of the topics mentioned earlier. In particular, do not forget smaller details like the requirement for a vector space to be finite-dimensional, a field to be algebraically closed, or whether the existence of something is unique. These are all vital details which taint the accuracy of your statement. Technically, of course, you are simply **wrong** if you omit anything, because this is maths. On the other hand, do not accidentally add more conditions to restrict the result, because what you state will then not be the required theorem, even though it may still be a true statement.

It helps if you are somewhat familiar with the proofs of these major theorems, because then you may be able to justify the conditions stated in the theorem even if you have not memorised the theorem statement verbatim. For example, the requirement for vector spaces to have finite dimension is because some of the theorems deal with matrices, which are by nature of finite dimension. The requirement for the field to be algebraically closed in the theorem about the Jordan normal form is because we require the minimal polynomial to be factored completely into linear factors, which is not always possible if the field is not algebraically closed.

You should expect to use the major theorem for each topic in Part B for the topics which are assessed, so try and apply the major theorem if you are ever stumped.

Concluding remarks

GTLA is a long stride away from most other undergraduate maths subjects (and an even further stride from actuarial subjects), but if you are comfortable with abstract theory, then it gives you an insight into a very beautiful area of mathematics. The hard work is there, but so is the satisfaction.

MAST90082 Mathematical Statistics

Exemption status	None.
Lecturer(s)	Professor Richard Huggins
Weekly contact hours	3 × 1-hour lectures
Assessments	2 individual assignments 2 × 10% 3-hour end-of-semester exam 80%
Textbook recommendation	Casella, G., & Berger, R. L. (1990). *Statistical Inference* (2nd ed.). Belmont, CA: Duxbury Press. Hogg, R.V., McKean, J., & Craig, A.T. (2013). *Introduction to Mathematical Statistics* (7th ed.). Upper Saddle River, US: Pearson Education. Davison, A.C. (2003). *Statistical Models*, Cambridge, United Kingdom: Cambridge University Press. Richard's notes are sufficient for the subject, but you may want access to the textbooks to explore concepts deeper.
Lecture capture	None
Year and semester reviewed	2017 Semester 1

Comments

Mathematical Statistics is a common breadth subject chosen by those who choose to do the Master of Commerce degree specialising in Actuarial Studies. It extends on topics covered in MAST20005 *Statistics*. However, it is extremely easy to become lost, even with the background knowledge from your previous studies.

Subject content

Statistics is about using data available to us and fitting it to a probabilistic model. Doing so requires us to make inferences on any parameters in the model (for example, the λ parameter for a Poisson distribution). This subject mainly covers many different methods of estimating these parameters, as well as how effective these methods may be. The topics explored are loosely categorised as follows:

- **Bayesian Statistics** — We assume that the parameter we are estimating is itself a random variable, and make inferences about the parameter using its "posterior distribution", i.e. the distribution of the parameter given we have observed the data we have observed.
- **Data Reduction and Classical Statistics** — Various desirable characteristics for estimators are explored, such as sufficiency, minimal sufficiency, completeness, etc. The Rao–Blackwell theorem is also covered here, giving us a way of finding better estimators provided a number of conditions are met.

This review was previously published in the 2017 mid-year edition of the *Actuarial Students' Society Subject Review*.

- **Hypothesis Testing** — If a friend flipped a coin 10 times, and 9 of those times out of 10 it came up as heads, you will probably say it is not an unbiased coin. That is a simplified example of hypothesis testing. You will cover an onslaught of definitions, the uniformly most powerful test, the Neyman-Pearson lemma and monotone likelihood ratios. p-values are formally defined, and pivots are briefly covered as well. **Interval Estimation** is covered at the tail end of this topic, covering confidence intervals. Finally, we explore the idea that Interval Estimation and Hypothesis Testing are two sides of the same coin.
- **Large Sample Inference** — is where the subject content starts become a bit harder to grasp. For large enough sample sizes, some statistics approach a distribution that is relatively easier to work with, such as the normal or the chi-squared distribution. The delta method is covered here (which you may remember from your statistics subjects) before moving on to multivariate extensions of the above topics.
- **Maximum Likelihood Theory** — the reason why maximum likelihood estimators are used often are because they have a number of desirable properties. These properties are proved here (assuming a long list of conditions). The topic closes off with the likelihood ratio test.
- **Estimating Equations** – when finding maximum likelihood estimators, you are essentially finding the solution to an equation (more specifically, the solution when the derivative of the log-likelihood is equal to zero). A more general method of finding estimators is to have any equation that we have defined and equating it to zero. What are the desirable properties of these equations? How can we tell when one is better than another?

