SUBJECT REVIEW

2024 EDITION

Acknowledgements

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Contents

Preface

Welcome to this guide on the subjects studied as part of an Actuarial Studies major under the Bachelor of Commerce degree. If you're reading this, you may be considering a career as an actuary, and you may be curious about what an actuarial student will encounter in their university studies.

While a quick online search will give you a definition of actuarial science as the discipline that uses mathematical and statistical methods to assess risk in various industries, this doesn't capture the full scope of becoming an actuary. The path to this career can be challenging and multifaceted, and as a result, the Actuarial Students' Society has made significant efforts to provide transparency regarding the subjects studied.

This guide is the result of our society's work, and we aim to provide you with an overview of each subject, written by students with diverse backgrounds, as well as general tips and advice based on their personal experiences. It's important to note that every review will be a subjective expression of opinion, and individual experiences may differ. Please keep in mind the year and semester of each subject review, as subject content, structure, and lecturers may change over time.

While we strive to ensure this guide is up to date, it's important to recognise that the reviewed curriculum may have been updated since the time of publication. However, we believe that these reviews will still be a valuable reference for understanding the general direction of each subject.

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

We hope that this guide will help you navigate the complex journey of becoming an actuary and provide you with the necessary tools to succeed in your studies!

— Suyao Liu and David Yue (Education Team), February 2025

Important Information on the 2024 Subject Review

Subject Reviews from Previous Editions

To provide the most value to our members, we have included reviews from previous editions of the ASS Subject Review for subjects not completed by any of our contributors in 2024. Each individual review specifies the year and semester in which the subject was completed.

Even though the curriculum, assessments, and/or other aspects of certain subjects may have changed since the original publication of their respective reviews, we still hope that these reviews will provide valuable guidance and insight to students who are enrolled in or considering enrolling in these subjects.

Inclusion of breadth and elective subjects

The change in the accreditation curriculum also meant that full-major Actuarial students seeking postgraduate study are only allowed one breadth/elective subject (if the student chooses not to take ACTL10001) and two non-math breadth subjects. With this in mind, the Actuarial Students' Society Subject Review will continue to include a range of breadths and electives available to our members. The inclusion of these reviews will assist all Actuarial students in deciding the right breadth or elective for them; whether they wanted a subject to broaden their study options, to learn concepts to complement their developing actuarial skillset or to have a "bludge" subject.

Finally, the Actuarial Students' Society Subject Review has always been a publication by Actuarial students for Actuarial students. Whilst the majority of our members have been pure Actuarial majors, a significant portion of our membership and committee alike undertake the Actuarial major with another. Therefore, we have expanded the 2024 edition of the Actuarial Students' Society Subject Review to include subjects relevant in obtaining double majors with Actuarial and the Economics or Finance majors – written by students taking double majors themselves. Ultimately, their experiences can relate to many other first or second year Actuarial students standing at this crossroad; we hope that these reviews will help facilitate the making of this decision.

Attention First Years:

It is important that you are aware of the mathematics prerequisites required in this major. Please click the following link or direct yourselves to page 146 (Mathematics Prerequisites for the Actuarial Major) to learn more:

Mathematics Prerequisites for the Actuarial Major

About the Actuarial Students' Society

Founded in 1989, the Actuarial Students' Society has established itself as the University of Melbourne's official society for students undertaking actuarial studies, with the support of the University of Melbourne Centre for Actuarial Studies. Our aim at the society is to expand our members' career opportunities by bridging relationships between students and professionals alike, and by developing their actuarial skill sets.

By connecting our student members with like-minded peers, experienced lecturers and sponsorship representatives, we enable our members to get a head-start in their actuarial careers. To achieve this, our society holds multifarious events, both social and professional. The Actuarial Students' Society's social calendar includes events like Trivia Night and Poker Night; they emulate a warm and amicable atmosphere that encourages students to mingle with other students and ask sponsors meaningful questions. Our professional calendar includes events like our flagship Contact Night, where students can network with and learn from working actuaries in a more formal setting.

The Actuarial Students' Society's didactic workshops in Excel and R equip our members with fundamental skills for the profession and the fiercest tools for job-seeking. Employers have favoured candidates who are proficient in such areas; we take pride in helping our members take real strides in their career development early on. Through the coalescence of constant exposure to the actuarial world, our members will learn to love the actuarial degree and profession. Your first step starts with us – the Actuarial Students' Society.

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

www.melbourneactuary.com

www.facebook.com/actuarialstudentssociety

Subject Reviews: First-Year Subjects

CMCE10001 Sustainable Commerce [SM1]

Exemption Status	Not an exemption subject, but it is a prerequisite for the *Bachelor of Commerce.*
Prerequisites	None
Lecturer(s)	Ms Kris Young, Dr Juna Tan, Ms Bessie Zhang, Mr Scott Tetley
Weekly Contact Hours	1 x 2-hour lecture, 1 x 1-hour tutorial
Assessments	Hurdle Quizzes (Joining Melbourne Module) - 10% Assignment 1 (Essay) - 10% Assignment 2 (Group assignment) - 30% Assignment 2 (Business report) - 30% Assignment 4 (Reflective essay) - 20%
Textbook recommendation	None
Lecture Capture	Partially recorded – the discussion section has been eliminated.
Year and Semester Reviewed	2024 Semester 1

Subject Content

Sustainable Commerce is a compulsory commerce subject that you must take in the first semester of your first year of Bachelor of Commerce. The aim of this subject is to teach the importance of sustainability in today's world of business, as well as giving new university students an idea about how to study at university. Below is the list of topics covered:

1. What is sustainable commerce?
2. Commerce and sustainability
3. What is commerce?
4. What is value?
5. Purpose and value creation
6. Needs of the organisation
7. Needs of stakeholders
8. Assignment 3 case study
9. Sustainability problems
10. Risk: sustainability problems in the future
11. Building a sustainable career
12. Reflective practice for business

There is nothing that needs to be memorised in this subject. One could argue that there is a lot of reading, yet most of the reading conveys quite similar main arguments. Therefore, the focus of this subject is how you apply the theories learnt into real life business scenarios.

Lectures

During each week's lecture, the teaching team tries to combine theory with interactive activities and examples. The lectures are not fast paced. Taking detailed notes is not necessary. However, enthusiastic students may want to note down some websites that lecturers source their examples from, as you may find them useful in future assignments. From my personal experience, attending/watching the lectures has no correlation with obtaining a good understanding of the content. Rather than saying that participating in the lectures will help you do well, I would say that it just ensures that you will not fail.

Tutorials

Tutorials are mainly revisions of lectures. It covers some case studies and some sample essay paragraphs. The tutor may also remind students of important due dates and respond to questions regarding assignments. Tutorial attendance does not form a part of the assessment. However, you do need to complete a group assignment. Hence, it is good to make trustworthy friends in your tutorial class.

Assessments

Throughout the semester, there are 4 assignments and 3 hurdle quizzes. There is no exam for this subject.

Hurdle Quizzes (Three Joining Melbourne Module) - 10%

These are the quizzes you will need to complete in the first few weeks of the semester. It just goes through some basic logistics about joining the university. So just make sure you do them before the deadline and these should be free marks.

Assignment 1: Essay writing on a given topic that is related to sustainability - 10%

This will be an essay that requires you to use the theories learnt in the first few weeks to analyse a topic. I obtained a lower-than-average result in this essay, because I did not follow the criteria. Therefore, I would highly recommend strictly following the structure of the sample paragraph that is given in the tutorial. Additionally, please note that it takes time for one to adjust to academic writing, so please do not feel bad about yourself after receiving the mark if you didn't get a good one. Rather, you should focus on the feedback that your tutor gave you and try to improve from there.

Assignment 2: Group assignment

This assignment consists of two parts - (A) annotating some articles with your group mates in the Perusall app, (B) making a creative video about the topic in that article.

Please note that this group assignment task may be different each year, so in 2025 you may not be asked to make a video. Therefore, the only tip I can give is to make sure you get good teammates.

Assignment 3: Business report on the sustainability issues of a given organisation - 30%
This is the most challenging task in this subject. It requires you to conduct research by yourself and analyse a business case. You also need to know what the markers want to see - a clear structure and precise language that is easy to read. It is easy to overspend time on this assignment, so I would suggest that you don't neglect other subjects while cramming for this one. Another tip worth mentioning is that you can use the university recite website to ensure that you do not lose any marks for the reciting criteria.

Assignment 4: Self-reflection essay - 20%
This task is due 2 weeks into the exam period. Therefore, I believe it is unnecessary to allocate your precious swotvac time to complete this assignment. I crammed this essay on the due date and scored poorly, but I do not regret prioritising other subjects during that period.

Overall Remarks

Sustainable Commerce is one of the very first subjects you will take in university. You learn some important skills such as referencing and researching in this subject. These skills are totally new to many of us, so it may be a valuable experience that could benefit the rest of your tertiary studies. In the end, I wish you best luck in your journey in CMCE10001, and I wish that you only have to take this journey once.

ACCT10001 Accounting Reports and Analysis [SM1]

Exemption Status	Not an exemption subject, but it is a prerequisite for ACCT10002 *Introductory Financial Accounting* (CB1 Business Finance) and the *Bachelor of Commerce*.
Prerequisites	None
Lecturer(s)	Mr Noel Boys
Weekly Contact Hours	1 x 1.5-hour lecture 1 x 1.5-hour tutorial
Assessments	Assessment 1 (individual) - 10% Assessment 2 (group) - 10% Tutorial attendance and participation - 6% Quizzes - 4% Final Exam (3hr, not hurdle) - 70%
Textbook recommendation	Accounting: Business Reporting for Decision Making, 8th Edition. (Jacqueline Birt, Keryn Chalmers, Suzanne Maloney, Albie Brooks, Judy Oliver, David Bond) ✓ Recommended. First of all, this textbook is affordable, charging only $19.95 per semester on the Wiley Business Now website and you will get access to many other potentially useful books. Secondly, this textbook explains the concepts in accounting in depth and is friendly to read for beginners. Last but not the least, this textbook provides some useful exercise questions that you can use to strengthen your accounting skills, the solutions to those questions will be provided on LMS.
Lecture Capture	Full audio + video with good quality. I would still recommend attending Mr Boys's fascinating lectures in person.
Year and Semester Reviewed	2024 Semester 1

Subject Content

ARA explored the following topics:

1. The Conceptual Framework
2. Transaction Analysis & Financial statements
3. Assets

4. Liabilities & Equity
5. Income and & Expenses / Other Comprehensive Income / Statement of Changes in Equity
6. The Statement of Cash Flows
7. Financial Statement Analysis
8. Budgeting
9. Cost-Volume-Profit Analysis
10. Sustainability

These topics (and perhaps new vocabularies for some of the readers) might look very intimidating to you now - that's why I would like to not go into the details of these concepts here. If you are not a beginner, then there is no need for me to tell you what the above words mean, because I am sure that you could explain these better than I do. The best way is to 'feel' the meanings of these concepts yourself in Mr Boys' phenomenal lectures.

Lectures

ARA lectures are fast paced. It is difficult to note everything down by hand and the slides on LMS are a little bit different from the actual slides presented by lecturers, therefore I suggest having the lecture slides on the side and annotating them. Students with accounting experience may learn the content independently, but most people should find lectures helpful.

Tutorials

Tutorials serve as revisions of previous week's lecture content, providing exercises for students to strengthen their accounting skills. Tutorial attendance and participation forms a part of the assessment; hence it is beneficial to attend these. For the group assignment, you will need to find group mates from your tutorial class, so attending and making friends there can be a good idea.

Assessments

Assignment 1: Individual assignment on financial statement preparation.

- This assignment consists of two parts: the first part asks students to record financial transactions, the second part builds up on the previous one and asks students to prepare financial statements (Statement of profit or loss and Balance sheet). The answer of the first part is released before the second part is due.

Assignment 2: group assignment on financial statement analysis.

- The group must be formed within your tutorial class during a specific week. If you do not attend that tutorial class (and didn't get to join a team through other means), you will be assigned to an arbitrary group. Notifications are sent to students prior to the week in which the groups are formed.
- This assignment also has two parts. Part 1 focuses on analysis (e.g. horizontal and vertical analysis, ratio analysis) and Part 2 focuses on interpretation (e.g. whether profitability improves) of financial data, and some short answer questions / multi choice will be completed via LMS. Consistency of the group members answers is an element of assessment.

- Students are expected to have some basic excel skills, as a large number of calculations will be performed (or at least recorded) on Excel.

4 Online Quizzes released throughout the semester

- Quizzes should be free marks if you've learnt the content in the lectures.

Final exam:

- The exam consists of three parts: (A) multiple choice, (B) short answer questions and (C) financial statement preparation.
- It is done on LockDown Browser (which you need to install before the exam and bring your own laptop and chargers into the exam venue). You will be given a printed question booklet in the exam, as well as extra working papers.
- The exam is harder than the practice exams, but without completing the practice exam, I could have done even worse.

Overall Remark

In general, ARA is a challenging but rewarding subject, especially for those who have never learnt accounting before. It is very possible to pass even if you have no experience with accounting. It also rewards people who spend appropriate amounts of time in it. Although the lecturers stated that students with VCE accounting experience tend to do worse in ARA due to them underestimating its difficulty, my personal experience suggests that people with a solid high school accounting foundation still have a huge advantage in this subject. But this isn't to say that the rest should feel discouraged. As a beginner, I struggled a lot in the first 70% of the semester, due to my need to constantly revise new concepts and ask my tutors stupid questions repeatedly. However, many things came together in the final weeks of revision, when I attempted the practice exams a couple of times and revisited the modules that I am weak at carefully. Having passed this subject, I now appreciate the beauty of accounting, a subject that involves both rigorous logic and subjective elements (estimations, judgement and choices).

ECON10004 Introductory Microeconomics [SM1]

Exemption Status	This subject is compulsory for the *Bachelor of Commerce*. It is also an exemption subject for CB2 Business Economics, in conjunction with ECON20001 *Intermediate Macroeconomics*. Satisfactory performance across both subjects is required.
Prerequisites	None
Lecturer(s)	A/Prof. Laura Panza (Week 1-6) A/Prof. Maria Recalde (Week 7-12)
Weekly Contact Hours	2 x 1-hour lecture 1 x 1-hour tutorial
Assessments	Assignment 1 - 15% Mid-Semester Exam - 25% Tutorial participation and attendance - 5% Pre-tutorial quizzes - 5% Final Exam (hurdle) - 50%
Textbook recommendation	Principles of Microeconomics – Mankiw, King, Gans and Byford (GKBM) Microeconomics: Case Studies and Applications – Borland ✗ *Not recommended*. The lectures cover enough detail that using the textbook is not necessary, but it may provide additional benefit to students who want to explore the topics in more depth, are interested in real-world applications, or seek extra practice questions.
Lecture Capture	Full audio + video
Year and Semester Reviewed	2024 Semester 1

Subject Content

Introductory Microeconomics covers a wide range of topics to a decent depth and serves as a basic introduction to key microeconomic concepts.

1. **Supply and Demand**

The first two weeks cover the fundamentals of microeconomics, including supply and demand factors, market assumptions, and comparative statics. This encompasses the

majority of Unit 3 of VCE Economics, and much of it does not reappear in the course. The key concept to nail here is marginal benefit and marginal cost, as they can be challenging without prior knowledge and are heavily featured throughout the subject.

2. **Elasticities and Welfare**

This section focuses on various aspects of elasticity, including point elasticity, the effect of elasticity on revenue, maximising revenue from elasticity, income elasticity, and cross-price elasticity. It also introduces consumer and producer welfare and how government intervention can affect it. Welfare is a new concept to many and is also featured prominently throughout the course, so it's important to develop a strong understanding early on.

3. **Government Intervention and International Trade**

This topic covers taxes, subsidies, price controls, wage subsidies, and quotas as examples of government interventions. In international trade, it introduces comparative and absolute advantage, import tariffs, and export taxes, along with their effects on welfare.

4. **Market Failures**

Here, you'll study externalities and asymmetric information. Externality problems entail identifying changes in welfare using graphs, while asymmetric information problems require basic calculations based on statistics. The content load in this topic is particularly heavy, so reviewing the relevant lectures thoroughly is recommended.

5. **Firm Production and Costs**

This section introduces concepts like long run, short run, average, fixed, variable, and marginal costs, and how firms make decisions based on these costs. It also covers economies of scale, returns to scale, and efficient scale, which influence firms' operational decisions.

6. **Monopolies**

This topic explores market power and the outcomes of imperfectly competitive markets. You'll calculate total and marginal revenue from demand functions, determine profit-maximising prices, graph these functions, and assess the welfare costs of monopolies. A solid understanding of these concepts is crucial.

7. **Price Discrimination and Monopolistic competition**

This section explains how price discrimination arises in monopolistic competition and involves calculating profit and welfare costs. Some concepts can be confusing, so creating a table identifying the three degrees of price discrimination could be helpful.

8. **Game Theory**

This is an introduction to game theory, where you'll learn fundamental game theory terminology, techniques to find the Nash Equilibrium, and create game tables and trees. These concepts will be applied to quantity and price calculations, particularly in Cournot and Stackelberg competition, as well as public good and common resource problems. I found this to be the most engaging and enjoyable part of the subject, specifically the mathematical elements.

Lectures

Laura took all four lecture streams during the first half of the semester, while Maria led the second half. Laura frequently engaged students by passing the microphone and encouraging

them to share their thoughts, many of which were insightful. She also covered case studies in great detail, which were often interesting and helped solidify my understanding of the content. Notably, one of these case studies appeared in the mid-semester test, highlighting their importance.

Both lecturers provided typed worked examples, though these were not always explained thoroughly. However, this gap was well supplemented by the tutorials and review sessions run by Nahid Khan. These sessions were incredibly useful to attend as they covered many calculation questions and were key to clarifying misunderstandings.

Tutorials

Tutorial attendance and participation account for 5% of the total grade. Tutorial questions are released in advance and are not required to complete beforehand, but helpful in Intro Micro as many of the problems involve calculations that may take longer if you have never attempted them before.

The usefulness of a tutorial largely depends on the tutor and how they structure the session. My tutor dedicated the first half of each tutorial to working on the tutorial questions, either individually or in groups. They would then go through all the questions using a document camera, writing the solutions on paper, and later sending them out. I found this approach very effective for fully understanding the material.

Since different tutors structure their tutorials differently, it's worth asking around in the first couple of weeks and switching to a tutorial that best suits your learning style if you feel you aren't getting the most out of your assigned tutorial.

Assessments

Pre-tutorial quizzes

There are a total of 11 pre-tutorial quizzes, each consisting of 10 multiple choice questions. The best 9 results count towards 5% of the final grade. Since you get two attempts per quiz, they are relatively easy to score well on and serve as good revision for the previous week's content.

Assignment 1

Assignment 1 is a straightforward set of 3 questions covering the first four weeks of content, up to government intervention and welfare. It is an individual assignment and is very manageable to complete within the given timeframe. This assignment also provides good revision of the early weeks, as you are encouraged to be specific in your explanations to demonstrate a strong understanding of the foundational content.

Mid-Semester Test

The mid-semester test is a new addition to the subject and counts for 25% of the final grade, replacing what was previously Assignment 2. It covered the first six weeks of content and was worth 26 points, to be completed in 45 minutes. Many students struggled with time

management, as there were six questions, each with multiple components. The mid-term practice consisted of 8 multiple choice questions that did not reflect the structure of the actual mid-sem, making it insufficient for revision. Since no other revision material was given, I recommend reattempting tutorial and revision lecture questions. The overall results were poor, and most students automatically received an additional 7-point adjustment to their mark. Students particularly struggled with questions about government intervention and identifying welfare changes. For this reason, I would also recommend revising by drawing graphs that illustrate welfare changes in various scenarios (such as Pigouvian taxes, price controls, and international trade) as covered in lectures.

Final Exam

The final exam is a 2-hour long exam worth 50% of the final grade and is a hurdle requirement to pass this subject. While no notes are allowed, you can bring a calculator. We were provided with two practice exams and four practice problem sheets covering all 11 weeks of content. These materials, along with tutorial problems, are good representations of the final exam's difficulty. Completing them as part of your revision should prepare you well. Pay attention to the final week of revision lectures, where the lecturer often highlights challenging topics (these were adverse selection and Cournot competition calculations for our semester). Additionally, Maria explicitly outlined topics that would not be in the exam, so avoid wasting valuable revision time on those.

Overall Remarks

The maths involved in the subject is relatively simple – at times, fun – as there isn't much beyond quadratic equations and partial differentiation and graphs are not drawn to scale. The main difficulty lies in understanding the logic behind economic concepts. Introductory Microeconomics is not a difficult subject but ensure that you are familiar with all topics. Unlike VCE Economics, you are rarely asked to recite definitions or recite a formulaic response to market changes. Instead, value is placed on demonstrating a genuine understanding of the wide range of topics covered.

A comprehensive understanding of the material is likely to result in a high score due to the low variability in the types of questions asked. Revision involves repetitive work with graphs and calculations, but this is more about familiarising yourself with the cause and effect relationships in economics than rote memorisation. It's one of the easier commerce subjects to excel in if you commit to understanding the material thoroughly.

I regret not taking full advantage of tutorials by preparing for them in advance as they provide good opportunities to revise content and receive specific feedback on exam-style questions. Overall, I found Introductory Microeconomics to be an interesting and rewarding subject, making it a great introduction to economics for students with and without prior experience in the subject.

ECON10003 Introductory Macroeconomics [SM2]

Exemption Status	Not an exemption subject, but it is a compulsory subject for the *Bachelor of Commerce*, and a prerequisite for ECON20001 *Intermediate Macroeconomics.*
Prerequisites	ECON10004 Introductory Microeconomics
Lecturer(s)	Prof Jonathan Thong Prof Daniel Minutillo
Weekly Contact Hours	2 x 1-hour Lectures 1 x 1-hour Tutorial
Assessments	2 x Group Short Answer Assignments 12.5% 2 x Multiple Choice Tests 5% Tutorial Preparation and Participation 5% Final Exam (Hurdle) 60%
Textbook recommendation	*Bernanke, Olekalns, Frank, Antonovics & Heffetz: Principles of Macroeconomics. 5th Edition. McGraw-Hill, 2019 (BOFAH)* ✗ *Not recommended. The weekly lectures provided explanations of key concepts with enough depth and detail. There are full sets of lecture notes available upon the respective week of teaching which allows students to work in line with the content taught within the course.*
Lecture Capture	Full audio + video
Year and Semester Reviewed	2024 Semester 2

Subject Content

Introductory Macroeconomics introduces students to the basics of concepts surrounding macroeconomic theory and policy. It lays the foundation for the second-year subject *Intermediate Macroeconomics* and discusses a wide range of applications in monetary and fiscal policy, balance of payments, economic growth, interest rates, and exchange rates.

1. Aggregate Economic Activity

This topic introduces foundational macroeconomic concepts, which may be familiar to students who have studied high-school economics before. Simple mathematical formulas

were used to analyse aggregate economic activity, inflation, interest rates, and the labour market. Key formulas such as Okun's law were also introduced at this early stage.

2. Keynesian Model and Fiscal Policy

This topic focuses on short-run economic fluctuations and the Keynesian model, examining how aggregate demand, the Keynesian multiplier, and fiscal policy interacts to influence output and employment. This topic is important to understand as fiscal policy questions including mathematical calculations, graph sketching, and identifying appropriate curve shifts were often tested in past-year exams. This topic notably featured as the only topic covered in the extended response of the 2024 Semester 2 exam.

3. Monetary Policy

This topic covers monetary policy, focusing on how central banks use tools like interest rates and money supply to control inflation and maintain financial stability. Notable concepts include the Quantity Theory of Money and Unconventional Monetary Policy, which were often seen coming up in MCQ-style questions.

4. AD/AS Model

The topic introduces the Aggregate Supply/Aggregate Demand (AS/AD) model, illustrating how shifts in aggregate demand and supply impact output, price levels, and economic equilibrium in both the short and long run. It is important to understand how shifts in different factors affecting demand and supply affect the AD/AS model.

5. Production Function and Solow-Swan Model

This topic introduces the Solow-Swan model, which examines how capital accumulation, labour, and technological progress influence steady-state growth in an economy. In my opinion, this topic was the hardest and most abstract concept in the course. Past exams have asked MCQ questions on the production function formula, and extended answer responses requiring use of mathematical formulas and graphs to interpret the Solow-Swan model. It is better to understand rather than memorise this topic.

6. International Trade

This topic examines the principles of international trade, focusing on how trade benefits economies through comparative advantage. Concepts to know include comparative advantage vs. absolute advantage, PPF, sketching economic surplus, and the Ricardian model. Content was occasionally tested in past-year exams, but when it came up, it was usually within a question containing many marks.

7. Exchange Rates

This topic explores exchange rates, focusing on how they are determined. After this topic, students can evaluate the feasibility of economic policy via the Policy Trilemma, as well as sketch graphs of undervalued and overvalued exchange rates. One concept that is important to understand is relative PPP vs. absolute PPP.

8. Balance of Payments

This topic covers the balance of payments, explaining its structure, including the current account and capital account. Whilst I felt this topic was disproportionately overlooked in assessments, I think it is still important to understand how international capital flows can affect the balance of payments as we were occasionally asked to explain this concept.

Lectures

There were 2 x 1 hour lectures every week. The content was decently-paced.

Tutorials

Tutorials can be beneficial depending on your tutor. I personally had a friendly tutor whom I could ask questions to before and after the tutorial. Some exam questions were derived from tutorial questions, so it is worth going through each week of questions to understand key concepts. However, some of the more research-based tutorial questions were kind of useless and time-consuming, so be picky about the ones you attempt.

Assessments

Multiple-Choice Test:
There were two tests, each weighted at 5%. These quizzes tested your knowledge of the lecture content and could be attempted within a given timeframe. It is very easy to miss the deadline of these tests, so I recommend jotting it down in a calendar so that you don't make my mistake of losing 10% of your grade.

Assignments:
There were two assignments, each weighted at 12.5%. The assignments were closely tied to lecture content, so it rewards anyone who is consistent with coursework. Many of the short-answer responses were straightforward given the lecture and tutorial content provided. However, the Excel questions were time-consuming – for Actuarial students that did not go through the QM pathway, I highly recommend finding group members with QM knowledge as they will have the prior experience to compute similar Excel-style questions.

End-of-semester exam:
The exam was 2 hours and held in-person (calculator and formula sheet provided). Past-year exams have no worked solutions, so I recommend that you show up to the SWOTVAC consultations to cross-check your answers with the marking key. Some of the consultation tutors will refuse to explain the solutions to you. We had access to two past-year papers during the study period that were closely tied to the content tested in the exam. This alongside the tutorial questions should cover the knowledge that you require to attempt the final exam.

Overall Remarks

In terms of difficulty, I would put this subject on par with the rest of the first-year subjects. Most tutors in this subject are receptive and friendly. The main concepts to study include the Keynesian model, production function, AD/AS model, and Solow-Swan model, as they get tested often in assessments. If you study the main concepts and understand the past-paper questions, a good mark is definitely achievable in this subject.

FNCE10002 Principles of Finance [SM2]

Exemption Status	CB1 Business Finance, in conjunction with ACCT1002 *Introductory Financial Accounting*. Satisfactory performance across these two subjects is required
Lecturer(s)	Associate Prof. Sean Pinder
Weekly Contact Hours	1 x 2-hour lecture, 1 x 1-hour tutorial
Assessments	Four short sets of peer-review tasks – 15% Mid-semester test – 25% End-of-semester exam – 60%
Textbook recommendation	Corporate Finance by John Graham, Chris Adam, and Brindha Gunasingham ✗ Not recommended – the lecture slides are comprehensive enough. The lecturers occasionally provide additional readings which are sufficient for us to understand the concepts.
Lecture Capture	Full audio + video with good quality. I would still recommend attending Prof. Pinder's lecture in person, because there will be TAPPS questions that are not recorded.
Year and Semester Reviewed	2024 Semester 2

Subject Content

This subject explored the following topics:

1. **Introduction to Financial Mathematics I and II**
   The mathematical tools introduced in these two lectures are fundamental to the future problem-solving in PoF. You will learn about how to calculate the present value of different styles of cash flows (e.g. annuities/perpetuities, ordinary and non-ordinary cash flows). The mathematics here are merely geometric series, but the financial concept is key.
2. **Debt Securities**
   Debt securities include short- and long-term debt. You will learn how to apply different mathematical models to this topic, and the financial properties of this kind of securities.
3. **Equity**
   This topic covers a different type of financial securities - Equity (e.g. shares). You will learn about how Equity is priced and why it is different from debts. An important model, Gordon's Growth Model is also introduced here.
4. **Portfolio Theory and Asset Pricing I and II**

A portfolio can contain a mix of different financial instruments (e.g. mix of debt and equity). You will learn about how the expected returns are associated with systematic risk of the portfolio and how diversification benefits can be achieved. You will learn about the Nobel-winning model, CAPM (Capital Asset Pricing Model), and apply it to price individual assets.

5. **Capital Budgeting I and II**
   Firms look for profitable projects to take on in order to increase shareholder return (as reflected by increased market value of a firm). This topic explains how a firm can choose between different projects by using a variety of techniques, such as NPV and IRR. It is important to differentiate between mutually exclusive projects and independent projects. It is also critical to learn about the assumptions and conditions underlying each project valuation method.
6. **Capital Structure and Payout Policy I and II**
   There are mainly two ways that a firm gets its finances - debt or equity. Having learnt about the characteristics of each of them in the earlier chapters, you will now learn about how the mix of debt and equity changes a firm's profitability and market value. You will learn about the theoretical proposal of Modigliani and Miller stating that firm value is irrelevant to debt equity mix under a very restrictive set of assumptions, and you will compare and contrast theory with empirical evidence. You will also learn about different ways of cash distribution to shareholders (e.g. cash dividend, share buy-backs) and how shareholders' financial position changes or not changes according to the firm's decisions.
7. **Introduction to Options (Financial Derivatives)**
   Options is a type of financial derivatives; its value is dependent on some underlying asset. You will learn about different types of options and how to determine their payoffs.

Lectures

Prof. Pinder's lectures are engaging and long. He will emphasise when you need to 'wake up' to pay attention to the content, which I find very helpful and kind. He constantly interacts with students and asks thought-provoking questions, making it difficult to not be intrigued by the fun of finance. Prof. Pinder often combines theories with real-life examples, providing students with a comprehensive view about how the mechanism of the financial market impacts our everyday lives. Lectures are also a great opportunity to make new friends - the "TAPPS" questions are for physically attending students only and you will be discussing those questions with a peer.

Tutorials

Tutorials are not compulsory, and no attendance will be marked. You can find the tutorial exercises and detailed solutions each week under the relevant topic page. During tutorials, your tutors will patiently go through a couple of important questions in the material in detail, ensuring that everyone develops a good foundation about what is learnt in the previous week. A lot of the tutorial questions in the second half of the semester are real exam questions from the past, so I would highly recommend doing practice on those and

ask your tutor about them if you have any questions. However, Prof. Pinder emphasised that he does not pay those tutors to answer our emails - so please make sure you make good use of the EdDiscussion board and the tutorial time to raise your questions rather than contacting tutors using emails.

Assessments

Assessment1: 4 sets of exam-style practice questions (ExamBuddy):
If you make a genuine attempt, you should be able to get full marks for those questions, as you don't lose marks for a false answer. Your work will be marked by a 'buddy' that the system randomly finds for you, so you will not know who is marking you.

Assessment2: Mid Semester Test:
The one-hour test consisted of 25 multiple choice questions related to the first half of the course. Only a calculator and the provided formula sheet is allowed. You will be given a couple of practice exams with solutions. Make sure you do well in time management and stay calm if there is a question that has errors - I spent too much time on a single question that had an error in its options and scored very poorly on this assessment. As long as you've been paying attention in class you should do very well - just avoid repeating my mistake of freaking out for a single question.

Assessment3: Final exam
The exam has fair difficulty. We were given three sets of practice exams, and they are very helpful in the preparation. In terms of question style, you might see some True/False, some multiple-choice questions, and some short answer questions. The exam assesses a student's ability to make calculations with little errors and articulate their understanding of the content. Therefore, students who truly understand the lecture material will be able to earn the marks they deserve.

Overall Remarks

Principles of Finance is both interesting and practical. If you are a BCom student, this knowledge will benefit you throughout your degree. If you are from another discipline, you will be amazed by how much your financial literacy has increased. To me, Principles of Finance is the first subject that makes me feel like at the ripe old age of 19 I finally gained a basic understanding about how the financial market works.

Many of my friends reflect that PoF is not a hard subject - not because the contents are easy (in fact some of them are quite challenging), but because it is fun to learn. The teaching team is very helpful and welcoming, that's why a lot of us enjoy attending the tutorials even if they are not compulsory.

ACTL10001 Introduction to Actuarial Studies [SM1]

Exemption Status	None
Prerequisites	None
Lecturer(s)	Professor David Pitt
Weekly Contact Hours	1 x 2-hour lecture 1 x 1-hour tutorial
Assessments	Individual Assignment - 10% Recorded Presentation - 10% Mid-Semester Test - 10% Final Exam (hurdle) - 70%
Textbook recommendation	An Introduction to Actuarial Studies, 2nd Edition by Atkinson and Dickson ✗ Not recommended. Lecture slides and tutorial sheets provide detailed explanations and practice such that the textbook was not necessary.
Lecture Capture	Full audio + video
Year and Semester Reviewed	2024 Semester 2

Subject Content

ACTL10001 provides a comprehensive introduction to key actuarial topics, combining analytical calculations and theoretical understanding.

1. **Financial Mathematics**
   This topic covers simple and compound interest, nominal and effective rates, annuities, bonds, and loans. The content is very similar to what's delivered in Principles of Finance, but with simpler notation.
2. **Demography and Survival Analysis**
   This topic introduces demography and mortality. Students analyse population pyramids and life tables and calculate crude rates, stationary population, expectation of life, fertility, and population projection figures.
3. **Life Insurance Mathematics**
   This topic covers contingent payments, term and whole life insurance, endowment insurance, pricing and reserving, and profit analysis. This topic relies heavily on calculations and summation formulas.
4. **Applications**

This final topic covers general insurance, reinsurance, superannuation, and reverse mortgages. Majority of the questions in this section require a written explanation instead of calculations.

Lectures

The weekly 2-hour lectures were delivered in person and fully recorded. During lectures, David would annotate the printed lecture slides and project these using a document camera. The lectures were easy to follow, with clear explanations and engaging delivery. There were many worked examples to consolidate the content.

Tutorials

Tutorial attendance was not marked but highly recommended. Tutorials began in the first week of semester, with this first session covering assumed mathematical knowledge that proved pertinent to the course, such as derivations from first principals and summation formulas. The structure of each tutorial depended on the tutor. Some tutorials required students to solve the problems in small groups on the whiteboard, while some tutors provided weekly summaries and worked examples. The best way to prepare for tutorials would be to attempt the problem sets prior to the tutorial and use the tutorial to check your understanding.

Assessments

Assessment 1

Assessment 1 was a written assignment containing six questions and only covered financial maths. This assignment was straightforward, and many questions were simply iterations of those found in lectures or tutorials.

Assessment 2

Assessment 2 required students to record a 5-minute presentation about what an actuary is. There were few instructions and students were encouraged to give a high-level overview of different actuarial roles. The marking scheme was quite lenient, allowing many students to achieve full marks.

Mid-Semester Test

This year, the Mid-Semester Test was held in week 9 and covered content from the first six weeks of lectures. One double-sided A4 sheet and a calculator were permitted. Most of the questions were manageable after revising lecture slides, tutorial problems, and the three past/practice tests provided, but the final question was a tricky loan problem that many students struggled to complete. There was not much variety with annuity and life table questions, so I would advise to revisit the decomposition of instalments as this was the topic of the "separator" question for two consecutive years. David provided summary statistics for cohort performance and mapped the scores to a final grade, which was helpful to manage expectations depending on the level of effort invested.

End of Year Exam

The final exam was a 2-hour long written test with 15 minutes of reading time, with a fair mix of questions ranging in difficulty levels. The exam is usually held towards the end of the assessment period, well after other first-year subjects, so there is plenty of time to revise. Two double-sided A4 sheet and a calculator were permitted, without a formula sheet provided. There was a greater emphasis on the second half of the course, which had had not been assessed. As with the mid-semester test, lecture slides, tutorial problems, and past/practice tests provided sufficient revision material for the exam. The Ed Discussion Board was particularly useful as students and the teaching staff were active, quick, and thorough with explaining questions. Most of these questions were about insurance calculations, which many students found the most challenging topic of this course.

Overall Remarks

The subject is well-organised and efficiently run, with thorough resources provided. A high level of effort invested in the course is rewarded with proportional marks. In hindsight, I regret not focusing more on developing an intuition for the symbols and their formulas, as this would have helped solve certain problems more quickly. David gives excellent explanations and shows genuine care for students' understanding and interest in actuarial studies. His anecdotes about learning and working as an actuary were relatable and motivating. Overall, I found the subject very enjoyable and a strong introduction to key actuarial concepts. I would even recommend ACTL10001 to non-actuarial students who enjoy maths or finance, as it requires no prior knowledge and offers valuable, practical insights.

MAST10005 Calculus 1 [SM1]

Exemption Status	None
Prerequisites	None
Lecturer(s)	Dr Gufang Zhao Dr Yaping Yang Dr Daniel Murfet
Weekly Contact Hours	3 x 1-hour lecture 1 x 1-hour tutorial 1 x 1-hour workshop
Assessments	Fortnightly Assignments - 15% Mid-Semester Written Test - 15% Final Exam (not hurdle) - 70%
Textbook recommendation	None
Lecture Capture	Full audio + video
Year and Semester Reviewed	2024 Semester 1

Subject Content

Calculus 1 extends upon the topics of functions and calculus and introduces vectors and complex numbers. This subject best compares in level and content to the more basic topics in Specialist Maths, for example you learn how to differentiate inverse trigonometric functions and integrate first order differential equations.

1. **The language of mathematics**

This first topic is the most theoretical and outside of Specialist Maths also; you are introduced to injectivity, surjectivity and bijectivity and there is a large focus on proofs and different ways of proving theorems. As an introduction to uni maths this first topic is quite conceptual and abstract.

2. **The Fundamental Theorem of Algebra**

This topic introduces complex numbers with the assumption that you have no background knowledge; a short, reasonably paced and straightforward topic which is much more numbers-based than the proofs and theorems in the first topic.

3. **Differential and Integral Calculus**

This topic is by far the longest; taking up almost half the course. It's a deep dive into calculus: here you cover differentiation techniques, implicit differentiation and sketching their graphs, integration and differential equations.

4. **Mathematics in Higher Dimensions**

This final topic is the shortest, introducing vectors and finishing with parametric curves. This is mostly formula-based; most of the exam and practice questions are some variants of lecture slide examples.