Before the start of Bayesian Statistics, Richard briefly gives an overview on the entire course, giving us a preview of what is to come. Topics are not strictly in the above order — some topics such as the Rao–Blackwell Theorem, Hypothesis tests and Maximum Likelihood Theory are briefly shown earlier in the course before being covered in depth later.

Lectures

Unlike most other subjects, Mathematical Statistics had no document camera or recordings (though this might be standard amongst MAST##### subjects at graduate level). Richard wrote all of his notes on the whiteboard, and provided no notes outside of class other than a few references in various textbooks, forcing students to write their own notes. This essentially meant that attendance at lectures was compulsory (or you could poach notes off your mates). On the flip side, the amount of content that could be covered in the subject was limited to the writing speed of Richard. That said, the content in the subject was still very intimidating throughout the semester.

Richard was very clear in his explanations of each topic in the course, regularly giving worked examples to see how theory was put into practice. While there were a few typos on the whiteboard, switched-on students were quick to point them out for the benefit of everyone.

Workshops

In place of the standard tutorials, Richard held workshops every week. These were essentially the same as lectures, but Richard would work on exercises rather than subject content. There was no expectation to complete exercises before the workshop, and I personally found the questions to be extremely difficult, but this was mainly because I struggled to keep up with the content. As is standard for tutorials, attempting the questions before the workshop is very valuable.

Most of the comments in the lectures section above apply to the workshops as well.

Assignments

There were two assignments due in weeks 7 and 12 of semester, each worth 10% of the overall mark. The first assignment covered all the topics up to and including data reduction and classical statistics, and the second assignment focused on the rest of the course.

These assignments were incredibly long, with roughly 10-12 questions each, and the difficulty of each was roughly the same as that of tutorial problems, with a few exceptions being a leap above the rest. Like other maths subjects you will have taken, only a subset of the questions are marked.

These assignments really tested your understanding of the definitions and application of theorems. Hence, they helped me keep up with the subject content, and were extremely useful for revising for the end-of-semester exam.

End of Semester Exam

The exam was a standard 3 hour exam that you would expect from the mathematics department. What I considered a blessing was the one double-sided hand-written A4 cheat sheet that we were allowed to take into the exam. This very obviously meant writing every definition and theorem (and proof) in as small of a font as possible, and other mathematical identities that were useful. I am obviously kidding, as many students made it through sufficiently without resorting to eye-straining measures — less confident students did put the entire course on their cheat sheet, others only put in more challenging topics such as the delta method approximations. Unlike your actuarial exams, calculators are not allowed.

Richard does not explicitly provide past exams, but he does point you in the direction of the Unimelb library, which does have them (2015 and 2016). Solutions for these exams are unavailable online, and you had to go to his office to correct your exam. Unfortunately, many of the assignment questions were taken from the past exams, but the extra practice is very helpful regardless.

Past exams had very similar structures, with three questions covering classical statistics, followed by hypothesis testing, followed by estimating equations. 2017's exam was very different, with the majority of the exam covering delta method approximations. Consequently, our exam was relatively tougher than past exams, which is yet another reason why you should not predict the difficulty of exams based on past papers.

One thing to note was that Richard suspiciously spent most of the last lecture covering uniformly most powerful tests, and how to argue that a specific hypothesis test is not uniformly most powerful. Guess what came up on the exam ;).

Many students did not do as well as they expected, considering the relatively easy exam (compared to ACTL##### exams). This was likely due to silly mistakes or having insufficiently rigorous arguments to justify certain results.

Tips for Success

A lot of the lectures are taken up by examples and proofs, and the subject content is very intimidating due to the sheer volume of what Richard goes through in each lecture. However, once you strip away all the examples and proofs, the content becomes infinitely more manageable, and it becomes clear what all the core concepts covered are. Take some time to differentiate between worked examples, proofs, definitions and theorems — in order from most important to least important, you should understand the theorems and definitions, use the examples to help you apply the definitions and theorems, and study the proofs for an in-depth understanding of how the theorems work. If you are feeling extra daring, you can recreate Richard's notes in LaTeX (though this may take more effort than it is worth).

MGMT30017 Global Managment Consulting [JUL] — Berlin

Exemption status	None.	
Coordinator(s)	Dr. Tine Koehler (Subject co-ordinator and person in charge for the Berlin program)	
Weekly contact hours	1 full day pre-departure seminar in week 12, and variable working hours during the in-country period depending on your host company	
Assessments	Team presentation & 1000-word report (Due end of 2 week in-country period)	40%
	5000-word full team report (Due 1 month after in-country period)	30%
	2000-word reflective individual essay (Due 1 month after in-country period)	20%
	Peer review assessment (Due 1 month after in-country period)	10%
Textbook recommendation	None. Some resources will be uploaded to the LMS.	
Lecture capture	N/A	
Year and semester reviewed	2017 July Term	

Comments

Global Management Consulting (GMC) is a commerce capstone subject. The basic idea is that instead of going to lectures and sitting exams, you go overseas and work with a real client on a real project for two weeks with a team of other highly-capable students, and you have to deliver an end-product. You will be assessed on the quality of your deliverables and your ability to work with others in a team.

Application Process

In my year, the application consisted of an academic transcript, a resume and a questionnaire, which includes a personal statement. Every city has a quota of 20 students, and they selected 50% above the quota of students to progress to the interview stage. In my year this meant the top 120 students by WAM were selected to progress to the interview stage. The cut off was 73.067 (yes, this was verified with the admin), and if you don't meet this they won't even bother looking at the rest of your application. That being said, my WAM was just below this cut off, as was another student who was ultimately selected for the program. Let's just say we were a bit proactive in our approach. It is in part because of students like us that I think they have modified the selection process for next year (2018). Check the GMC Handbook link and website for exact details as they are subject to change, but I believe they have lowered the cut off to 65.

Scholarships and costs

You will have to pay the usual subject fee and an additional "GMC subject cost" of around $1500, which covers accommodation, travel insurance and some basic sightseeing tours. You will have to pay for your own food and travel.

You may be eligible for the Global Scholars Award of $1000. Application outcomes are generally lenient and are based on your WAM. You are automatically selected if you had an ATAR of over 98.

The FBE also selects 1 candidate per city to receive the FBE travel grant of $1500. This will be based on how well you perform in the application process. All applicants are automatically considered and you do not need to apply.

You can find more information here: Scholarship Link

Pre-country period

You will be required to attend a full day pre-departure seminar in week 12. There will also be some information sessions regarding travel and accommodation arrangements. These sessions are optional but highly recommended. You are free to travel before and after the designated in-country period as you wish, as long as your subject co-ordinator is aware of your travel plans. Unfortunately I had an exam scheduled to the last days of the exam period so I could only squeeze in 4 days of travel, but had a blast in Italy and the Vatican.

In-country period

I only found out about my team and client 3 days before the designated in-country period of 2 weeks, but you should normally expect to receive this information sooner. I was in a team with a high school colleague heading into investment banking, an accounting student with an active interest in aerospace engineering, and a second accounting student. We were allocated MTU Maintenance, an aircraft engine maintenance company. They were a relatively smaller player in the world of aircraft engine maintenance, repair and overhaul (MRO), and they gave us a real project they wanted to work on for a long time but never had the time to. Due to our non-disclosure agreement, I can only tell you in basic words that we were tasked with curating a database and providing insights and recommendations based on the data. Given that my background was in data analytics, this got me very excited. I won't go through too much about the work process, but what I can reminisce on is that we had a relatively chill time compared to the other teams. We encountered daily technical roadblocks and sometimes we just left early because there was nothing we could do until it was resolved the next day. I spent many evenings sightseeing and socialising with other students from other teams with no worry about not finishing our task in time. Not saying our task was easy, but it was highly technical and very specific. The teams that had to work overtime usually had very broad time-consuming tasks, which is challenging in a different way.