Lectures

The lecture slides for each topic are added to the LMS a week or so before the start of each topic. Most of these slides are filled with either theorems, definitions or relevant examples. However, the examples are left completely blank and are only filled in by the lecturers during lectures, thus attending the lectures or watching them online is essential for learning how to properly write out mathematical solutions, particularly for more theoretical topics.

Tutorials

There is no attendance requirement for tutorials or workshops in this subject, however they are beneficial in numerous ways. Tutorial questions are more theoretical-based whilst workshop questions are more practical.

In tutorials, you work in small groups of no more than 4 on whiteboards to work through problem sets each week which relate to the previous week's lectures. These questions are much more theoretical in nature and are more helpful for understanding why certain theorems work or how they come to be. Understanding these foundations is immensely beneficial for then being able to apply this knowledge to more practical questions, such as those in workshops. Your tutor for this class marks your assignments so this is also an opportunity to get their insights and get instant feedback on your thinking processes and methodologies.

In workshops, you sit in larger classrooms and individually, or in a group, work through a problem sheet which relates the previous week's lecture. This is more helpful for getting in practice for the types of questions you may be asked in exams and the questions worked through in the worked examples; helping to cement knowledge learnt in lectures and tutorials. Around three tutors attend these, who are also readily available to help you better understand concepts and questions, particularly if the topics are all new.

Finally, both are opportunities to make new friends and study buddies, who can expand the ways in which you think about approaching questions.

Assessments

Fortnightly Assignments x 6 (Written component + Webwork component)

The best 5 of the 6 fortnightly assignments count to 15% of your final mark. They are released on alternating Mondays/Wednesdays (10-day turn-around) after the content is presented, and you generally have 10 days to complete them. Each assignment consists of a few Webwork questions you are encouraged to complete first, followed by 3 written questions with several sub-parts. The Webwork questions are quite straightforward, whilst the written questions are somewhat harder than the level of the worked examples in lectures. However, with a solid understanding built by workshop and tutorial attendance these questions are very doable and would not require more than 2 hours to complete.

Mid-Semester Test

Only one practice test was provided for the MST, however the test is highly predictable; easier than assignment questions and mostly drawing upon the format of worked examples. No notes or calculators are allowed, however a few formulas are provided. Furthermore, an overview of the exact sub-topics and definitions that will be assessed is provided making preparation straightforward and very doable. The MST takes place during your scheduled lecture time on a Monday, with 45 minutes of writing time for several MCQ and several short-answer questions (half a page or less each). The whole test is 3 pages, totalling 20 marks and covering topics 1 and 2. As long as you have done the questions provided in tutorials and workshops and the worked examples from lecture slides, the MST is a chance to gain some easy marks. Students who did not familiarise themselves with these questions, particularly proofs, did not succeed.

Final Exam

The End of Year Exam is a 3-hour long written test with 15 minutes of reading time. No notes or calculator is permitted but a formula sheet is provided. Whilst not a hurdle requirement, the exam contributes to 70% of your final mark and is thus a large contributor to success or failure in the subject which should not be underestimated. Only one sample exam is provided so most preparation comes from tutorial, workshop and lecture questions as well as extensive problem sheets which are provided for each topic. The questions range in level of difficulty from simpler MCQs to harder questions comparable to those on practice problem sheets and finally more difficult questions outside the scope of familiar questions that require you to draw upon your Calculs 1 knowledge to answer. The exam is not too time pressured given you time manage wisely and postpone the more difficult types of questions for the end.

Overall Remarks

Transitioning from high school maths to university-level maths, the first topic in this subject is quite the introduction. Those who completed Specialist Mathematics will find it extremely doable; only the first topic really deviates from the topics taught in high school. However, the biggest difference is definitely the explanations expected in university; sentences and words in your solutions are essential for success and thus knowing how to correctly and clearly explain your thinking processes is crucial.

With three lectures a week, a tutorial, a workshop and regular assignments, it is essential to not fall behind as this can jeopardise your understanding of topics and mathematical processes and ultimately hinder your final grade. With so many resources given to you through all these contact hours, the workload can sometimes feel overwhelming, however ensuring you know all the concepts presented in lectures and the correct way to answer questions in each topic is the most important key to success in this subject. Because very few practice MSTs and final exams are given, practice problems, tutorial and workshop questions are the best way to gain confidence in this subject.

Calculus 1 is fundamentally a subject that provides students with the knowledge taught in Specialist Mathematics whilst also providing a short but unfortunately memorable

introduction to theoretical maths. Success in this subject is highly achievable by simply attending the scheduled classes and completing the weekly work; not much extra study is required as the concepts are, for the most part, quite introductory in nature. This subject sets you up well for other uni subjects such as Calculus 2 and Linear Algebra, a sweet but useful introduction to university mathematics.

MAST10006 Calculus 2 [SM1]

Exemption Status	Not an exemption subject, but it is a prerequisite for ACTL20001 *Introductory Financial Mathematics* (CM1 Actuarial Mathematics I)
Prerequisites	A study score of at least 29 in VCE Specialist Mathematics 3/4, or equivalent OR MAST10005 Calculus 1
Lecturer(s)	Professor Sanming Zhou Dr Justine Fasquel Dr Lance Gurney
Weekly Contact Hours	3 x 1-hour lecture 1 x 1-hour tutorial
Assessments	Weekly Assignments - 15% Mid-Semester Written Test - 15% Final Exam (not hurdle) - 70%
Textbook recommendation	None
Lecture Capture	Full audio + video
Year and Semester Reviewed	2024 Semester 1

Subject Content

Calculus 2 extends on the calculus previously learnt in the prerequisite subjects, with the expansion into three-dimensional calculus and introductions to infinite series, complex exponentials, differential equations, and more.

1. **Limits, Continuity, Sequences, and Series**
   This topic covers the theorems, techniques, and tests associated with limits, sequences, and series. Practice and exposure to questions are necessary to become familiar with the different techniques needed to tackle some of the more creative problems.
2. **Hyperbolic Functions**
   A brief and straightforward introduction to hyperbolic functions and their identities.
3. **Complex numbers**
   This topic introduces the complex exponential, along with differentiation and integration via the complex exponential. Complex numbers are expressed differently from what is taught in VCE Specialist, with the complex exponential form being more versatile to use.
4. **Integral Calculus**
   Most of this topic (integration techniques and partial fractions) is covered in VCE Specialist at a comparable level but is also thoroughly explained in lectures.

Trigonometric and hyperbolic substitutions can be challenging but are formulaic to use and solve.

5. **First Order Differential Equations**
   This topic introduces first order ODEs and the methods to solve them. It also involves the qualitative analysis of ODEs, including analysing the equilibria and phase plots. The concepts are applied to population models and mixing problems.
6. **Second Order Ordinary Differential Equations**
   This topic introduces second order ODEs, how to solve them in their homogeneous and inhomogeneous forms, and their applications to springs.
7. **Functions of Two Variables**
   All to do with functions of two variables including their limits, continuity, and sketching them. Partial derivatives are heavily featured in the calculation of tangent planes, linear approximations, directional derivatives, gradient vectors.

Lectures

The complete lecture slides are provided on LMS before the semester starts and students are expected to work through the slides alongside the lecturers during lectures. The lectures consist of brief explanations of the concept followed by multiple worked examples. The heavy emphasis on questions and explanations in lectures make them worth attending. Note that many students report difficulty hearing the lecturers in the JH Michell Theatre, while the audio in the recorded lectures is clear and without issues.

Tutorials

Although there is no attendance requirement for tutorials, attending them is beneficial for several reasons. Firstly, the tutor often shares common errors from the previous week's assignment or the upcoming topics, which can help you avoid these mistakes. Secondly, working through questions as a group can provide insight into different and more efficient techniques or ways of thinking. Lastly, having a tutor accessible while attempting questions means you receive immediate feedback on details that might easily be overlooked during private study.

Assessments

Weekly Assignments (5 x Written and 2 x Online)

The best 6 of the 7 weekly assignments count towards 15% of the final grade. They are released the Monday after the content is presented and are due one week later. Each assignment consists of 2-3 questions with several parts, but only one of the questions will be assessed. The difficulty level is similar to that of the lecture examples and tutorial questions, making the assignments very doable and requiring only 1-2 hours to complete.

Mid-Semester Test

The Mid-Semester Test is a new addition to the subject, introduced only in the summer term. No practice tests were provided, so students were directed to revise using relevant questions from past end-of-semester exams. No notes or calculators are allowed, but a summary sheet is provided. There is 45 minutes of writing time to complete 3 questions,

totalling 60 marks. The first two questions were one-part questions focused on series and first order differential ODEs, respectively, but the last question had several components involving complex numbers, integral calculus, and second order ODEs. The questions varied significantly in complexity but were not excessively difficult. Some students struggled to complete the test due to the range of questions and the time constraint.

End of Year Exam

The End of Year Exam is a 3-hour long written test with 15 minutes of reading time. A double-sided A4 sheet of notes is permitted, and a formula sheet is provided. Although there is no hurdle requirement for the exam, it contributes significantly (70%) to the final grade, making it crucial to perform well if you are aiming for a high grade. Six past exam papers are provided for revision, which is plenty for adequate preparation. Due to the length and rigour of the exam, it is essential to practice past exams under timed conditions. The difficulty of the questions is comparable to the assignment questions, though they may be more challenging and require unwavering confidence to continue in face of messy algebra.

Overall remarks

Prior knowledge is beneficial but not necessary to succeed in this subject. The lecturers do a thorough job of explaining the mathematical processes throughout the course. Due to the heavy content load and fast pace of the lectures, falling behind can be extremely detrimental and demotivating. I recommend staying on top of the weekly lectures at the very least. This should be achievable, as completing the weekly assignments requires an adequate understanding of each topic.

The exercise sheets contain additional practice questions and are completed individually. Although they are not assessed, I found them to be highly beneficial. The questions progress from simple to challenging and help to consolidate the fundamentals of each topic. While they do not always reflect the style of questions found in exams, they are excellent for establishing the fluidity required in timed assessments.

Calculus 2 is a well-organised and well-presented subject that builds on several key topics introduced in VCE Specialist. It is entirely possible to succeed in this subject regardless of previous performance if you stay on top of the content, attempt practice questions, and prepare effectively for the tests. I found this subject to be very enjoyable, as it covers a diverse range of topics to an engaging yet manageable depth and offers the potential to develop strong mathematical intuition in the relevant areas.

MAST10007 Linear Algebra [SM1]

Exemption Status	Not an exemption subject, but it is a prerequisite for ACTL20001 *Introductory Financial Mathematics* (CM1 Actuarial Mathematics I)
Prerequisites	A study score of at least 27 in VCE Specialist Mathematics 3,4 or equivalent OR MAST10005 Calculus 1
Lecturer(s)	Prof. Nora Ganter, Dr. Jean-Emile Bourgine, Dr. Guillaume Laplante-Anfossi
Weekly Contact Hours	3 x 1-hour Lectures 1 x 1-hour Tutorial 1 x 1-hour MATLAB Practical
Assessments	6 weekly assessments 12% Mid-semester test 8% MATLAB test 10% Final Exam (not hurdle) – 70%
Textbook recommendation	Linear Algebra - Jim Hefferon ✗ Not recommended - repeats lecture content just with more examples
Lecture Capture	Full audio + video
Year and Semester Reviewed	2024 Semester 1

Subject Content

1. **Matrices and Vectors**
   The first topic is ultimately just high school revision, covering preliminary matrix concepts such as scalars, combinations, transformations, and projections. The vector transpose and Frobenius product are also introduced.
2. **Linear Equations**
   This topic introduces the Gauss-Jordan algorithm; A technique used countless times throughout the course to solve equations and determine a matrix's rank and nullity. Students should become proficient in using the Gauss-Jordan algorithm as full marks can only be obtained when full working is shown.
3. **Vector spaces and Linear transformations**
   The sub-topics cover vector spaces and subspaces, linear combinations, and linear transformations. Students should be able to recall the axioms and key theory points explicitly outlined in the lecture slides. Several worked examples are used to prove

whether a statement satisfies these aforementioned axioms. Once the topics within this section are mastered then most questions relating to them within are straightforward as they become repetitive.

4. **Bases and Dimension**
   This section tends to be most difficult and unfamiliar to students. It covers an onslaught of topics such as spans, orthogonal projections, change of coordinates, dimension, the four fundamental subspaces and determinants. Some explanations of concepts were unnecessarily convoluted and thus confusing. Change of basis relies entirely on a new set of notations that may take students some time to understand. This topic makes way for many assessable question types so students must practice a wide variety of questions in their own time to truly understand the content.
5. **Inner Products**
   This section introduces students to inner products and inner product spaces, as well as applications of these such as the Gram-Schmidt algorithm and the cross-product. Like topic 3, questions related to the topics in this section become relatively straightforward when definitions and processes are memorised as again, they become repetitive.
6. **Eigenvalues and Eigenvectors**
   The last section is one of the more straightforward of the entire course, with students being introduced to eigenvalues and their corresponding eigenvectors as well as the concepts of diagonalisation, matrix powers and real symmetric matrices. This section usually has some of the most easily obtained marks in assessments. Students should practice the methods shown per the lecture workings in finding eigenvalues and eigenvectors.

Almost every topic contained a rinse-and-repeat computational method that had assessable potential and guaranteed a handful of marks. It is important to note where theory has explicitly been cited in worked examples as students are expected to do the same. The content wasn't highly reliant on Specialist however requires similar quick-thinking skills.

Lectures

Nora would introduce a new topic and always explain it using a worked example. Sometimes key terminology lacked a concise explanation which led to confusion and necessary post-lecture clarification. All materials are uploaded on Canvas appropriately. It is the bare minimum that you keep up with the free exercise book provided on Canvas. Pre-reading was beneficial due to the fast-paced nature of lectures and keeping up to date is essential for the (2%) weekly assignments.

This subject does require you to engage immediately as topics are dependent on previously taught content. Annotated slides were ONLY available when the entire document was completed (near exams). Out of the two streams, Nora's was the 'benchmark stream' as she was coordinating it that semester.

Tutorials

There was no formal teaching nor lecture reviews conducted by tutors in tutorials (stand-up group whiteboard work). Solutions are posted at the end of the week however I'd advise against skipping tutorials as they are quite helpful. Tutorial sheets did have some eccentric applications but were heavily related to and were often mentioned in lectures. The idea of working in groups may seem juvenile to those who prefer to work independently, but it was worthwhile seeing how others approached the subject.

Assessments

Mid-Semester Test:

Completed on WebWork from home and timed (45 minutes). The mid-semester test was relatively similar to the practice WebWork, assessing fundamental concepts taught up until a signified week. Pay attention to what topics the current lecturer as I believe it varies between semesters.

MATLAB Test:

An in-class timed WebWork test during a student's lab in week twelve and timed (45 minutes). Ultimately, this test assessed the MATLAB functions taught during labs and how they could be applied to the fundamental concepts in linear algebra topics. Students can easily receive a reasonable grade by completing the weekly lab sheets and using the practice test provided. Students were given working papers to use during the test. Researching summary MATLAB sheets may be beneficial for revision.

Weekly Written Assignments:

We had 6 weekly assignments that made up a total of 12% of a student's final grade (2% each). I found that this weighting was unjust considering the time required to complete them however it allowed those who understood the assignments to shine in the exam (more mentioned later). There were also no mark allocations labelled on the assignment and the marking keys were often quite harsh, often using half marks.

The topic coverage on assessments was very straightforward compared to assignments and tutorial questions. Completing the practice materials provided and attending the weekly computer lab was sufficient to obtain a more-than-reasonable mark. There are no hurdle requirements. Summary statistics for assessments were posted on the Ed Board upon request.

Exam

There were some very elementary formulas on the front of the exam paper and an A4 double-sided note sheet was allowed. We were strongly encouraged to bring the tetrahedron we crafted for an assignment into the exam which was fun but rather useless. Some exam questions strongly resemble previous assignment questions, and I highly recommend comparing your assignment results to the solutions (which are uploaded to Canvas) before your exam. Keep an eye out for abstract examples that reappear in lectures, subsequent tutorial questions and assignment questions as these were also used

throughout our exam. I'd also suggest becoming familiar with brainstorming examples of matrices given a set of specific characteristics under exam conditions.

Overall remarks

I particularly struggled with this course. That said, this is most likely due to my prejudice against matrices, and high marks are definitely achievable with consistency. Marks lost throughout the semester can be recovered in the heavily weighted exam. Prior knowledge on vectors in 3D is very useful. I fell behind around the coordinate-bases topics and I highly regret this – it was assessed frequently. I highly recommend understanding this topic ASAP! Despite my prejudices towards the subject, the lecturers were enthusiastic and open to questions during lectures. The Ed Discussion page was quite a good resource as staff would always reply within a few hours – also keep an eye on Ed Discussion pages leading up to exams. Nora also mentioned Gil Strang's free MIT Linear Algebra course; It is worth a watch if you are struggling with fundamental concepts as the content overlaps.

MAST10008 Accelerated Mathematics 1 [SM1]

Exemption Status	Not an exemption subject, but it is a prerequisite for ACTL20001 *Introductory Financial Mathematics* (CM1 Actuarial Mathematics I)
Prerequisites	A study score of at least 38 in VCE Specialist Mathematics 3,4 or equivalent
Lecturer(s)	A/Prof Alexandru Ghitza
Weekly Contact Hours	4 × 1-hour lecture 1 × 1-hour tutorial 1 x 1-hour lab tutorial
Assessments	3 x Online Assignments 7.5% 3 x Written Assignments 7.5% Lab (MATLAB) Test 5% Final Exam 80%
Textbook Recommendation	Anton, H, & Rorres C, 2013, Elementary Linear Algebra, Applications Version, 11th edn, Wiley ✗ Not recommended. The textbook may give you more questions to practice with, but the supplied lectures and question topic sheets give you more than enough information and questions to get a good grasp at the topics.
Lecture Capture	Full (both audio and video)
Year and Semester Reviewed	2024 Semester 1

Subject Content

1. **Introduction to rigorous mathematics:** As the name of this topic suggests – the first week was a stark introduction to the depth and rigour expected from this subject and tertiary mathematics. Proofing techniques from high school were revised, and also further developed to definitions and proofs involving sets, functions, 'countability'. There also was some pre-reading to be done before the semester about complex numbers (mostly revision), for the purpose of being introduced to the complex exponential.
2. **Matrices and linear equations:** This topic provides the backbone of 'Linear Algebra', introducing us to the essential computational tool in this subject - matrices. We were exposed to axiomatic treatment of linear systems, elementary row operations, reduced row echelon forms, matrix arithmetic and determinants. This topic was straightforward but does take some time to get used to if you haven't worked with matrices before.

3. **Vector spaces and linear transformations:** This topic covers definitions and operations of vectors, vector spaces, linear transformations, bases, eigenvectors and eigenvalues. A degree of further 'abstraction' is required to grasp this topic, compared to high school. In this topic, especially due to the axiomatic treatment of theorems and lemmas, the proofs seem more complicated than they really are, and it really helps to confidently recall and use the definitions taught in lectures.
4. **Inner product spaces:** This topic covers inner product spaces, orthogonality, and orthogonal projections. Intuitively, the notions of 'length of vectors' and 'perpendicular vectors' are generalised to a broader context – with relevance to the previous topic. Albeit short, this topic is quite important and I found the proofs explored in this topic the most fruitful for personal enjoyment.
5. **Some applications:** This topic was entirely revision from high school solid geometry, with familiar concepts of vector planes, lines and vector cross product. It was definitely a relief following the previous couple of heavy topics. The end of this topic marks the conclusion of the 'Linear Algebra' content in this subject.
6. **Introduction to multivariable calculus:** This topic comprises the 'Calculus II' content in this subject, and was taught very quickly and briefly, being the last one. Definitions and illustrations of functions in two variables, as well as limits and partial derivatives were explored. Directional derivatives, stationary points and double integrals were also a part of this topic. There wasn't much time offered to thoroughly digest this topic, but it still remained quite straightforward compared to earlier topics.

Lectures

Alex is a super engaging lecturer and teaches in a very relaxed manner that makes all the heavy content seem more intuitive (sometimes even trivial). The 4 lectures per week is a lot, especially if you intend to complete most of the practice problems that supplement every lecture. This is because the fast-paced nature of this subject does not offer too much time for you to properly sit and 'think' about new concepts or proofs that you encounter. Hence, I would recommend being extremely sharp and switched-on during lectures (I personally chowed on caffeinated gum during every lecture), as this will save you time in your own revision if you are able to immediately grasp something during the lectures.

Tutorials

The computer lab and tutorial do not have compulsory attendance, but are extremely well worth your time. The 1-hour 'tutorial' involved us splitting up into small groups working on practice questions to apply theory learnt from the previous week. I had the most fun in this subject collaborating with peers to solve weekly tutorial problem sets, with the guidance of Nick – an excellent tutor I was fortunate to have. The 1-hour computer lab helps you to consolidate, often in a visual manner, the topics that you learn. The computer lab worksheet provides very straightforward and comprehensive instructions on how to use MATLAB and familiarise yourself with the language, which is helpful for someone with no prior experience with coding. These labs culminate in a MATLAB test in Week 12, so I recommend that you complete all the worksheets.

Assessment

Online Assignments

There were three webwork assignments spread evenly throughout the semester. They were all quite low stakes as you were given 3 attempts for each question, with no time limit. The questions themselves were also straightforward if you understand the content. These assignments usually stay open for a week which is plenty of time.

Written Assignments

These assignments are usually open at the end of 'big' topics. The most challenging problems in this subject are found in these assignments. The level of abstraction found in these problems is a step up from the lectures, and will be nothing like you have seen in high school. To score well on these assignments, the best tip I would recommend is to strictly use only the definitions and logic you are taught in the lectures, and avoid the 'high school mindset' of writing meaningless algebra, or things that you see on the internet. Luckily, each assignment isn't worth much of your grade, so it is best to view these assignments as genuine opportunities to learn and consolidate knowledge. Also, unlike high school mathematics, ChatGPT is hopeless at solving the problems in these assignments – speaking from personal experience.

MATLAB Test

The test is 45 minutes and questions are provided and answered on Webwork but solved using MATLAB. It is conducted in your usual computer lab session. There is a practice MATLAB test available the week prior. It also helps to consolidate the worksheets handed out from previous weeks to familiarise yourself with MATLAB. The actual questions in this test are not that difficult, but there is some time pressure in this test.

Exam

The exam was in-person and 3 hours, allowing one double-sided A4 page of notes and no calculator. The exam is less daunting than one would presume, because there are relatively less proofs and more computational problems. Most of the questions are all very similar to Alex's previous exams. A recommendation of not just mine, but also my tutor, was to complete all the tutorial sheet problems – as mastering these problems would put you in a comfortable place to score highly on the exam. There wasn't much time pressure, and I was able to answer all questions, although without much time for checking.

Overall Remarks

AM1 is quite a content-heavy and fast-paced subject that requires a lot of effort to stay up to date. I'd strongly recommend that you do not fall behind in this subject. Ultimately, having a deep understanding of concepts and sticking to the proof techniques taught in lectures and tutorials will help you go a long way. Never be afraid to ask questions to Alex, your tutors, the Ed discussion board, and please attend the tutorials, consultations and labs. Overall, AM1 is a very rewarding subject, and offers a great introduction to proof-based tertiary mathematics. Scoring a H1 is very manageable, and despite what others say, there's nothing to be scared of in this subject – your peers in MAST10007 Linear Algebra are essentially learning the same content as you are.

MAST10008 Accelerated Mathematics 2 [SM2]

Exemption Status	Not an exemption subject, but it is a prerequisite for ACTL20001 *Introductory Financial Mathematics* (CM1 Actuarial Mathematics I)
Prerequisites	A study score of at least 38 in VCE Specialist Mathematics 3,4 or equivalent
Lecturer(s)	Prof Jan de Gier
Weekly Contact Hours	4 × 1-hour lecture 1 × 1-hour tutorial
Assessments	2 x Written Assignments 5% Mid-semester Test 10% Final Exam 80%
Textbook Recommendation	Hughes, B, 2023, MAST10009 Accelerated Mathematics 2 Textbook ✓ Recommended. There is no external textbook however the given textbook is tailored for this subject and gives explanations and examples to all the content.
Lecture Capture	Full* (both audio and video) *Sometimes hard to see worked examples on the blackboard
Year and Semester Reviewed	2024 Semester 2

Comments

The highly rigorous and fast-paced nature of the subject can be overwhelming at times. Keeping up with lectures will already be a challenge. This subject will challenge any preconceived notions of mathematics you may have from high school, and builds mathematics from axiomatic principles.
Also, there is some pre-reading to be done before commencement of this subject. Ensure you read all of it – especially the rigorous construction of number sets – as this will be assumed knowledge during the subject.

Subject Content

MAST10009 Accelerated Mathematics 2, builds on MAST10008 Accelerated Mathematics 1, to cover prerequisites for 3 mathematics subjects, being MAST10005 Linear Algebra, MAST10006 Calculus 2, and MAST20006 Real Analysis. This subject will be one of the most challenging subjects in your entire undergraduate degree. The content may not be the most advanced but the pace at which you learn is what you expect given MAST10009 covers

topics from both Calculus 2 and Real Analysis. The topics covered are very interesting but often require deep thinking and time to fully understand. Keeping up to date was a challenge, however, given the structured manner Jan employs, students can easily track their progress.

1. **Sequences**
   Right from the get-go, the lectures of this subject are rather daunting - establishing rigorous definitions and proofing techniques of convergence, divergence, asymptotic behaviour, Landau's symbols, the order hierarchy and limits of sequences. Construction of epsilon-*N*, and *K*-*N* proofs are essential skills needed for the entire subject, and become much easier with practice. Also, you will explore topics such as boundedness, suprema and infima, which will allow you to analyse real number sets, and are very useful for proving essential theorems. All of the content in the pre-reading and first lectures builds the foundation for what we call 'Real Analysis'.
2. **Functions, Limits and Continuity**
   The concepts explored in sequences are now applied to real functions. Rigorous definitions of convergence, continuity, and limits of functions are explored. The proofs covered follow a similar manner that you are exposed to in the first topic, and the techniques used should seem a bit more intuitive. Again, this is a foundation topic for the rest of the subject, and will be heavily assessed.
3. **Differential Calculus**
   This topic builds upon high-school calculus, establishing the definition of differentiability. Personally, while the name of this topic seems familiar from high school, I found this topic even more difficult than the previous two. Many new theorems, such as L'Hopital's Rule and Mean Value Theorem are introduced and proved rigorously. On top of these theorems, hyperbolic trigonometric functions are also covered, looking at identities and converting between different forms of these functions. You will be able to derive familiar algorithms such as Newton's Method, and prove why they work.
4. **Integral Calculus**
   Described by Jan himself as the hardest topic in this subject, prepare to spend lots of time understanding this content. The definition of the definite integral, partitions, Riemann Sums, Darboux Integrals and Riemann integrability are given. You will rigorously analyse which types of functions are Riemann integrable, and not integrable, as well as being exposed to a rigorous proof of the Fundamental Theorem of Calculus. This topic is quite heavily assessed, probably because it's known that students find it hardest.
5. **Differential Equations**
   This topic looks at the different types of differential equations and how to approach and solve these equations. Mostly just Calculus II content, this topic serves as the first relief in this subject from extensively rigorous mathematics. The differential equations are applied to models of population growth, spring motion, mixing, and electric circuits. This topic was most similar to high school mathematics, and it should be noted that the examples given in the lecture slides are rather overly generalised and complicated. The questions in this topic are almost always computational, not proof-based.

6. **Improper Integrals**
   This topic explores integrals where the integrand may be undefined over given terminals, or where the terminal(s) for the integral is infinite. After defining improper integrals, this topic then covers various tests in assessing improper Riemann integrability, rigorously proving each test. This is a very interesting topic for actuarial students, as part of this topic is the introduction of the Gamma function, and analysis of probability density functions.
7. **Infinite Series**
   This topic defines infinite series, bringing together many concepts first introduced at the start of the subject, such as sequences of functions and uniform convergence. Similar to the previous topics, tests to determine convergence/divergence of infinite series are introduced and rigorously proved. Students are exposed to establishing the existence, and the construction of Taylor Series, Power Series and Fourier Series. Famous series such as the Zeta Function and the Basel Series are explored, and again, this was a very interesting topic.

Lectures

Lectures are very fast-paced, content-heavy and delivered through four 1-hour lectures throughout the week. In every lecture, Jan will cover a few worked examples illustrating nuances and important subtleties which attention should be given to. The lectures are very well-structured and follow the textbook, which essentially is the lecture slides. It is highly recommended to use the textbook in tandem with lectures, reading ahead when you can. Jan is a fantastic lecturer, staying behind to answer questions every time and genuinely tries to help you understand the content.

Tutorials

The tutorials for this subject were not compulsory, however, were a good resource to ask questions and seek clarification. I would recommend attending as many of these as possible. In these tutorials, selected problems from the textbook are done in collaborative small groups, under the guidance of a tutor.

Assessment

Assignments 1 & 2

There were two assignments spread over the semester, each worth 5% of your total grade. These assignments were much more difficult compared to the textbook problems and lecture examples. Each assignment was due within two weeks, which is ample time, but leaving the assignment to the last couple of days is not recommended. This semester, both assignments were quite difficult, but served as valuable tools in developing solid understanding of the first 5 topics. Also, taking the time to review feedback given after the assignment will tremendously help with your understanding of the subject.

Mid-Semester Exam

A 45-minute supervised test which was worth 10% of the final grade. This semester the MST covered content from the first 20 lectures, and would have been extremely challenging if

you were not completely familiar with all relevant concepts. I found this MST to be quite similar in difficulty to the final exam, so your performance in this test would indicate the trajectory of your progression in the subject as a whole. I highly recommend reading all feedback given to you in this MST, even if you score highly.

Final Exam

The end of semester exam was out of 100 marks this year and was quite challenging. No calculator, notes or formula sheet was allowed, which meant that you had to remember pretty much every single theorem and their conditions, as well as proof techniques. It was similar in difficulty to all of Jan's past exams (i.e., past papers up to and including 2020). Don't go into the exam hoping that the hardest topics won't be assessed – almost all of them will appear. In preparation, I would recommend doing all of Jan's practice exams, as well as past papers from MAST20006 Real Analysis, before attending consultations held in SWOTVAC with Jan. No solutions are provided, but in these consultations, Jan guides you extremely well to deduce solutions for yourself.

Overall Remarks

Claimed by Jan to be "the hardest subject you will do in your undergrad", it's natural to feel intimidated by MAST10009. Prioritising a thorough understanding of the content, which in itself is a huge investment of time, will get you far in this subject. Be sure to ask your peers, Jan and your tutor questions if you are unsure about anything. If you are completely familiar with all definitions and theorems, and know when to use them in your proofs, you are bound to score highly in this subject. By far, this subject is the most rewarding thing I have studied so far. Coming from somebody who scored a H1 despite averaging poorly before the final exam, you are capable of more than you think, make sure you try your best, and good luck!

Subject Reviews: Second-Year Subjects

MGMT20001 Organisational Behaviour [Summer Term]

Exemption Status	Not an exemption subject, but it is compulsory for the *Bachelor of Commerce*
Prerequisites	None
Lecturer(s)	Dr Bec Rees
Weekly Contact Hours	2 × 1-hour lecture 2 × 1-hour tutorial
Assessments	Tutorial Participation and Attendance 10% Individual Assignment 10% Group Assignment 30% Final Examination 50%
Textbook recommendation	*Mc Shane et al, 2018, Organisational Behaviour, 6th edn, McGraw-Hill* ✓ *Recommended. The textbook WILL be required to be read through for the assignments and final exam*
Lecture Capture	Full audio + video
Year and Semester Reviewed	2024 Summer

Subject Content

Organisational behaviour intends to introduce you to what are known as "micro" and "macro" approaches to understanding how people behave in organisations. Using this simple way of dividing up the social world of organisations. This subject also introduces you to a range of conceptual and practical skills that will help you throughout your education and in the workplace.

1. Contrasting Management Approaches: Scientific Management and Human Relations Approaches present different understandings of what shapes behaviour in organisations and how this should inform management.

"Micro" Topics:

2. Perception, Attribution & Decision Making: This topic discusses perception which is the process of organising and interpreting sensory data to make sense of your environment. It

also discusses perception which is a form the basis of much of our behaviour in organisations. Attributions allow us to observe people's behaviours and attribute internal or external causal factors.

3. Teams & Leadership: This topic discusses the advantages of teams, types of teams and how teams evolve over their life cycle. This topic also discusses the different types of leadership styles, which ones are beneficial and which ones fit particular people with different habits.

4. Values, Attitudes & Behaviours: This topic investigates what behaviour is influenced by and how a particular individual's values and attitudes can affect their behaviour. Values provide the normative basis of attitudes, which are evaluative statements about an object, person or event.

5. Motivation: This topic introduces the notion that theories of motivation form the basis for practical interventions in organisations. These interventions attempt to encourage desirable behaviours (e.g., citizenship behaviour) and discourage undesirable behaviours (e.g., unethical behaviour). These theories consider what motivates behaviour, as well as the process of thinking that motivates individual behaviour.

6. Conflict & Negotiation: Conflict is defined as when two or more parties have competing interests. This topic discusses how conflict can be managed, as it cannot be eliminated entirely and how conflict can be beneficial to a group and its performance.

"Macro" Topics:

7. Ethics: Ethics is a branch of philosophy which considers questions about morality – what is right and what is wrong – and how we should behave. This topic discusses ethical norms and what values and beliefs are considered unethical. Additionally it is also discussed how individuals and organisations can take steps to promote ethical behaviours and discourage unethical behaviours.

8. Organisational Change: This topic discusses how organisations operate in a dynamic environment requiring them to change. The topic also introduces a framework in which an organisation can follow to change successfully; employees at a company may resist change, however there are methods to overcome resistance and support permanent change.

9. Organisational Culture: Organisational culture is the usual way of thinking and doing things which is shared by all organisational members. This topic discusses how new members must learn the culture in order to be accepted into the organisation and there are three theories which can help explain the patterns of behaviour of individuals caused by the organisational culture.

10. Organisational Communication: There are two approaches to communication in an organisation, functional and meaning-centered. These theories have different assumptions

and provide different insights into the communication process and its outcomes, by applying these theories communication inefficiencies can be identified and fixed.

11. Power and Influence: Power is especially strong in organisations due to hierarchies. This topic discusses the three main dimensions of power (first, second and third) and investigates how the three dimensions demonstrate the different ways in which power can be used in an organisation.

Lectures

There are lectures twice a week since the subject was in the Summer semester. Due to the Summer semester structure, the content is very fast-paced, going through 2 weeks worth of normal semester content in 1 week meaning you have to stay on top of the content yourself. You need to consolidate your learning in each lecture within one day to make sure you can attempt the tutorial in the following day.

Tutorials

The tutorials are basic and self intuitive but take a while to complete. You must go to the tutorials, participate in the tutorials and complete the tutorial quiz before the tutorial to obtain the tutorial attendance and participation marks. With the Summer semester structure you are very tight on time between what you have just learnt in the lecture and what questions you will be asked during the tutorial, with that timeframe being a day or two. Most of the work done in tutorials is group based, however it is encouraged to look at the questions beforehand.

Assessments

Tutorial Preparation, Participation and Contribution:

This requires you to just do the pre-tutorial "Preparation Quiz: Knowledge Testing" quiz before the tutorial and the "Preparation Quiz: Application of Theory" quiz after the tutorial. Additionally, you must arrive at the tutorial on time and participate in group discussions to get the other marks. As long as you do the above you should get all the marks available for this assessment.

Assignments:

There were two assignments, the individual one weighted 10% and the group one weighted 30%. The assignment marking is very unforgiving and really dependent on your tutor. Even if you feel like you did amazing on an assignment, most students get a grade between 70% and 79%, and this was a common theme with some particular tutors being nicer than others during the Summer semester for this subject.

Individual Assignment:

The first, individual, assignment comes really quickly (within the first 2 weeks of the Summer semester). So get it done nice and early as soon as you have finished the content so you can focus on getting through the new content as the content keeps on going and doesn't stop. The assignment is a written essay broken up into a few questions with a total of 1000 words.

Doing the assignment early allows you to also proof read it and make it sound better, usually there are no "incorrect" answers to the assignment questions usually and you are assessed on your ability to answer the questions with support from the theories in the weekly readings, lecture notes and tutorial questions.

Group Assignment:
This assignment is 30% of your final grade and is broken up into 4 key parts: Team Contract, Team Structural Plan, Group Case Study Report, Group Assignment Peer Review. Your group is between 3-4 people and can only be formed with people in your tutorial so it is helpful if you have some friends you are comfortable doing the assignment with in the same tutorial as you. The team contract and team structural plan are not too difficult, just follow the given instructions and you should be able to get 100%. Same with the peer review as long as you participated to your groups expectations you should grade each other 5/5 awarding you full marks in that section. Finally, the main part is the actual group case study report, consisting of 5000 words, where you pretty much write up your structural plan into an essay, usually broken into 2 parts and broken into subheadings. Follow your tutors recommendations with the feedback given with the structural plan. In the essay you will need to draw on reputable online sources, weekly readings, the textbook and tutorial questions to get high marks. Again the marking is usually harsh with most groups getting a score of between 70% and 79% with few getting a H1.

End-of-semester exam:
The exam was 3 hours, held in-person and typed up on a laptop. The exam is traditionally broken down into 4 questions: question 1 being covering a single lecture between lectures 1-8 (the "micro" topics) and questions 2-4 covering a single lecture between lectures 9-12 (the "macro" topics). The "micro" topic question is you applying the course material and theories to how your group assignment went and reflecting on your experience in it. The other "macro" topic questions are based upon one of the case studies you will have analysed in tutorials.

Overall remarks

This subject gets a lot of negative reputation from students each semester, that's why Actuarial students generally want to complete this over the Summer term between their first and second year to get it out of the way. Overall, if completing this subject in the Summer, stay on top of your lectures, take notes and participate in all class discussions in tutorials. Also there is a lot, and I can't stress this enough a lot of readings, so try your best to keep on top of them as the Summer term won't stop and they are pivotal in your essay assignments and also your final exam if you can understand the theories and concepts being discussed in the readings. I would definitely recommend taking this subject in the Summer term if you can with a group of 2-3 other friends to do the group assignment with as it will make it more enjoyable.