It is important to use the skills of every single member of the team. While I was good with the whole excel and database building business, I needed the skills of the investment banker to recommend technical workarounds when some roadblocks were unsolvable, and to make sure everything looked pretty and presentable. The Chinese students were also excellent at market research. The insights they pulled out went so far beyond the data and it honestly blew my mind. This project cannot be done by yourself. You cannot carry the team even if you want to. Be open to ideas from everyone and resolve conflicts quickly if there are any.

Post-country period

The presentation and immediate deliverables (slides and supplementary materials) were completed in the country, but the final full report, self-reflective piece and peer review assessment are due around 1 month after you leave the country. It may sound like a lot of time, but usually the team energy drops after the team disperses. Two of my teammates went on exchange and the third went travelling, so we all took a step back and really came back together pretty late on Google Docs to complete the report. It was really hard to keep the energy up if you're all so far away from each other, so please be considerate with your travel plans. Don't be that guy who goes to Nepal for a spiritual escape and becomes unreachable until 4 days before the report is due. There is still substantial work to be done.

Final Comments

This was by far the best subject I have done at the University of Melbourne. I learnt from this subject that I was far better at working than studying. If you enjoy practical hands-on work, you will love this subject. Travel geeks out there will also love how this subject gives you the opportunity to travel. Tips for doing well in this subject:

- Be open to new ideas. Students selected for the GMC program are generally very remarkable. They're usually very unique individuals with thoughts and ideas that are very different to yours. Be open to trying new things even when they challenge your own technical specialty. It has the potential to absolutely revolutionise your deliverables.
- Socialise. You will be working in the same team for 2 weeks and you must hit the 'performing' stage as a team if you want to do well. Socialising is the basis for you to find that connection and get that energy rolling. Also socialise with those outside your team. It might sound weird but spending time with other very driven high-energy individuals allows some of that energy to rub off on you as well.
- Ask. You only have 2 weeks to finish this project. If you have a question, ask. You don't have all the time in the world to figure out everything. You might not even have enough time to figure out all of the important bits. Find out what you don't know, find out what you need, then find ways to get them. That is all I can say.

MGMT30017 Global Managment Consulting [JUL] — Shanghai

Exemption status	None.	
Coordinator(s)	Jill Lei (person in charge for the Shanghai program)	
Weekly contact hours	1 full day pre-departure seminar in week 12 Full-day attendance for 10 days at the host company internationally (70 hours) 2-hour de-briefing session after returning	
Assessments	Team presentation & 1000-word report (Due end of 2 week in-country period) 5000-word full team report (Due 1 month after in-country period) 2000-word reflective individual essay (Due 1 month after in-country period) Peer review assessment (Due 1 month after in-country period)	40% 30% 20% 10%
Textbook recommendation	None — there's no textbook for a work-experience project.	
Lecture capture	N/A	
Year and semester reviewed	2017 July Term	

Comments

Disclaimer: To enrol in this subject, you must have completed

- MGMT20001 *Organisational Behaviour*; and
- a minimum of 175 total accumulated subject credit points at commencement of the subject.

You must also receive permission from the Subject Coordinator via selection process.

Late night drinks, Maccas at 2am in the morning and a lot of networking. No other university subject offers anything close to this experience — an intense, two week course where you bond quickly with your teammates, enjoy Shanghainese night life and create a 5,000 word report + PowerPoint Presentation.

It is also one of the best ways to get a taste of management consulting, given that your advice and feedback will be actively considered by the firm you are working with. I should note early that this is the **most intense** subject I have personally encountered during university as well — if you are not someone who deals with stress or late nights well, you may need to reconsider selecting this subject.

It was not only a rewarding experience, where I was able to work in another country as a 'real' consultant, but also one of my most memorable times at university. Whether it was the late nights working with my team on finishing up our deliverables, or the 2am mornings drinking and staying up late with the rest of the students, this is something that will stay with me for a long time.