ACCT10002 Introductory Financial Accounting [SM1]

*Note that although this is a level 1 subject it is recommended for an undergraduate actuarial student to take this in their second year, using the normal progression of the Bachelor of Commerce majoring in Actuarial Studies

Exemption Status	CB1 Business Finance, in conjunction with FNCE10002 *Principles of Finance*. Satisfactory performance across both subjects is required
Prerequisites	ACCT10001 Accounting Reports and Analysis
Lecturer(s)	Ms Demi Wang
Weekly Contact Hours	1 x 1.5-hour lecture, 1 x 1.5-hour tutorial
Assessments	3 x Online Quiz – 10% Subject Engagement – 10% Xero Assignment – 20% Final Exam (not hurdle) – 60%
Textbook recommendation	Carlon et al (2022) Financial Accounting-Reporting, Analysis and Decision Making, 7th Edition, Wiley ✗ Not recommended. Lecture notes were comprehensive, and Demi provided sufficient practice questions from the tutorials.
Lecture Capture	Full audio + video (not lived streamed though)
Year and Semester Reviewed	2024 Semester 1

Subject Content

ACCT10002 extends the accounting knowledge from the prerequisite subject ACCT10001 (ARA) through the lens of double entry accounting.

1. Financial Reporting, Conceptual Framework, sustainability, and ethics
2. Double Entry Recording
3. Accrual Accounting and Adjustments
4. Inventories and Accounting for GST
5. Revenue Recognition, Cash Control and Receivables
6. Introduction to Xero (not examinable, only relevant for the assignment)
7. Non-current Assets
8. Liabilities
9. Equity
10. Statement of cash flows
11. Annual reports, Earnings Management Issues, Debt vs Equity

Each week Demi focused on a new topic relating to financial reporting, however the introductory content about double entry accounting (debits and credits) covered in Weeks 2 and 3 were the foundation of the course. A solid understanding of debits and credits, recording journal entries and reconstructing T-account was essential for success for this subject. Lectures discuss the multiple

scenarios from each topic and how to report these scenarios using journal entries. Whilst the content was reliant on the prerequisite subject ARA, students who struggled with that subject will not be heavily handicapped because aspects from ARA were often re-explained in a financial accounting context.

Lectures

Lectures occurred once a week with one lecture stream and were fully recorded, the full lecture slides were made available before the lecture. Demi's lecture notes were comprehensive, and she would spend the majority of the lecture working through relevant examples, and there was no expectation to be prepared before the lecture. I found Demi's lectures to assist my learning and had very few issues with them other than the dryness of the course content.

Tutorials

Tutorials ran from the second week of the semester for 1.5 hours each week. There was an expectation that students completed the tutorial questions before the tutorial to achieve tutorial participation marks. Tutorial spent the first 15 minutes with revision from the previous week's content and they the tutor went over the tutorial questions. At the end of the tute we would complete a bonus tutorial question which was only made available for students who attended the tutorial. Demi also previous extra tutorial questions for each tutorial that I found helpful to complete during SWOTVAC.

Assessments

3 x Online quizzes:

There were three online quizzes spaced throughout the semester. Each quiz only covered a few topics, and it was completed through Wiley online quizzes, not on the LMS. The questions varied in difficultly, some were quite difficult and others easy, and were multiple-choice, drop-down box or numerical answer questions.

Xero Assignment:

As a part of the subject, we were expected to learn how to use the accounting software Xero, this was worth 20% of our final grade. Demi spent one lecture where she gave an overview of Xero and we had one tutorial where we could focus on our Xero assignment. The assignment was divided into three parts, Part 1 involved completing a Xero course and a quiz about Xero functions and it was worth 3%. Part 2 involved using Xero to provide financial statements from given transactions using Xero, this was worth 7% and we also completed an online quiz worth 5% (totalling 12% for Part 2). Part 3 was worth 5% and involved critiquing financial statements produced from Xero and writing a brief essay on the mistakes the accountant made using Xero. This was an individual assignment and everyone's transaction data was "different".

Subject Engagement:

The subject engagement part of the course was worth 10% and involved four parts, tutorial participation, completion of weekly quizzes on Quitch (completion not correctness), lecture attendance and engagement on Ed Discussion. During the first lecture Demi allowed each student to choose the weighting of these four components, with a minimum weighting of 1% for each. For example, I chose to weight the Quitch quizzes as 7% and each other component as 1% (7% + 3 x 1% = 10%). Demi checked lecture attendance not livestreaming the lectures and providing an online quiz at the end of the lecture relating to lecture content that was only accessible to people in the room.

Final Exam

The final exam was an in person online exam, went for 3 hours with 15 minutes of reading time and was completed on LMS Classic Quiz using a lockdown browser, we also were allowed to use a calculator. There was a formula sheet that provided the relevant accounting ratios for ratio analysis and two of the questions that had lots of content to read were handed out in booklet form at the start of the exam, so we didn't have to scroll up and down too much on the LMS quiz. We were provided with a decent amount of past paper, and I found that they were of similar difficulty to the questions on the exam. The exam was also similar to the tutorial questions, except there were more written questions on the exam than in the tutorials. For me the most difficult part about the exam was the online format and at one point the platform glitched locking me out of the exam for 10 minutes, this was the case for a few people during the exam. Thankfully I had sufficient time to complete the exam and check it over.

Overall remarks

Overall, IFA was a very manageable subject and the fact that there was subject engagement marks meant that I was engaging with the subject throughout the semester. The main regret I had with the subject was that I didn't take the quizzes (the Wiley and Xero quizzes) seriously enough, assuming they would be as easy as the ARA quizzes and lost more marks than I would have liked from the quizzes. Thankfully I was lucky and had two weeks between my second last exam and IFA and was able to cram very successfully for the exam due to the copious amount of revision content provided by Demi. My main tip for the subject is to take it seriously and not fall behind, because whilst the content is easy compared the other subjects you might be taking, it's very easy to lose marks that you really shouldn't be losing.

ACTL20001 Introductory Financial Mathematics [SM1]

Exemption Status	CM1 Actuarial Mathematics I, in conjunction with ACTL30003 *Contingencies*. Satisfactory performance across both subjects is required
Prerequisites	First year mathematics subjects or equivalent, (e.g. a total of 150 marks for Linear Algebra and Caclulus2, detail see page ...)
Lecturer(s)	A/Prof Ping Chen
Weekly Contact Hours	1 × 2-hour lecture 1 × 1-hour tutorial
Assessments	2 x Individual Assignments, 15% each Final Exam 70%
Textbook recommendation	None
Lecture Capture	Full audio + video
Year and Semester Reviewed	2024 Semester 1

Subject Content

Introductory Financial Mathematics teaches students the fundamentals of cash flows evaluation and pricing of different financial instruments. IFM, along with Contingencies, make up one exemption. In 2024, the exemption mark has been set to 72 and 70% has passed the exemption mark. This subject is important as cash flow appears in many actuarial applications later on.

1. Introduction to data analysis and actuarial modelling

The first topic is very theoretical, covering the collection of data, analysis of data and the guidelines for a good model. This topic only takes one lecture to cover and is easy to understand. Its content often shows up in MCQs in the final exam.

2. Cash flow models

This topic focuses on different forms of cash flow models, including zero-coupon bond, fixed interest security, indexed security, and other potential cash flow scenarios involving insurance and investment.

3. Valuing Cash flows

This topic covers simple and compound interest calculations, present and discounted value, effective/nominal interest rate, accumulation factor, and the force of interest. A large proportion of this topic is covered in ACTL10001 Introduction to Actuarial Studies and

FNCE10002 Principles of Finance. However, the notation and proofs on the lecture slides can be overwhelming at the first glance. It is also important to understand how to derive present/future values from the first principle, as it helps with analysing more complicated cash flow scenarios.

4. Financial analysis of loan contracts and business projects
This topic covers loan repayments (also covered in ACTL10001), flat rate contracts, project (venture) evaluation and allowance for inflation. One major question on the assignment was a home loan question, and it requires a thorough understanding of this topic. Project evaluation techniques such as NPV, IRR and payback period are covered in FNCE10002 Principles of Finance.

5. Major asset types and pricing of bonds
This topic covers the three principal asset classes, bonds and index bonds and compares the differences between them. Personally, I found this chapter quite interesting but challenging.

6. Applications in Asset Markets
This topic introduces the concept of immunisation, forward/spot rates and yield curves. This topic is very short but the formulas can be overwhelming.

Lectures
There is a two-hour lecture each week. I strongly recommend attending these lectures in person. Ping often annotates the printed lecture slides during the session, making it easy to follow along and track the specific lines she is referring to.

Tutorials
The tutorials can be highly or not very beneficial depending on how you approach it. Tutorials are highly beneficial as my tutor reviews the lecture content in the first 10 minutes of the tutorial. She also uses multiple techniques for one question and it's really nice to understand a question from multiple approaches. The exam question is similar to the tutorial sheets so it is highly recommended to stay on top of them.

Assessments
Assignments:
There were two assignments, each weighted 15%. Both assignments are done via excel and require explanations. The first assignment was on annuities and the second assignment was on the application of home loans.

End-of-semester exam:
The exam was 2 hours and held in-person (calculator and a hand-written formula sheet allowed). There isn't a lot of practice material given to us, only one practice exam. The practice exam was very similar to the final exam. There were a lot of questions on the exam

and I was not able to finish on time. For extra practice, it is recommended to go back to the tutorial questions and examples from the lecture slides.

Overall remarks

This subject starts off easy and them difficulty increases gradually. It is the best to stay on track with the lectures, especially during week 6~7 when the assignments rain in. To achieve a high mark on the final exam, I would recommend doing calculations with the exam calculator from day 1.

ACTL20003 Stochastics Techniques in Insurance [SM2]

Exemption Status	Not an exemption subject, but it is a prerequisite for ACTL30001 *Actuarial Modelling I*, ACTL30002 *Actuarial Modelling II*, and *ACTL30007 Actuarial Modelling III* (CS2 Risk Modelling and Survival Analysis)
Prerequisites	ACTL20001 Introductory Financial Mathematics MAST20004 Probability Lecturer(s)
Lecturer(s)	A/Prof Han Li
Weekly Contact Hours	1 × 2-hour lecture 1 × 1-hour tutorial
Assessments	Assignment 1: 15% Assignment 2: 15% Final Exam (Hurdle): 70%
Textbook recommendation	None
Lecture Capture	Full: both audio and video
Year and Semester Reviewed	2024 Semester 2

Subject Content

1. **Three types of random variables and their characteristics**
   The subject builds on Discrete and Continuous Distributions, moment generating function, probability generating functions, and other basic concepts from probability. It also briefly examines truncated distributions, mixed random variables, and the simulation of all three types of RV's. Then applies mixed random variables to the context of insurance, particularly for reinsurance. Examines expectations of the three types of random variables and expectations of functions. Also considers some inequalities of probability and expectation. An important module for later units.
2. **Characteristics of sum of independent identically distributed (iid) random variables**
   Similar to Probability, the subject revises using the MGF to find the distribution of a sum of IID random variables. It builds on this through direct convolution and recursive calculation technique to find the distribution of a sum of IID random variables. Revises law of large numbers and central limit theorem.
3. **Conditional Probabilities and Conditional Expectations**
   Mostly revision and some expansion of basics of conditional probability and conditional expectations and variances, including Bayes Theorem. Expands to mixture distributions. The topic also explains the best estimator property of conditional expectations.
4. **Ordinary Differential Equations (ODE) and Laplace Transform**
   Revises the three types of first-order ODE and second-order ODEs with constant coefficients.

Examines Laplace transform and its use in solving ODEs. Provides a systematic way of approaching systems of ODE's.

5. **Poisson Process**
   Examines Poisson Processes: properties, definitions, and associated distributions. Applies Poisson Process to discounted aggregate claims process. Content overlaps with topics in actuarial studies (ACTL20004).
6. **Brownian Motions and Geometric Brownian Motions**
   Examine stochastic processes, moves to the properties of standard, arithmetic, and geometric Brownian motion. Applies these concepts in modelling stock prices and log returns.
7. **Ito's integral and its properties**
   Considers Reimann Integral, Riemann-Stieltjes Integral, Stochastic Integrals and Ito's Integral, including its properties and differences. Examines the limits of Brownian motion's first and quadratic variations, followed by some basic calculations using Ito's integral.
8. **Stochastic Differential Equations**
   Examines differential equations out of a deterministic context. Utilises Ito's processes and Ito's lemma to incorporate stochastic element in modelling accumulation through time.

Lectures

Lectures were two hours and were quite comprehensive, moving at a fast pace. It's important to be thorough and have a strong set of notes made for reference. I enjoyed attending the lectures in person but felt it difficult to fully understand the material on my first run-through. I found it useful to rewatch lecture recordings so I could pause and annotate the slides and take longer with topics that were denser. Han Li explained concepts well, and I found it a better explanation for some of the overlapping/revised materials than the other courses, particularly when they are applied in a real actuarial context. The lectures covered some important examples, and it is important to be able to complete these examples yourself as assignment and even exam questions were built from this foundation. Hamza's lecturing style was quite different, often easier to digest during the lecture, but be prepared to drill down the lecture slide contents to be able to tackle the questions in tutorials.

Tutorials

Tutorials are not recorded, and attendance is not assessed. The sheets and answers are available on the LMS. Tutors would provide a summary of that week's content and then cover the solutions to that week's tutorial questions. The tutors explained concepts well and were open to questions. It is important to be clear on the concepts covered early in the semester, so make sure to ask your tutors for help if needed. While the answers were provided, they were not as detailed, and having tutor's solutions is more useful. Please note the tutorials were very content heavy, often covering the solutions to the questions would take up most of the allocated time. Therefore, come prepared to the tutorials beforehand, having reviews the questions on the tutorial sheet.

Assessments

Assignments

There were two assignments of the same format: a set of questions that could be completed either individually or as a group of up to 4 students (doesn't need to be the same tutorial group). I would highly recommend completing the assignments as a group as they are quite long and can be tough to get through alone. The questions were all extensions of what we had seen in class and were not unduly difficult or confusing. While sufficient time was given to complete the assignments, they

would each cover half of the course contents, so it can be difficult to complete if you do not stay up to date with course contents. The marking was fair, and students generally scored well for them.

Final Exam

The final exam was 2 hours long with 15 minutes of reading time and had a mixture of multiple-choice questions and long-answer questions. You were permitted to bring 2 A4 double-sided sheets, which was a generous amount of space for notes. Many students actually found it difficult to find enough notes to fill up these pages.

The time was enough to complete the exam, but you would need strong knowledge and move quickly to do so. Overall, it was moderately difficult, and the exam questions were of a similar difficulty to questions from assignments and tutorial sheets. Interestingly, there were multi-mark conceptual questions which had single line answers. Students should emphasize knowing the important results which are derived within lectures.

ACTL20004 Topics in Actuarial Studies [SM2]

Exemption Status	CM2 Financial Engineering and Loss Reserving, in conjunction with ACTL30006 *Intermediate Financial Mathematics* and ACCT40004 *Advanced Financial Mathematics*. Satisfactory performance across the three subjects is required
Prerequisites	ACTL20001 Introductory Financial Mathematics MAST20004 Probability
Lecturer(s)	Professor Benjamin Avanzi Doctor Yuyu Chen
Weekly Contact Hours	1 x 2-hour lecture 1 x 1-hour tutorial
Assessments	Individual Assignment – 25 % Mid Semester Exam - 15 % Final Exam (Hurdle) - 60 %
Textbook recommendation	Various texts prescribed in the subject review the most useful ones are • Taylor, G. (2000) Loss Reserving: An Actuarial Perspective Huebner International Series on Risk, Insurance and Economic Security (HSRI volume 21) • Dickson, D. C. M. (2016) Insurance Risk and Ruin, 2nd Edition, Cambridge University Press
Lecture Capture	Full audio + video
Year and Semester Reviewed	2024 Semester 2

Subject Content

These subject covers theories of financial market behaviour, stochastic interest rate of return models and liability (reserving and ruin theory) valuations. This subject teaches and uses a variety of excel formulas and techniques within each topic. The order in which this subject is taught varies throughout the years, during the 2024 semester 2 the order of the subject was theories of financial market behaviour -> reserving techniques -> stochastic interest rate of return models -> ruin theory.

1. **Theories of financial market behaviour**
   Here you investigate rational choice theory and calculate what a decision maker will do based on factors such as their risk preference, wealth and utility. Utility functions are used to model what choices a respective decision maker will make with respect

to any insurance they have and whether they will lose or make money with a specific decision.

2. **Stochastic interest rate of return models**
   In this topic you derive simple models for annual rates of returns using normal and log normal distributions, so you can investigate the means and variances of a series of payments with regards to changing interest rates. These models will also be applied to some life insurance notation and formulas.
3. **Liability Valuations (Reserving Techniques)**
   You will learn the exposure method, chain ladder, Bornhuetter-Ferguson and payment per claims incurred method to reserving (the separation method is mentioned but not assessed). The first 2 techniques are used on the mid-semester exam and the last 2 techniques used on the final exam *in this teaching period*. These methods provide a way to investigate how insurance policies will claim over time so you can estimate adequate reserves to cover future losses.
4. **Liability Valuations (Ruin Theory)**
   This topic contains a lot of formulas and derivations which uses probability to describe and insures vulnerability to insolvency/ruin. The poisson distribution will be used a lot in this section to describe a series of an uncertain number of payments of an uncertain amount.
5. **Excel Skills**
   Throughout this subject excel formulas and VBA (coding in excel) is used to carry out the calculations. It is highly recommended you take the time to understand excel and keyboard shortcuts as it will make you more efficient when completing the tutorial questions, the assignment and the final exam. You will be shown the basic formulas you will need to know in lectures, and you will learn how to apply them in the tutorial questions.

Lectures

Lectures are very packed with lots of information, so it is advised you to read the assigned reading, in the appropriate textbooks, beforehand so you have had at least a glance of the new notation and techniques to come in the lecture notes. In the theories of financial market behaviour and liability valuation part of the subject there are few examples in lecture notes which makes it difficult to learn the actual techniques, so it is advised to read the textbook and excel sheets provided to understand the concepts better. In the stochastic interest rate of return models' section of the subject there are plenty of examples and derivations in the lecture notes which help prepare you for the questions provided in assessments.

Tutorials

Tutorials are a must with this subject and attendance is quite high to tutorials in this subject. Often you may not fully understand the content, even after preparing beforehand, when you attend the tutorials, however the questions in the tutorials should better equip you for the assessments. Once reserving is taught, generally everyone attends tutorials due to the

difference in content and difficulty between what is taught in lectures and what is expected of you in the tutorial questions.

If you attend tutorials, attempt the questions beforehand and ask questions you should be well equipped to do well on your assessments.

Assessments

Mid-semester Exam

During this teaching period the topics covered on this assessment were theories of financial market behaviour and reserving techniques (with only the exposure method and chain ladder reserving techniques being assessable). Preparing for this can be particularly challenging for most as the difficulty and length of the reserving tutorial questions is challenging at first, however this exam is not too challenging with much simpler questions being asked than the tutorial questions. You should have a good grasp on the theoretical as well as the mathematical understanding as you may be asked to explain what is fundamentally going on rather than just doing calculations.

Assignment (25% of overall grade)

The assignment only covered the stochastic interest rate of return models topic and was a mix of calculations, proofs, simulations on excel and some VBA on excel. There were many questions and they are not too difficult if you refer to lecture notes and tutorial questions. Students generally scored very highly on this assignment and the average was very high leading to a hard final exam being produced as described below.

Final Exam (60% of overall grade, and hurdle assessment)

For this teaching period (2024 Sem 2) the exam was completely changed and posed a lot of challenges for everyone with the examination being on excel (on a laptop provided by the uni) and on paper. The exam was broken up into 2 long excel questions (utility theory and reserving techniques), 3 multiple answer questions (theoretical questions about liability valuations) and 2-3 long questions on ruin theory with a mix of proofs, explanations and calculations. In this semester stochastic interest rate of return models was covered in the assignment and as a result was not at all covered on the final exam.