The friends I made on this journey I still talk to, as we bonded over good food, great drinks and just a good time in Shanghai, in my opinion, a symbol of Chinese economic might and prosperity. The subject coordinator, in our case Jill, acts as the advisor who mediates and provides ongoing feedback. In my opinion, the Shanghai experience was significantly enhanced due to Jill's efforts with each team. She was honest in her advice, experienced in her approach and always available for a chat, even at 2am in the morning if situation was dire.

I would recommend anyone who has space in their undergraduate degree to seriously consider this subject, because it honestly reshaped my perception of working life and what areas/industries I may work for.

Subject Content

When enrolling in this subject, you can choose to go to Berlin, Seoul, Shanghai and Singapore. Depending on the time of year, there are different quotas — January and November have quotas of 40 students, while July has a quota of 80 students.

Rather than writing a TripAdvisor review on why Shanghai is such a great place to be (not biased at all), some opening thoughts on what makes Shanghai such an interesting place to experience the Global Management Consulting subject, while giving some tips on how to get the most out of your time in Shanghai.

The majority of individuals in Shanghai do not use cash as their preferred method of payment. Substitutes that are widely used are WeChat Pay, Alipay or the consolidated company Royal Pay. Due to changes in China's regulatory system, a Chinese bank account is now required to open an Alipay or WeChat Pay account.

As of 1st July 2017, it is very difficult for foreigners to open a bank account in China with one of the Big Four Chinese Banks, being Industrial and Commercial Bank of China, China Construction Bank, Bank of China and Agricultural Bank of China. Instead, smaller banks include China Merchant's Bank, which is (as at December 2017) still open to foreigners who seek to open a bank account in China.

China's public transportation system is quite congested, with the Shanghai Metro (subway system) being the predominant method of travelling. It is significantly faster and more punctual than Melbourne's Metro, with trains arriving almost every minute.

The Chinese equivalent of Uber, known as DiDi Chuxing is quite easy and flexible to use, but is not as reliable as Uber in Australia, as demand for taxis usually outstrips supply. Taxi prices were generally around 1/4 the price of Uber's in Australia.

Download the University of Melbourne VPN on your phone and laptops. This is imperative, or you will not have access to Google, Snapchat, Facebook, Instagram, Whatsapp at all during your time in Shanghai.

Team

The quota of 20 students per country roughly translates to 4 people per team, with 5 teams in each country.

Teams are assigned based on previous experience and degree majors, to ensure there is a mix of skills and backgrounds.

Industries

The Shanghai experience included a diverse range of businesses that ranged from industries in Real estate and property development, health and well-being, marketing, supply chain and logistics.

Our team worked in the real estate and property development industry, which was both insightful and open in terms of our learning and experience, given none of us had any experience in real estate prior to the project.

Management Consulting

As part of the subject, you will spend 10 days embedded within the firm you are consulting for. Your team will need to create a project scoping document, project plan and timeline to map out what the final deliverable to be provided to the client would be. Naturally, the subject coordinators will be there to help, and are extremely helpful, but you will be relying on your team to develop and provide most of the documents.

Believe me, you will quickly realise whether or not there is anything you dislike or find irritating about team members — I would highly recommend trying to reconcile differences or issues, rather than letting them fester early on, because they can significantly affect the output of your team.

Consulting itself is quite broad, so you may find a variety of different tasks depending on which team and client you are working for. For example, our team's project was more on the cost-side, with a creative design component and plenty of financial modelling (it was my first time using a Chinese-language financial model!). For other groups, some needed to conduct surveys to draw recommendations from while others had to look for supply chain optimisations.

Team Presentation

The team presentation is the culmination of the 10 days you spend in Shanghai, as your team will need to present in front of clients your key findings and recommendations in a short 10 minute presentation, with 5 minutes allocated afterwards for Q&A.

This is easily one of the most stressful parts of the entire course — it is basically a crash course case competition except that you are presenting to actual clients who understand their business, and can easily tell if you have no idea what you are talking about. Believe me, some clients will call you out if you overstep your boundaries in terms of understanding or awareness, so it is always a good idea to check with Jill, the subject coordinator of your ideas.

Generally, teams were well-balanced to have at least one or two individuals who were proficient in PowerPoint.

Reflective Essay

I would highly recommend keeping a journal of what your experience in Shanghai on a daily, or twice-weekly basis, so you don't forget everything when you come back to write the reflective essay.

Peer Review

Make sure you worked out all the disagreements with your teammates, this part can easily turn ugly when things don't work as well as expected.

Team Essay

The 5,000 word essay may seem challenging, however remember that you have already created a detailed PowerPoint and have hopefully kept all of the information you used to research your recommendations during Shanghai. This makes

writing the team essay more of a process of refining the research and recommendations, rather than creating an entirely new document from scratch.

Concluding Statements

Global Management Consulting is one of the most challenging experiences in university. This should not deter anyone from applying for it — the application process is a group interview, where you may asked difficult or thought-provoking behavioural questions. As it is one of the only times during university where you will be able to experience practical learning in a commercial environment, I would highly recommend at least checking out this subject.

SCIE20001 Thinking Scientifically

Exemption status	None.	
Lecturer(s)	Professor Andrew Drinnan Dr Sue Finch Dr Heather Gaunt	Professor Ian Gordon Dr Jenny Martin Dr Charles Robin
Weekly contact hours	2 × 1-hour online lecture(s)	
Assessments	3 × Online quizzes 4 × Module assessment tasks Take-home exam	16.7% 4 × 16.7% 16.7%
Textbook recommendation	None — there are various website links throughout the semester that are recommended readings, and I found them interesting and helpful for the assignments.	
Year and semester reviewed	2017 Semester 2	

Comments

Originally, I picked this subject because it was heralded as a great 'wam booster'. However, the more lectures and assignments I did, the more genuine interest I had developed about this subject and its content. The 4 different topics covered in the subject are not hard, but still offer an interesting take on how various topics are explored in the scientific community.

Subject Content

Introduction

The first 2 weeks cover the basic idea of what science can be defined as, and how it fits into the subject. Ideas such as the scientific method, critical thinking, and several approaches are introduced, and extra reading in the form of blogs and videos are given as an optional enhancement. Though the extra resources given do not directly help you achieve a better score, they are often times still interesting, and will enhance your knowledge, so it is worth the time.

Science communication

This topic was about conveying scientific research and jargon to the general public effectively. Certain aspects regarding the assessment in this subject is somewhat difficult, but I enjoyed the creative element of writing a blog, rather than an essay, as the final assignment. It allowed me to explore a broader range of media in my research, or cast my net more widely, so to speak. Having the freedom to use sources that would be unavailable (or more restricted) in other forms of assessment was deeply beneficial to my own study.

Observation

In this topic, we learned about making unbiased and impartial decisions in the world of science. To be honest, I enjoyed this topic the most. The concept of bias in science and media is something that has always interested me, and is especially relevant in this current political climate. Nowadays (and perhaps in the past as well), it has become increasingly difficult to discern truth from fiction. Given the rise of "alternative facts", I believe the general community should always be vigilant

when consuming media, and always attempt to find the truth in the information they receive. In this regard, science may be the last bastion in the pursuit of neutral and unprejudiced knowledge. In our assignment for this topic, we were given the classic painting 'Shearing the Rams', by renowned Australian artist Tom Roberts. We had to make unbiased observations of the painting, from which an individual could replicate the image without seeing it, or having any prior knowledge of it. This was trickier than it seemed; the assessment demonstrated to me that our everyday observations are intrinsically biased. Describing the painting in an impartial (or scientific) manner was difficult – it revealed to me the nature of observation, and the lens in which we perceive things through.

Thinking with data

Relative to the other areas of study, I found this topic to be the most confusing. The topic was divided into several subsections, including statistics, graphing, sampling, p-tests and tables. The lectures cover all the topics to a conceptual extent, but the assignment in this module has more difficult questions that stretch the scope of the topic, and, in my opinion, is the hardest test in this subject. The 3 online quizzes are focused on this one topic, with each quiz testing a different aspect of thinking with data. In addition, there is an assignment to make a PowerPoint explaining and outlining the effectiveness of Lamarckian theory etc. which requires graphing making, logical reasoning and comparisons. I am unsure whether the topic for PowerPoint remains constant, but pre-reading on these topics will help you understand and draw better conclusions in this module.