You are allowed to bring 4 pages (2 A4 double sided sheets) of notes which may not be absolutely required for a topic like reserving techniques as there are not "formulas" to use, rather techniques and processes, but the notes sheets is more useful for the ruin theory and utility theory topics as there are some formulas in there.

The CM2 and CT6 IFoA past examinations are useful in preparing for this examination, however the questions in these past exams are generally easier than what you will be provided on the final exam. Additionally, the Insurance Risk and Ruin textbook provided in the subject, its detailed explanations, proofs, practice questions and solutions are especially useful in preparing for the ruin theory part of the exam.

Overall Remarks

This subject is challenging and is easy to fall behind in. You have to be on top of the work you are given and be willing to dive into the textbooks provided to learn about concepts shown in lectures to appropriately apply them to tutorials, assignments and the exams. Despite how fast paced the subject is, it is very rewarding with regards to the amount of work that you put into it and the result you will achieve at the end of the subject.

Generally, individuals in this subject score high on the mid-semester exam and very highly on the assignment and not that great in the final exam, resulting in a lot of scaling being applied.

ECON20001 Intermediate Macroeconomics [SM2]

Exemption Status	CB2 Business Economics, in conjunction with ECON10004 *Introductory Microeconomics*. Satisfactory performance across both subjects is required
Prerequisites	ECON10003 Introductory Microeconomics ECON10004 Introductory Macroeconomics
Lecturer(s)	Prof Daniel Minutillo Prof Faisal Sohail
Weekly Contact Hours	2 x 1-hour Lectures 1 x 1-hour Tutorial
Assessments	Tutorial Participation 10% Online Multiple-Choice Test 5% 2 x Assignments 12.5% each Final Exam (Hurdle) 60%
Textbook recommendation	*Blanchard, O, 2021, Macroeconomics, 8 th edn, Pearson* ✗ *Not recommended. The lecture slides provide enough depth of material to help you understand the course, and the subject heads provide you with supplementary reading material for the 'heavier' concepts.*
Lecture Capture	Full audio + video
Year and Semester Reviewed	2024 Semester 2

Alternative Texts:
There are many textbooks on intermediate macroeconomics in the library. If you'd like an alternative take on the course material, you might want to consult: N. Gregory Mankiw (2016). Macroeconomics. ninth edition.

Subject Content

1. IS/LM Model (Short-run macroeconomics)
This topic gives students a chance to recap the contents from first-year economics. It takes the aggregate production function relationship with the consumption multiplier that all students learn in first year and creates a slightly more advanced model known as the IS/LM.. It aims to express consumption and investment as functions of interest rates so that the set equilibrium outputs in the market for goods (and services) can be paired with financial markets. It particularly highlights the relationship between output and inflation by way of

action taken by the government (fiscal) and reserve bank (monetary). This topic is extensively covered in the first multiple choice test.

2. Labour markets and unemployment

This topic explores labour market dynamism and how economies tend toward steady state unemployment rates. It also introduces the concept of job matches, which demonstrates the interactions between jobseekers and employers in their bids to find and create jobs. This is taught through the Beveridge Curve model, the Job Creation Curve model, and the concept of labour market tightness. This topic can be confusing at first but given enough time, can be comprehensively understood. This has been known to consistently appear in the final exam.

3. Dynamic AD/AS Model

The Dynamic AD/AS model goes further than previous models of the macroeconomy in that it includes an array of variables beyond inflation and output. There is an extensive derivation process that originates from 5 key formulae. Understanding the logical process is far more important to memorising the derivation. This topic, like in first-year economics, focuses on the impact of short-term shocks as well as long-run impacts on the economy's output and inflation rate. This was heavily assessed in the first assignment and appeared in the final exam.

4. Solow-Swan and Growth Models

An introduction of more models that map economic growth in the long run. This looks at the Cobb-Douglas model relating output, capital, labour, and productivity akin to the first-year model, however in this course these concepts are explored further with different models. You will start to notice that you must do more than memorise formulas as the questions require you to prove that you understand these models and how to apply them. Lots of exam and assignment questions are based around some novel adjustment or variation to the model, and you will need to know how to mathematically and intuitively explain how that adjustment would impact the macro-economic outcomes. Ensure you have set a good foundation in understanding these models from the previous topics.

5. Open Economy IS/LM Model

This is a return of the first topic, however with additional levels of complexity as it now caters for an open economy. This explores concepts of foreign capital flows, exchange rates and their relationship with domestic and foreign interest rates as well as an exploration on exchange rate regimes. Often the effects will be intuitive, however it is important to think about things logically and ensure your resultant net income shown by your model is consistent with that. This was a relatively less mathematical topic where intuition goes a long way.

6. Topics in macroeconomic policy

This is a one lecture miscellaneous topic introduced at the end of the semester. It is a simple model outlining the different outcomes of 'rule' vs 'discretion' in monetary policy decision

making. You deal with a simple function and need to conceptually understand the different outcomes of that function.

Lectures

There were 2 x 1 hour lectures every week. The content was decently-paced, making it easy to digest content during and after the lecture. The semester was split in half with Daniel taking the first half of the course addressing short-run macroeconomics and Faisal taking the latter half. Both lecturers explained the content very clearly and engaged the students.

Tutorials

Tutorials can be beneficial in different ways depending on your tutor. From my personal experience, I had a friendly tutor who walked through the tutorial questions and welcomed any clarifying questions after the tutorial. My tutor tried to emphasise the intuitive process of how to think about questions and how different changes can result in macroeconomic effects rather than how to purely solve the questions.

Assessments

Multiple-Choice Test:
The multiple choice quiz tested your knowledge of the lecture content and could be attempted within a certain timeframe. It was relatively straightforward and you can score very highly if you keep up with the lecture content.

Assignments:
There were two assignments, each weighted at 12.5%. The assignments were closely tied to lecture content, so it rewards anyone who is consistent with coursework. However the assignment questions were designed to challenge students, extending the material covered in lectures to different scenarios. It is highly recommended to start assignments early to give yourself time to understand what the question is asking and how the different components fit together. Excel was also required for multiple questions so having a strong Excel foundation will help a lot.

Final Exam:
- Section A: 12 Multiple-Choice Questions [20 marks]
- Section B: 3 Short Answer Calculation and Explanation Questions (Pick 2) [20 marks]
- Section C: 3 Short Answer Calculation and Explanation Questions (Pick 2) [20 marks]

Each question in Section B and C tests a particular topic in the subject, however, it is important to have a broad understanding across all the potential topics as there is no standard pattern of content covered across these sections. Completing past exam questions will be beneficial for the exam overall as the questions are known to be relatively similar. Section B and C is generally like tutorial questions with process-driven calculations based on the standard models. Section A can prove to be difficult at times as strong performance relies on a broad understanding of the macro economy.

Overall remarks

Content-wise, like Introductory Macroeconomics, you spend time developing these seemingly strange models that attempt to explain economic activities. The main difference is that in this course, you begin to appreciate the effectiveness of these models a bit more and consider how particularly important variables were determined (endogenous vs exogenous). This course is also more conceptually challenging as you start to explore variations behind models and make more variables interdependent. Overall, ensure you understand the purpose of each model in terms of how they fit together and how to derive them as this will ensure you truly comprehend their purpose and are ready for any complications posed by exams and assignments. It is definitely possible to do very well in this subject if you engage with the content.

MAST20004 Probability [SM1]

Exemption Status	CS1 Actuarial Statistics I, in conjunction with MAST20005 *Statistics* and ACTL30004 *Actuarial Statistics*. Satisfactory performance across the three subjects is required
Prerequisites	Linear Algebra & Calculus 2 OR Accelerated Mathematics 1 & 2 OR Equivalent combinations
Lecturer(s)	Prof Peter Taylor Prof Mark Holmes
Weekly Contact Hours	3 × 1-hour lecture 1 × 1-hour tutorial 1 x 1-hour computer lab
Assessments	4 x Individual Assignments 20% Final Exam 80%
Textbook recommendation	*Ghahramani, S, 2005, Fundamentals of Probability, with Stochastic Processes, 3rd edn, Pearson Education* ✗ *Not recommended. The lecturers teach the content with enough depth and provide lots of practice questions. There are also a full set of lecture notes and supplementary lecture notes available at the start of the semester which allows students to work ahead in the content.*
Lecture Capture	Full audio + video
Year and Semester Reviewed	2024 Semester 1

Subject Content

Probability introduces the basics of mathematical probability and probabilistic modelling and lays the foundation for a wide range of applications in statistics and actuarial studies. Probability is a very important subject if you wish to continue with actuarial or statistics. Developing a strong understanding of the concepts covered in this subject is highly recommended.

1. Basics: This topic summarises high school probability with slightly more rigour, highlighting probability axioms, events, the probability function, conditional probability, independence and exclusion, law of total probability and Bayes' formula.

2. Random Variables: This topic defines the concept of random variables, both discrete and continuous. It covers the basic building blocks of probability theory: probability mass/density functions and distribution functions. It also introduces the concept of expectation and variance, and higher moments of a random variable. This topic is not challenging content-wise but forms the basis of the majority of actuarial studies.

3. Special Probability Distributions: This topic introduces the many special probability distributions for both discrete and continuous random variables. We go through each distribution, calculating their distribution function, probability density function or probability mass function (where they exist), expectation and variance. This topic also focuses on the normal distribution, explaining about the process of standardization into the standard normal distribution, moments, and the many approximations that the normal distribution can be used for.

4. Transformations: This topic focuses on the transformations of random variables, including monotonic functions, square functions, and pseudorandom numbers. This also goes on to introduce more distributions, such as the Cauchy distribution and the lognormal distribution. Having a good understanding of transformations of random variables is essential and is often examined.

5. Bivariate Random Variables: This topic introduces the concept of bivariate random variables. The same process is repeated, covering the distribution function of a bivariate random variable, joint and marginal probability mass/density functions, and their conditional counterparts. Then independence of bivariate random variables, expectations, convolution integrals, variance, covariance, correlation and conditional expectation and variance. At this point, the hardest concepts of the subject have been covered.

6. Generating Functions and Applications: This topic dives into probability generating functions and moment generating functions. Other concepts like cumulant generating functions and Laplace transforms are mentioned but were not examinable. This is a useful and relatively simple concept to understand if you've been keeping up and is most certainly going to be a heavy-marked question in the final exam.

7. Convergence Theorems: This topic explains the concept of convergence in distribution, law of large numbers, central limit theorem. These two theorems are very important and very useful and will definitely be examined.

8. Stochastic Processes: This topic talks about discrete-time Markov Chains, transition matrices and equilibrium distributions. This was a simple topic with relatively less content to cover. Stochastic process exam questions have been straightforward in the past.

Lectures

There were 3 lectures every week, normally around 50 minutes each. The content was quite fast-paced, making it seem a lot more difficult than it is. Give yourself time to digest the information and practise application of the content to questions to consolidate your understanding. Both lecturers had in-person lectures, where they welcomed any questions afterwards. I went to Mark's lectures and could see him keep the lecture engaging wherever possible.

Tutorials

The tutorials can be highly or not very beneficial depending on how you approach it. I highly recommend giving the tutorial questions a go before the tutorial so you can ask the tutor to help fill in gaps in your understanding. Exam questions will feel relatively simple if you fully understand all the tutorial questions. If you could answer all the questions before the tutorial, it may not be very helpful as the tutor splits you into groups where you work on the tutorial questions for the full hour.

Assessments

Assignments:

There were four assignments, each weighted 5%. The assignments were quite difficult in general. They were designed in a way that required you to think rather than have you apply the content to answer questions. It may feel as the time spent completing the assignments does not match the weighting of the assignments however, doing the assignments will naturally increase your understanding and it is very possible to get a high grade.

End-of-semester exam:

The exam was 3 hours and held in-person (calculator and a hand-written formula sheet allowed). In comparison to past years, our exam was much easier. As long as you had put in the work throughout the semester, you were rewarded in the exam. We had access to multiple past papers and solutions during the study period. This along with the tutorial questions and problem booklet meant there are more than enough resources available.

Overall remarks

This subject is very fast paced and content-heavy, so it's best to stay on track with the lectures or else you might find it difficult to catch up. Overall, this was quite intimidating for a lot of the students, but if you stay on top of your lectures, attend your tutorials, and review a lot of past papers, you will be rewarded. My biggest advice is to find people to study this subject with. This made the subject a lot easier and enjoyable for me and at the very end, a lot of people did quite well.

MAST20005 Statistics [SM1]

Exemption Status	CS1 Actuarial Statistics I, in conjunction with MAST20004 *Probability* and ACTL30004 *Actuarial Statistics*. Satisfactory performance across the three subjects is required
Prerequisites	MAST20004 Probability
Lecturer(s)	Dr Robert Maillardet Dr Patricia Menendez
Weekly Contact Hours	3 x 1-hour lectures, 1 x 2-hour tutorial & lab (back-to-back)
Assessments	3 evenly weighted assignments – 20% 45-minute computer lab test – 10% 3-hour final exam – 70%
Textbook recommendation	None
Lecture Capture	Full video and audio
Year and Semester Reviewed	2024 Semester 2

Subject Content

The main topic areas covered include:

1. Descriptive statistics
2. Point estimation (Sampling distributions, Method of Moments, Method of Quantiles, Maximum Likelihood, bias, variance)
3. Asymptotics for Maximum Likelihood Estimators and Optimality
4. Interval estimation
5. Regression/Correlation
6. Hypothesis Testing
7. 'Distribution free' methods
8. ANOVA (Analysis of Variance)
9. Bayesian inference (updating your prior ideas conditional on new evidence)

Lectures

The course has two streams: a morning session led by Robert and an afternoon session conducted by Patricia. The pace of the lectures is generally fast, with a significant amount of content to cover, particularly in the first half of the semester. To stay on track, I highly recommend that students review the lecture slides before attending class. This will help ensure they can keep up with the material. In my experience, the course becomes more manageable in the second half, as some of the topics are already familiar from high school curricula.

Tutorials

Tutorials and labs are scheduled back-to-back. Since the subject doesn't have a separate question booklet, all practice questions are provided in the tutorial sheets. This means there is often not enough time to complete all the questions during the tutorial, so students are expected to work on them beforehand. Both the tutorial questions and their solutions are released simultaneously, which makes self-study more convenient. While tutorial attendance is recorded, it is not mandatory and does not impact the final grade. Personally, I didn't find the tutorials particularly helpful. Instead of attending, I preferred to work through the tutorial questions and lab sheets on my own, as I find I am more effective studying independently.

Assessments

Assessment 1: Three equally weighted assignments I personally found the Statistics assignments much easier than the Probability assignments. The questions are relatively straightforward, and if you stay up to date with the tutorials, you should find the assignments manageable.
Assessment 2: Lab test In this course, you will continue your R journey from Probability. The R lab test not only requires knowledge of R commands but also an understanding of the underlying principles. I recommend future students create an R command summary sheet and avoid leaving all the lab work until week 11.
Assessment 3: Past exams Past exams from 2017 to 2023 are provided. The actual exam closely mirrors the practice exams, so it is highly recommended to thoroughly review and understand every question in the past exams.

Overall remarks

Overall, while I found statistics challenging throughout the semester, with sufficient revision during SWOTVAC, it became more manageable. Staying up to date is essential in this subject, as there is a lot of content to cover. In hindsight, I wish I had focused more on practice exams during SWOTVAC and dedicated more time to the proof questions in the tutorials (I mistakenly thought they wouldn't appear in the final exam, but I was wrong). Don't be intimidated by the first few tutorials—things will start to make sense by the end.

MAST20026 Real Analysis [SM2]

Exemption Status	Not an exemption subject, but it is a valid prerequisite for ACTL20001 *Introductory Financial Mathematics* (CM1 Actuarial Mathematics I)
Lecturer(s)	Dr Brian Krummel
Weekly Contact Hours	3 × 1-hour lecture 2 × 1-hour tutorial
Assessments	5 x Individual Assignments 20% Final Exam 80%
Textbook recommendation	*MAST20026 Real Analysis (lecture notes which serves as a textbook)* ✓ Highly Recommended. *Highly recommended, many explanations were quite in depth, and it was helpful to review content from lectures at one's own pace.*
Lecture Capture	Full audio + video
Year and Semester Reviewed	2024 Semester 2

Subject Content

MAST20026 Real Analysis is a gentle yet thorough introduction to mathematical rigour, and a deeper look into tools used previously in calculus courses (convergence and divergence of limits, differentiability, integration, etc). Real analysis is great as a first introduction to pure mathematics, allowing you to develop a strong grasp of mathematical rigour and opens one's eyes to how detailed mathematics can get. Despite the polarising sentiment on this subject, I highly recommend it as a first taste of pure mathematics.

1. Formal logic and proof techniques: Great introduction to formal logic, it was particularly interesting to see simple logic used in such an unfamiliar and mathematical manner.

2. Set theory and Real Numbers: A fairly deep formulation of set theory and discussions on the qualities of real numbers, and a great introduction to working with axioms.

3. Sequences and Convergence: We delved into sequences and different types of convergence, and tests for convergence.

4. Limits and Continuity: We looked at formal definitions of limits and continuity, it was interesting to see the pitfalls of common preconceptions of limits and how limit points are used in aiding constructing the definition of a limit.

5. Differentiation and Integration: We looked at formal definitions of differentiation, investigating the chain rule and product rule as well. We also learned about Riemann sums, the upper and lower sums and the formal definition of integration and integrability of a function.

6. Series: A great topic about different types of series and the myriad of convergence tests. We also looked at the taylor series and the remainder estimation theorem.

Lectures

There were 3 lectures every week, normally around 50 minutes each. Some were quite fast paced, while others were slow in comparison. Brian was quite engaging and made sure to explain concepts as simply as possible which I loved.

Tutorials

The tutorials were very beneficial in teaching you how to apply the concepts from lectures. Many of the exam questions were based off tutorial questions so it is a good idea to attend them. Furthermore, the tutors were also very helpful in explaining any confusing topics.

Assessments

Assignments:
There were five equally weighted assignments worth 20% in total. The difficulty was varied across the assignments, although I found them quite doable if you kept up with the lecture content and made sure to clarify any confusion with tutors/Ed-discussion.

End-of-semester exam:
The exam was 3 hours and held in-person. It was fairly comprehensive on all of the topics covered, although the exam followed the recent trend with slightly more eccentric questions.

Overall remarks

This subject is a very rewarding subject for those who keep up with the requirements throughout the semester. Not only does the score directly correlate with the effort expended, it also widens your knowledge about mathematics and how precise it can be.

Subject Reviews: Third-Year Subjects

ACTL30001 Actuarial Modelling I [SM1]

Exemption Status	CS2 Risk Modelling and Survival Analysis, in conjunction with ACTL30002 *Actuarial Modelling II* and ACTL30007 *Actuarial Modelling III*. Satisfactory performance across the three subjects is required
Prerequisites	ACTL20003 Stochastic Techniques in Insurance MAST20005 Statistics
Lecturer(s)	Professor Shuanming Li
Weekly Contact Hours	2 × 1-hour lecture 1 × 1 hour tutorial
Assessments	Individual Assignment – 2x15% Final Exam (hurdle) - 70 %
Textbook recommendation	✗ Not recommended. There is a prescribed textbook in the subject guide, but no readings are assigned by the lecturer, and the lecture notes are sufficient
Lecture Capture	Full audio + video
Year and Semester Reviewed	2024 Semester 1

Subject Content

This subject covers survival models concepts, estimation procedures for lifetime distributions, multiple state models, binomial and Poisson models of mortality, actuarial applications of discrete-time and continuous-time Markov chains. This subject focuses on modelling techniques in life insurance.

This subject covers some topics in life insurance mathematics, including survival models, life tables, non-parametric estimation of the survival functions, three models for estimating the mortality rate (q_x) and the force of the mortality (mu_x), continuous time and discrete time Markov processes and actuarial applications.

1. **Mortality Calculations and Distribution of Future Lifetime of a life:**

- Future lifetime, survival function, force of mortality, the density of future lifetime.
- Complete and curtate life expectation, life table functions
- Three fractional age assumptions: UDD, CFM, Balducci

Unit 1 revises lots of the mortality concepts and actuarial notation for life table functions. There are lots of proofs and calculation questions within this topic, but they are extremely important for the exam, and for future subjects.

2. **Estimations of Life Distributions or Survival Distributions**

- Laws of Mortality, Parametric method, types of censoring, K-M estimation without censoring K-M estimation with censoring
- Greenwood's formula, Nelson- Aalen estimation, proportional hazard mode

This unit introduces some new concepts of considering truncated and censored data in Maximum likelihood estimation. It draws upon Statistics, and the Unit 1 Content to introduce methods of estimating the "hazard rate". One important concept is K-M and NA estimation.

3. **Estimations of Mortality Rates or Force of Moralities Using Three Parametric Mortality Models.**

- Two-state mortality model, binomial model of mortality Poison model of mortality

This unit focuses on using different numerical and special-case methods to approximate mortality probabilities and force of mortality using maximum likelihood estimation and moment estimation, under different assumptions and models for mortality.

4. **Continuous-Time Markov Processes and Applications**

- Continuous-time Markov processes: definitions and properties
- Kolmogorov forward differential equations, Chapman- Kolmogorov equations, estimation
- Four Markov- Mortality models, estimations and simulation

This is one of the newer and more challenging concepts. Utilises lots of conditional probability concepts, understanding of Matrix algebra and intuitive understanding of probability to complete proofs and calculations.

5. **Discrete-Time Markov Chain (MC) and Applications**

- Discrete time Markov chain: definition, properties, transition probability matrix and n- step transition probability matrix
- First-step analysis, class of state space, applications of MC, estimation and simulation

Lectures

Lectures are quite packed with content and derivations. It is advised you to read the lecture notes beforehand. The lecturer goes through content quite quickly and annotates lecture notes lots, and so it is advised you bring lots of blank paper or use an iPad if you attend the lecture live.

If you watch the recording, it is advised you annotate lecture slides, or write down the derivations conducted by the lecturer.

The lecturer also provides lots of supplementary notes and exercises during the lecture, so it is advised you complete those.

Tutorials

Tutorials are quite important to attend, and attendance is generally quite high in this subject. Tutorials start from week 1, and it is advised you complete questions beforehand. Tutors generally provide weekly summaries, and give you different strategies to answer questions, so it is advised you attend them.

Assessments

Assessments 1 and 2: Assignment 1 and 2 (2 x 15% of overall grade)

These assignments generally involve either proof questions or numerical calculations/approximations of mortality rates and parameters from simple mortality data. It is not specified which software to use, but R and Excel are generally best for these assignments.

The assignments are quite lengthy, so it is recommended you start them early and complete questions incrementally.

Assignment 1 mainly focuses on Unit 1 and Unit 2

Assignment 2 mainly focuses on Unit 3 and Unit 4, however concepts from previous units are required.

Assessment 3: Final Exam (70% of overall grade, and hurdle assessment)

The final exam for this subject is quite lengthy. It consists of three True/False questions, three Multiple-Choice questions, and 6-7 long answer questions.

The nature of the questions are similar to what is shown within lectures, and on assignments so there are no 'curve-ball' questions, however there is quite a lot of content to remember and so completing the exam can be quite difficult.

4 pages worth (2 sheets) of notes are permitted. It is absolutely necessary you include all the key formulas in this formula sheet, because a majority of the exam will require those formulas.

The exam assesses Units 3-5 more heavily, and lots of questions may simply require you to use intuition to 'write an equation' or 'write an expression' without necessarily solving it. So it is important to understand the concepts intuitively, which can be boosted through tutorial attendance.

ACTL30002 Actuarial Modelling II [SM1]

Exemption Status	CS2 Risk Modelling and Survival Analysis, in conjunction with ACTL30001 *Actuarial Modelling I* and ACTL30007 *Actuarial Modelling III.* Satisfactory performance across the three subjects is required.
Prerequisites	ACTL20003 Stochastic Techniques in Insurance MAST20005 Statistics
Lecturer(s)	Associate Professor Rui Zhou
Weekly Contact Hours	2 x 1-hour lectures 1 x 1-hour tutorial
Assessments	Assignment 1 - 15% Assignment 2 - 15% Final Exam (Hurdle) - 70%
Textbook recommendation	N/A
Lecture Capture	Full audio + video (generally clear)
Year and Semester Reviewed	2024 Semester 1

Subject Content

This subject mainly focuses on estimating mortality rates from crude data, understanding the concepts of rate intervals, smoothing these estimated rates, testing the smoothed rates for adherence and smoothness and then forecasting these rates into the future. There is also a section on elementary machine learning. The content, excluding the machine learning, is all linked in the process of forecasting mortality rates so understanding each module is useful to the next. Some concepts, like converting age labels, can be deceptively difficult but with proper practice can be understood well.

Lectures

There were two lectures per week for AM2 and I found them to be more digestible than the other actuarial modelling subjects. They did involve more information than just what was on the lecture slides so you should be prepared to note down the additional information during the lecture. The lectures were paced well with the last topic being straightforward and easing into the exam period.

The initial topics on rate intervals and age labels were a bit tedious and can take a bit of practise to be confident with, especially in time for the first assessment but isn't computationally heavy. Given that you are able to bring 4 A4 pages of notes the aim is not to memorise formulas as you will have access to anything you'd need. Take more time to understand and be confident in each concept and you will do well.

The lectures were well paced and picked up in complexity in the forecasting section but wasn't unmanageable. It just requires a good understanding of the previous section and the bigger goal to guide you.

Tutorials

The tutorials were very to the point and built upon the examples in the lecture slides and linked well to the assignment questions and to the exam questions. The tutors for the subject also provided a weekly summary sheet which I found very useful, especially when making my summary sheet at the end of the semester. It is useful to have completed the tutorial work before the tutorial so you could follow along.

Assessments

Assignments

There were 2 equally weighted individual assignments. The questions extended and applied the main ideas of the lecture contents and tutorial questions. The main focus of the first assignment was on Unit 1 and 2 and was more simple computations. The second assignment mainly focused on graduation methods and Lee Carter Method on Excel data and had more use of Excel or R. Since the lectures and tutorials showcased similar Excel spreadsheets, the assignments were quite straightforward and could be completed within a short amount of time as long as you know what to look for.

Final Exam

It is a 2 hour in-person exam with 15 minutes reading time. You are allowed to bring 2 double-sided A4 paper printed or handwritten as notes, and it is wise to note down key formulas as well as more niche formulas. This year's exam (2024) was quite similar in style with the provided review materials, but it was a struggle for time. It is important to allocate time efficiently and to be quick and confident in the easier sections (counting days).

ACTL30007 Actuarial Modelling III [SM1]

Exemption Status	CS2 Risk Modelling and Survival Analysis, in conjunction with ACTL30001 *Actuarial Modelling I* and ACTL30002 *Actuarial Modelling II*. Satisfactory performance across the three subjects is required.
Prerequisites	ACTL20003 Stochastic Techniques in Insurance MAST20005 Statistics
Lecturer(s)	Professor Benjamin Avanzi
Weekly Contact Hours	1 x 2-hour lecture 1 x 1 hour tutorial
Assessments	Midsemester Exam – 15% Individual Assignment – 25% Final Exam (hurdle) - 60 %
Textbook recommendation	Various Texts – provided within subject. ✓ Recommended. Supplementary readings help to consolidate understanding of key concepts, as this is quite a content-heavy subject
Lecture Capture	Full audio + video
Year and Semester Reviewed	2024 Semester 1

Subject Content

This subject is focused on utilising probability and statistics concepts in a general insurance modelling context. ACTL30007 is meant to cover Items 1 and 2 of the CS2 syllabus, that is, Random variables and distributions for risk modelling and Time series, respectively.

1. **Time Series**

- Includes Characteristics of Time Series. You learn about what a time series is, terminology surrounding time series data and theoretical calculations regarding calculating autocovariance of time series models. Learn about the important concepts of **stationary** time series.
- Time Series Regression and Exploratory Data Analysis: Know the notation for backwards shift operator, backwards difference operator and the concept of roots of the characteristic equation of time series. Explain the concept and properties of discrete random walks and random walks with normally distributed increments, both with and without drift.
- Time Series Models: Explain the concepts and basic properties of Autoregressive (AR), Moving Average (MA), Autoregressive Moving Average (ARMA) and Autoregressive Integrated Moving Average (ARIMA) time series. Outline the processes of identification, estimation and diagnosis of a time series, the criteria for

choosing between models and the diagnostic tests that may be applied to the residuals of a time series after estimation.

2. Claims Modelling

- Learn about Loss distributions (work with continuous distributions such as Gamma, Weibull, Pareto, Log-normal, Log-Gamma, Inverse Gaussian) to model claim amounts (losses)
- Learn about the properties of the statistical distributions that are suitable for modelling individual and aggregate losses.
- Learn how to fit claim losses to distributions using method of moments or maximum likelihood methods.
- Compound distributions and their applications in risk modelling.
    - Compound Poisson, Binomial and Negative Binomial distributions.
    - Panjer's recursion
    - Discretisation of claim amounts (losses) to approximate an aggregate claim distribution.
- An introduction to **Copulas**
    - Learn about concordance and discordance.
    - Describe the form and characteristics of the Gaussian copula and the Archimedean family of copulas.
- Introduction to **Extreme Value Theory**:
    - Recognise extreme value distributions, suitable for modelling the distribution of severity of loss and their relationships.
    - Calculate various measures of tail weight and interpret the results to compare the tail weights.

Important Tip 1:
There is a heavy emphasis on the **R component** of this subject. All of the topics will have associated R questions involved and the nature of these questions are to work with data and make inferences, so use of **R** is extremely important.
Important Tip 2:
This is quite a content-heavy subject. It is not advised to cram any concepts and skipping readings or tutorials is not advised if you wish to score high on this subject.

Lectures

Lectures are very useful to attend **in-person** to gain the best understanding of concepts. The professor runs through both the required **R-components** of each topic, and this will help your understanding.
The lectures are recorded however and are quite understandable in the recordings, so this could be an alternative.
The professor also provides many supplementary video recordings of walkthroughs of tutorial questions, and illustrations of particular concepts (especially if it cannot be covered within the lecture time), so those are also advised to watch.

Tutorials

Tutorials are quite important to attend, and attendance is generally quite high in this subject. Tutorials start from week 1, and it is advised that you at least know the content behind each tutorial before you attend it, so that you make the most out of these classes. Again, the **R-component** of the subject is quite important, so it is advised you attend tutorials to see how the tutors use R efficiently, quickly and effectively.
Tutorials are **not** recorded.

Assessments

Assessment 1: Mid-semester exam (15% of overall grade)
This is a 1-hour, in-person, pen on paper closed book examination. Depending on the year, it will either assess **Time Series (Module 7,8,9 within the subject)** or **Claims Modelling (Module 2,3,4 within the subject**).
You are permitted to bring in two A4 sheets of paper, double sided (so 4 pages in total) as notes.
Questions include numerical calculations, proofs and interpretation of R output. Questions can be quite difficult, so it is advised you start revising quite early on.

Assessment 2: Individual Assignment (25% of overall grade)
Assignments in this subject , especially with Professor Benjamin Avanzi are quite broad and are based on **analysing data in R**, creating a **presentation** with key findings about the data, and **recording a 5 minute video** to present the findings.
Marks are generally awarded for correct formatting, good presentation skills, and providing useful insights toward the data.
One really challenging aspect of these assignments is focusing your analysis on 2-3 key points that are worth discussing. It can get quite difficult to stay within the strict 5-minute deadline so planning out what you will include in your presentation is quite important.
The data will be based on claims within a portfolio, and the content of analysis will be on either **Time Series (Module 7,8,9 within the subject)** or **Claims Modelling (Module 2,3,4 within the subject**).

Assessment 3: Final Exam (60% of overall grade, and hurdle assessment)
The final exam for this subject is quite difficult. It assesses all content (but less emphasis on the modules assessed within the mid-semester exam and assignment) and will require ability to compute results and proofs **by-hand**, but majority of the assessment requires strong understanding of the **R-components of the subject**.

In 2024, a new exam format was piloted, where students completed a CANVAS quiz, in-person, with the use of University assigned laptops. These questions required the use of data analysis in **R-studio** to answer questions.
The exam is open-book and is a '2 in 3-hour exam', where the exam is of a normal 2 hour length, however an extra hour is allowed for submitting code, importing data into R and conducting analysis on R.

ACTL30008 Actuarial Analytics and Data I [SM1]

Exemption status	None, but is a prerequisite to ACTL40012 *Actuarial Analytics and Data II* (Honours exemption subject for DSP: Data Science Principles)
Prerequisites	MAST20005 Statistics
Lecturer(s)	A/Prof Xueyuan (Shane) Wu
Weekly contact hours	2 × 1-hour lecture 1 × 1 hour computer lab
Assessments	Individual Computer-Based assignment 2 × 15% = 30% 2-hour end-of-semester exam (hurdle) 70%
Textbook Recommendation	An Introduction to Statistical Learning with Applications in R, by Gareth James et al. (Springer Science + Business Media New York 2013). This textbook is essential as the subject is heavily based on the textbook and the resources provided on the textbook website. It is ✓ highly recommended to have a preview of this book before taking the course as you will get a clear and comprehensive overview of the subject.
Lecture Capture	Full (both audio and video) Year and
Year and Semester Reviewed	2023 Semester 1

Subject Content

1. Overview of Statistical Learning: This unit introduces the concept of supervised learning (covers Unit 2 to Unit 7) and unsupervised learning (covers Unit 8). It is relatively easy, but make sure that you get a good grasp on concepts such as classification vs regression, bias-variance trade-off, training MSE and test MSE. These theories are applied extensively in later units.

2. Linear Regression: This unit builds on the knowledge of simple linear regression in MAST20005 and is an extension of linear regression. The KNN method discussed in this unit was quite intuitive for me.

3. Resampling methods: Resampling methods involve repeatedly drawing samples from a training set and refitting a model of interest on each sample to obtain additional information about the fitted model.

4. Subset Selection; shrinkage methods: Make sure you understand the algorithm of best subset selection, forward stepwise selection, and backward stepwise selection, and be able to implement them in R and interpret the result.

5. Non-linear models: This unit covers several more complex non-linear models. I would recommend that you spend some extra time to understand how each of these models work and be able to implement each of them in R.

6. Classification methods: This unit shifts to the classification setting. It is important to understand which model suits different kinds of datasets, their pros, and cons, as well as whether there are any assumptions made behind the models, for example, the assumptions behind linear discriminant analysis.

7. Tree based methods: I found decision trees quite intuitive and fun to implement. Bagging, random forests and boosting are their more complex variations.

8. Unsupervised learning methods: This unit takes a different statistical learning approach from the previous chapters and explores situations where the response variable is not present, for example, identifying shoppers with a similar interest. This unit was examinable as well.

Lectures

The structure of the course follows the idea that Shane presents the theoretical side of the statistical methods in lectures and leaves the application/practical side of implementing these statistical methods for tutorials. Shane explains the different models in detail, in a way that I found quite easy to comprehend. Additionally, the lecture material is extracted mostly from the textbook, so the textbook offers more explanation. I also enjoyed the way that Shane structures the course in a very organised way and you will find it very easy to navigate on Canvas.

Tutorials

The tutorials focus on the R applications. I would highly recommend you attend or watch all tutorials and implement the R code by yourself because both assignments and a large proportion of the final exam are based on coding in R. Personally, I feel that the key would be to understand roughly what each line of code is doing and in my tutorial the tutor usually had comments which I found useful.

Assessment

Assignments

Both assignments are quite similar R-based group assignments. Tutorial material and the textbook are really good resources you can refer to. Decent marks can be achieved in both assignments.

End of Semester Exam

Since a larger proportion of the marks comes from R-based questions, the lab material is just as, or even more, important as the lecture content in the preparation of your final exam. Apart from the lectures and tutorials, I would recommend using the after class exercises that Shane organises as a good resource. It is not enough to just memorise the theory and code. A good way to tackle this subject would be to take a practical approach and try to understand how the models we implement help us achieve our goal. Some example considerations that should be made are (please note that they are not limited to the below):

- What type of problem are you presented with?
- What kind of data are we given?
- Why would you choose a particular model? Are there any other candidate models?
- What are the fundamental assumptions behind your model?
- How would you analyse your model fit based on the R codes?
- What are the advantages and disadvantages of your model?
- How could you improve your model?

Overall Remark

This subject introduces the basic statistical learning methods as well as their applications in R. It is not an exemption subject, but it forms a solid foundation for the exemption subject ACTL40012. In terms of difficulty, it is on the easier side compared with AM1, AM2 and AM3. However, to truly understand and be comfortable with the subject I feel like it was essential to be willing to spend time with R and "get dirty with the data". In general, I found that even though this subject is heavily based in R most of the codes we required to complete our assignments and exams were presented directly to us and given in tutorials. Shane mentioned at the start of the course that "there are often no correct answers, only wrong answers". This should give a glimpse into the type of subject this is, as there are often multiple ways of tackling a problem. Therefore, the key to this subject is to understand what you are doing and being able to justify your actions.

ACTL30003 Contingencies [SM2]

Exemption Status	CS2 Risk Modelling and Survival Analysis, in conjunction with ACTL30001 *Actuarial Modelling I* and ACTL30002 *Actuarial Modelling II*. Satisfactory performance across the three subjects is required
Prerequisites	ACTL30001 Actuarial Modelling I
Lecturer(s)	Prof Rui Zhou A/Prof Chong It Tan
Weekly Contact Hours	2 × 1-hour lecture 1 × 1 hour tutorial
Assessments	Individual assignment 1 × 15% = 15% Individual assignment 1 × 15% = 15% 2-hour end-of-semester exam (hurdle) 70%
Textbook recommendation	Actuarial Mathematics for Life Contingent Risks, 2nd Edition. ✗ Not recommended. I did the textbook questions throughout the semester, and this did not help me for the final exam, since the lecturer creates new and 'interesting' questions for the final exam.
Lecture Capture	Full (both audio and video, however some recorded lectures were glitchy and missing audio.)
Year and Semester Reviewed	2024 Semester 2

Subject Content

Overall, understanding of probability theory and financial mathematics is essential for this subject. It mainly provides actuarial techniques for calculating premiums and policy values for life insurances and life annuities.

- **Overview and select Life Table**
  Introduces underwriting 'selection effect' concept to differentiate between insured lives and standard population. To reflect this in practice, select life tables are constructed following similar results used in deriving the ultimate mortality table. This concept will be applied throughout the semester.

- **Insurance Benefits and Annuities**
  Teaches core techniques of calculating mean and variance traditional insurance and annuity benefits (whole life, term, etc.). These techniques involve first principles, recursive relationships, and interconnection of various insurance products. What

made this challenging was the many new notations introduced, but with a lot of practice, students will find it very easy to identify and interpret them.

- **Premium calculation and Policy valuation**
- This topic prepared us to calculate premiums using the principle of equivalence. Some applications on with-profit insurance and extensions with extra risks were included afterwards. After premium calculation, the teaching flowed into policy valuation. We learnt profit analysis on an annual basis and Thiele's Different Equation under the context of policy value.