Science in the media

This was the last topic of study, and it was also what the exam is mainly based upon. Science in the media discusses how to think critically about Science as it is presented in the general media. For example, common critiques such as factual errors, incorrect statistical interpretation, or over-simplification are explained and then tasked to us to find in some sample articles. This topic exposes the biases within the scientific community caused by biased funding or just ignorant journalism. The assignment for this module involved reading 10 different online science articles and identifying whether they are rigorously written. Afterwards, we were to pick one biased article, and write our own objective article based off the original study. It was harder than expected to remain completely objective in the writing process, as there are many subtle mistakes that could have been made, such as incorrect connotations and careless interpretation of facts.

Exam

The take-home exam was due to be submitted online about a week in to the exam period, plenty of time to write the 1000 word response required. There were no past exams on the lms for reference, but I assume the format is consistent: you are given a recent scientific event/discovery/topic and a series of articles discussing it. After reading all the different viewpoints regarding the topic, 2 questions, 500 words each, are given regarding the legitimacy or controversy of the topic. This is really a test about reading comprehension, critical thinking about sorting through large blocks of information, but was not very hard.

Overall, I enjoyed this subject's interesting content, and the topics are not time consuming nor overly confusing. I would recommend this subject for anyone looking to try something new and low stress.

Subject Review Index

This section serves as an index for each subject review across all the different editions of the *Actuarial Students' Society Subject Review*.

Table 1: Core Subjects

Subject Code	2015 Start	2016 Start	Mid	End	2017 Mid	End
ACCT10001		1	1	1	1	1
ACCT10002	2	2	2	2	2	2
ACTL10001	2	2	2	2	2	2
ECON10003		2	2	2	2	2
ECON10004	1	1	1	1	1	1
FNCE10002					1	1
MAST10006		1	1			1
MAST10007			S	S		2
MAST10008	1	1	1	1	1	1
MAST10009	2	2	2	2	2	2
ACTL20001	1	1	1	1	1	1
ACTL20002	2	2	2	2	2	2
ECON20001	2	2	2	2	2	2
MAST20004	1	1	1	1	1	1
MAST20005	2	2	2	2	2	2
MGMT20001		2	2S	2S	1	1
ACTL30001	1	1	1	1	1	1
ACTL30002	1	1	1	1	1	1
ACTL30003	2	2	2	2	2	2
ACTL30004	2	2	2	2	2	2
ACTL30005	2	2	2	2	2	2
ACTL30006	1	1	1	1	1	1
ACTL40002		1	1	1	1	1
ACTL40003				2	2	2
ACTL40004		1	1	1	1	1
ACTL40005				A	A	A
ACTL40006		1	1	1	1	1
ACTL40007						2
ACTL40008		2	2	2	2	2
ACTL40009				2		2
ACTL90001						1
ACTL90002						2
ACTL90009					1	2

Table 2: Breadths and Electives

Subject Code	2016 Start	Mid	End	2017 Mid	End
AGRI20030			J		
BLAW10001	1	1			
BLAW20001	1	1			
CHIN20026				2	2
COMP10001		1	1		
COMP20005	2	2		1	1
ECON20002	1	1	S	S	
ECON20005			2	2	
FNCE10001		1			
FNCE20001	2	2	2	1	
FNCE30007	2	2		1	1
GERM10008	1	1			
JAPN10001		1	1		
MAST20022			2	2	2
MAST30020		1	1		
MAST90082				1	1
MGMT30006			2		
MGMT30017			W	W	J
MUSI20168			1	1	
SCIE20001					2
D-MATHSC		O			

Table 3: Legend

1	Semester 1
2	Semester 2
S	Summer Term
W	Winter Term
J	July Intensive
A	All Year
O	Other

List of Exemptions

Table 4: 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 FNCE10002 Principles of Finance[1]
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 19th January 2017.

[0]Students are also eligible for the exemption if they complete FNCE20001 Business Finance

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 5. Others will just contribute to the same exemption subject as their undergraduate counterparts (and hence have common content), as in Table 6.

Table 5: 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 6: 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