- **Multiple state models**
  This part started with a review of the Markov process learnt in Actuarial Modelling I. Topics in multiple state models are extensions of materials in Week 4 to Week 6 where the alive-dead model was used.

- **Joint Life Theory**
  Further to the standard notations in Week 1 to Week 3, functions on joint life, last survivor and contingent life were introduced. The difficulty came from questions that applied these functions. I found drawing timelines to understand the relationships between two lives before writing down formulae is the best approach to tackle these questions.

- **Multiple Decrement Model**
  The multiple decrement model is a special case of the multi-state model where there is one alive state and n absorbing states (not necessarily a dead state). Knowledge on constructing relationships between the single decrement model and multiple decrement model and finding probabilities under fractional age assumptions were discussed.

- **Emerging costs and Unit-linked Insurance**
  So far in the course, we had focused on determining the EPV of cash flow series. This topic mainly talked about how to project the cash flow emerging from a contract in each time period for pricing, reserving and profit testing.

Lectures

The first 4 weeks were covered by Rui Zhou and the remainder was covered by Chong-it Tan. Lecture notes were generally well structured, however I found Chong-it Tan's lectures to be confusing to follow, and his notes very unclear. It is advisable to ask additional questions to the tutor and/or book consults with the lecturer for extra clarification on the content.

Tutorials

Weekly tutorials are delivered in-person. Personally, I found it beneficial to attempt or at least preview questions beforehand to check your conceptual understanding. Both

assignments and exam questions have a similar format to the tutorial – although exam questions are relatively harder. Solutions are provided at the end of every week. Exam tip – practice the tutorial questions as many times as possible until you are confident in answering the different types of questions!

Assessment

Assignments

There were two individual assignments, each consisting of six or seven long answer questions. Some of the questions involve an extensive use of excel spreadsheet, e.g. constructing annuity tables from scratch. Both assignments were comparatively easier than other actuarial subjects, but tedious and took a lot of time. However, they were manageable, and you should be able to score well, if you have good time management skills and understand the lectures' contents.

Final Exam

The final exam was in-person. The exam was 2 hours plus 15 minutes of reading time. Students were allowed two A4 sheets of paper with notes, either handwritten and/or typed, on both sides (total 4 pages). I found it beneficial to review lectures whilst writing down formulas into the cheat sheet. This might be a little time consuming but writing your cheat sheet will allow you to understand and remember the formulas. Otherwise, you can compile weekly summary notes given by your tutor and add any additional notes – this might save you sometime during SWOTVAC!

Overall Remark

I believe that Life Contingencies is the most difficult of the actuarial subjects. There is lots of content to be covered, and it requires lots of prerequisite knowledge from ACTL30001 Actuarial Modelling 1. There are lots of tedious calculations and algebra required to solve problems, and there is heavy use of actuarial notation. The content of the subject itself is quite interesting, but sometimes it is not clearly explained, so using supplementary resources on google or the textbook may be useful.

ACTL30004 Actuarial Statistics [SM2]

Exemption status	CM1 Actuarial Mathematics in conjunction with ACTL20001 *Introductory Financial Mathematics*. Satisfactory performance across the three subjects is required.
Prerequisites	MAST20005 Statistics
Lecturer(s)	Dr Enrique Calderin
Weekly contact hours	2 × 1-hour lectures 1 × 1 hour tutorial
Assessments	R-based Individual assignment 1 × 15% = 15% R-based Individual assignment 1 × 15% = 15% 2-hour end-of-semester exam (hurdle) 70%
Textbook Recommendation	Prescribed Readings Provided Lecture Slides / Unit Summaries Supplementary Readings (not recommended) • Predictive Modelling Applications in Actuarial Science. Volume I: Predictive Modelling Techniques by Frees, Derrig and Meyers. Chapters 1 to 5 and 13 • Statistical and Probabilistic Methods in Actuarial Science by Boland. Chapters 2, 5 and 7 • Generalized Linear Models for Insurance Data by De Jong and Heller. Chapters 2,3, and 5 • Regression modelling with financial and actuarial applications by Edward W. Frees. Chapters 1 to 6 and 13
Lecture Capture	Full (both audio and video)
Year and Semester Reviewed	2024 Semester 2

Subject Content

1. Exploratory data analysis with R

This covers some of the basics of R: data frames, solving, graphing, etc. Also covers basic linear regression and multivariate normal distributions, principal component analysis and

displaying data. Most of it is a review from previous years' content however some parts are derived more thoroughly.

2. Properties of estimation and estimators

Covers maximum likelihood estimation, properties of estimators, unbiasedness and mean-square error, score statistics and asymptotic distribution, simulation and bootstrap methods. Again, a lot of the content has been learnt before in Statistics but this unit is important to everything that comes afterwards as it is applied in new ways, so make sure to understand the logic behind the processes.

3. Multiple linear regression

Performing multiple linear regression in R, including fitting and conducting residual analysis, multicollinearity tests and variable selection methods. Knowing the ANOVA table and statistical inferences of MLR coefficients are also necessary. While we learn a lot of this regarding R in the final exam it will be interpreting the outputs so be familiar with how to calculate R2, ESS, etc. from the tables and outputs.

4. Generalised linear model (GLM)

This begins by defining the exponential family of distributions and their properties and moves onto GLMs. Generalised linear models are an extension of MLR by removing the assumption of normally distributed response variables and thus this topic builds on your knowledge of MLR as well as different probability distribution and their properties. We then apply Fisher's scoring algorithm and residual analysis to these models. This topic can seem challenging at first, but with self-study it is quite manageable.

5. Credibility theory

The aim of the unit is to calculate a premium for an individual by taking both their individual experience into account as well as their experience of their collective (group experience) and how to weight these accordingly. To do this, we revise Bayesian inference and estimators, then apply it to Bayesian credibility theory models and empirical Bayes credibility theory models. The main idea of this topic is to estimate risk experience for an individual by combining their individual experience with that of a larger group.

Lectures

The lectures are structured to introduce concepts, prove them and then apply them to problems by hand and using R. While a lot of content has already been covered in Statistics, it is covered in more depth in Actuarial Statistics including proofs and derivations. These proofs can sometimes be very long and hard to follow but they only have a small weighting on the exam. I focused more on the idea than memorise a collection of proofs.

The lectures can also be hard to follow with adjusting to Enrique's accent and handwriting being a challenge but by revisiting the slides and looking online, the content is not particularly challenging. I'd recommend looking online for other explanations if you find a concept difficult as these topics (unlike most actuarial subjects) have plenty of resources online. Just take care with notation and their definition of variables.

I'd recommend keeping a summary document as you go, condensing notes and formulas and allowing you to see the links between the different topics. Keep in mind that the different units have links and try to see how the different topics would work together in insurance contexts.

Tutorials

The tutorials are a mix of R based modelling questions and written exam style questions. Note that while assessment and tutorials may ask you to write code, the final exam is by hand and only assess R by having you interpret code. Thus, even for questions meant to be done with R in tutorials, see if you could do them by hand if provided relevant outputs (e.g. Spearman or Kendall's Correlation). The tutorial questions are at a good difficulty and generally reflect the difficulty of the exam.

Assessment

There were 2 equally weighted individual assignments for this subject, both being R-based and requiring you to write your own functions. The concepts and questions tested in assignments are just variation of the lecture slides and tutorial worksheet. You may need some time to write the functions if you aren't too fluent with programming in R. Also make sure to read the assignment rubric on LMS as Enrique marks the assignments based of off that and those who did not follow the rubric lost some straightforward marks. They are marked fairly and it is not difficult to score well on the assignments. Note, that writing functions isn't relevant to the exam.

The final exam is a two-hour written exam with 15 minutes of reading time. We were allowed to bring in two A4 doubled sided pages of notes (unlike previous years which had no notes but were supplied a formula sheet). The note sheet meant that memorising formulas and identities wasn't needed and the questions were applying the formulas to questions and examining your understanding of how and when to apply ideas as well as possible drawbacks or alternatives. The exam questions were very similar to the tutorials and to the past exams we were provided. If you can do those questions without a problem you didn't have a problem with the exam.

Overall Remarks

While Actuarial Statistics has a lot of content overlap with subjects you've previously studied, it generally goes into more detail so keep up with the content as it goes. Some parts, the GLM unit for example, can seem challenging but after reviewing it, the questions and required understanding is quite straightforward. Remember that the final exam is written and that only R output understanding is needed so learn to do the calculations for appropriate concepts by hand. Overall, I found this to be one of the easier third year subjects.

ACTL30006 Intermediate Financial Mathematics [SM2]

Exemption Status	CM2 Financial Engineering and Loss Reserving in conjunction with ACTL20004 *Topics in Actuarial Studies* and ACTL40004 *Advanced Financial Mathematics*. Satisfactory performance across the three subjects is required
Prerequisites	ACTL20003 Stochastic Techniques in Insurance ACTL20004 Topics in Actuarial Studies
Lecturer(s)	Associate Professor Han Li
Weekly Contact Hours	1 x 2-hour lecture 1 x 1-hour tutorial
Assessments	Assignment 1 – Individual (10%) Assignment 2 – Individual (10%) Mid-semester Exam (10%) Final Exam (70% - Hurdle)
Textbook recommendation	Introduction to Mathematical Portfolio Theory by Mark S. Joshi and Jane M. Paterson ✓ Recommended – Some of the final examination questions were very similar to some of the textbook questions, and it provides good practice for the concepts learned in lectures
Lecture Capture	Full audio + video, Lecturer uses a document camera and often has supplementary notes written.
Year and Semester Reviewed	2024 Semester 2

Subject Content

Intermediate Financial Mathematics is very different to its Introductory counterpart and is more concerned with ***Modern Portfolio Theory.*** In this subject you work with expected returns, variance of returns, utility theory and various models that are used to analyse portfolios under some simplifying assumptions.

• Topic 1 – Modern Portfolio Theory

The objective of the modern portfolio theory is to maximise the risk-return trade-off when investing in the markets through the use of mathematical tools. Here you use matrix algebra, and linear equations to solve optimisation problems, and find a number of ***efficient***

portfolios with some certain conditions (e.g., a certain standard deviation). You also learn about the definition of an ***efficient frontier,*** and a ***tangent portfolio***.

• Topic 2 – Mean-variance Theory
The mean-variance theory provides a way of choosing a combination of assets based on the idea that investors only care about mean-variance efficiency. This topic guides you through the steps of constructing an opportunity set and finding efficient frontier and typical portfolios.

• Topic 3 – Single-factor Model and Multi-factor Model
These two models simplify the mean-variance theory by relating assets to the market portfolio, which largely reduces the number of variables required for analysis. The mathematics involved here is largely finding expectation, variance and covariance for a linear combination of random variables representing the 'market return', and the return of a portfolio of assets.

• Topic 4 – Expected Utility Theory
Expected Utility Theory helps to choose portfolios by giving assumptions on risk preferences.
This is in comparison to the mean-variance analysis, which does not show which portfolio to hold, which instead reduces the set of investments worth considering. You are assessed on the axioms of utility theory, indifference pricing, quadratic approximation of utility functions and the link between quadratic utility functions and mean-variance analysis.

Topics 1-4 are usually the scope of the midsemester exam.

• Topic 5 – Geometric Means
Given the previous two criteria in portfolio selection (mean-variance criteria and expected utility theory), geometric means is another method used for long-time (lifetime) growth of a portfolio, using a simple criteria of maximising expected log returns

• Topic 6 – Stochastic Dominance
Stochastic dominance is a criterion of choosing investment options purely based on the probability distribution of returns. It involves comparing the cumulative distribution, and the integrated cumulative distribution of assets against each other to meet conditions of dominance.

• Topic 7 – Capital Pricing Asset Model
Depending on the investor's analysing ability, the investment pool varies from investor to investor. The CAPM develops a simple relationship between the expected return of an asset and its covariance with the market portfolio by making a large set of assumptions that investors have identical analysing abilities and share the same market portfolio. It is very similar to the CAPM mathematics done in first year finance subjects.

• Topic 8 – Arbitrage Pricing Theory

APT provides analysis based on the multiple factor model but with no diversifiable risk Involved. Arbitrage pricing theory also holds that if any asset's payoffs can be replicated, then we can price assets based on the principle that arbitrage cannot hold. This topic also covers the idea that if you can eliminate risk by buying/selling a number of assets linked to a common random variable, then you should always produce the same 'risk-free' rate of return.

- **Topic 9 – Derivative Contracts**

Here you learn more theory and concepts behind basic derivative contracts, such as futures contracts, forward contracts, put options and call options. By the end of this topic, you should be able to explain the similarities and differences between these contracts in words. This topic also covers the put-call parity concept.

- **Topic 10 – Efficiency and Rationality**

This lecture examines three different forms of market efficiency. It is one of the most theoretical topics in the subject and is purely conceptual knowledge (there is no mathematics involved here)

- **Topic 11 – Value at Risk**

To this point, the variance has been used as the principal measure of risk. Value at Risk is another measure of risk that compensates for some disadvantages of the variance. For example, the variance penalises upside variance as well as down-size variance. Here we also learn about modelling rates of returns under a log-normal model, very similar to ACTL20002 content on Brownian motion.

- **Topic 12 – Behavioural Economics**

Again, a more theoretical topic which covers the idea of bounded rationality, heuristics and prospect theory.

Lectures

The lectures and lecture examples were very useful. The professor always walks you through the mathematics of solving each of the lecture examples and explains the concepts quite clearly.

Since the lectures are 2 hours long, it is advisable that (if you watch the recordings), you take a break at the 1 hour mark, as it may be difficult to digest so much content at once.

Tutorials

It is crucial to attend the tutorials. There is not much other revision material given in the subject and so the tutor's walkthroughs of the solutions (especially for proof questions), as well as their summary notes (which you may not necessarily gain access to if you don't attend tutorials) are paramount to understanding the concepts in the subject well, and for assessments.

Assessments

Assignments

Assignments 1 and 2 are both on Excel.

Assignment 1 involved using Excel to model the average returns, and volatility of returns (variance) and correlation between certain assets in a portfolio.

Then, using formulas and matrix operations on Excel, you are asked to calculate portfolio weightings that satisfy certain conditions (such as minimum variance and tangency under a given risk free rate) and the expected return and variance of these portfolios.

Assignment 2 involved using Excel to create a model which output the expected utility and ranked three different assets under different criteria such as geometric returns, stochastic dominance, and mean-variance optimisation. This involved lots of preliminary calculations, problem-solving and the use of conditionals (IF/IFS) on Excel.

Midsemester Exam:

The midsemester exam is generally 30 marks and is an hour long. It covers topics 1-4 (weeks 1-6) of content and takes more general or tougher versions of the tutorial questions. Practice exams were not given to my cohort, which is why the textbook, or doing past CM2 questions for the IFM content is useful.

Final Exam

The final exam can be quite time pressuring but if you prepare a comprehensive formula sheet and answer the theory questions accurately, you can score well on the exam. Utility theory, lognormal rates of return, Value-at-Risk, CAPM and APT questions are guaranteed to come up on the final exam, so revising these topics are crucial, and the questions were familiar either from the textbook or altered versions of tutorial questions. In summary, while the final exam might not be 'easy', it Is much more manageable to prepare for the final exam compared to other actuarial subjects.

Final remarks

This subject was quite enjoyable since there is a lot of coverage on these topics on Youtube and other resources, which helped my understanding and helped me see different examples of the concepts I learned. This subject also gives you a breather from all the insurance-heavy content you learn in the other level 3 subjects, so it is definitely one you should engage in and aim to score highly.

Subject Reviews: Graduate Subjects

ACTL90003 Mathematics of Finance III [SM1]

Exemption status	CM2 Financial Engineering and Loss Reserving, in conjunction with ACTL20004 *Topics in Actuarial Studies* and ACTL30006 *Intermediate Financial Mathematics*. Satisfactory performance across the three subjects is required.
Prerequisites	ACTL90002 Mathematics of Finance II OR Admission to Master of Commerce (Actuarial Studies)
Non-allowed subjects	ACTL40004 Advanced Financial Mathematics
Lecturer(s)	Guo Liu
Weekly contact hours	1 × 1.5-hour lecture 1 × 1-hour tutorial
Assessments	Tutorial participation and preparation: 6% Assessable test: 1 × 4% = 4% Individual assignment 1 × 10% = 10% Individual assignment 1 × 10% = 10% 3-hour end-of-semester exam (hurdle) 70%
Textbook Recommendation	N/A
Lecture Capture	Full (both audio and video)
Year and Semester Reviewed	2021 Semester 1, updated by a student from the 2024 cohort.

Comments

It was very exciting to know that MoF3 is the last subject in the Part I qualification. The beauty of this subject is that some content taught in this subject is highly applicable in practice. Especially, the Black-Scholes model was the first widely used model for option pricing. The first half of the lecture materials (Weeks 1-6) are the building blocks and mathematical tools for understanding the derivation and application of the Black-Scholes formula, including risk-neutral pricing, martingales, Brownian motion, and Stochastic Calculus. The last three weeks are an introduction to simple interest rate derivatives and credit derivatives. As everything sounded new to us, this subject could be daunting, especially during the first half, when it was difficult to see connections between topics. Moreover, you might get lost when starting to learn Stochastic Integrals, as it deviates quite a bit from the technique of Riemann Integral, which is the definite integral we normally encounter in calculus texts.

Subject Content

As I have mentioned above, the first six weeks are about the mathematical foundation of understanding the Black-Scholes formula. Weeks 7-9 give a comprehensive overview of the Black-Scholes model, and you can research more in-depth concepts related to this topic if it appeals to you. The last three weeks change the objective to making interest rate stochastic rather than the stock price and the subject concludes with an introduction of default/credit risk.

Lectures

In terms of time commitment, I had a three-hour lecture per week rather than a two-hour lecture that I had been used to during the bachelor's course. Twelve more lectures mean more time and energy needed to absorb knowledge, take notes and revise for the final exam. I should not forget to mention that we still have specimen questions included in the lecture notes for us to practice weekly. As there is no tutorial, you might get less motivated to keep up with practice. I would recommend you attempt them weekly as some questions can be difficult at first sight and you will regret it if all of them are left to SWOTVAC.

Assessment

Mid-term exam

The mid-term exam was quite interesting as it looked pretty like the specimen paper, we were provided a few weeks before the exam. Therefore, to maximise your utility, make sure you practice the specimen paper a few times and familiarise yourself with lecture notes, so you know where to quickly look during the exam if it is open book. (p.s. I can only be sure that this will be the case in 2022.) You will only be given one hour to complete it.

Assignment

This subject has one assignment due at the end of the semester and it was released two weeks prior to the due date in my year. I felt that the assignment was easy, and we were required to build an Excel spreadsheet for option pricing using a hundred steps binomial tree and the Black-Scholes formula. Your life will be easier if you have completed the lecture materials up until week 8. You still need to be careful about it as it is quite heavily weighted (20%).

Final exam

The final exam consisted of 10 multiple choice questions and eight long answer questions. Admittedly, those long answer questions were much more complicated than the weekly specimen questions. It required a holistic understanding of the concepts of a class of methods or models. One tip I can give is that you might find the revision tutorial (the last lecture in the semester) to be very useful, as those are the key concepts and are highly likely to be examined in the final exam.

ACTL90010 Actuarial Practice and Control I [SM1]

Exemption status	ACC: Actuarial Control Cycle, in conjunction with ACTL90011 *Actuarial Practice and Control II*. Satisfactory performance across both the subjects is required
Prerequisites	Admission into one of the following: MC-ACTSC Master of Actuarial Science, MC-ACTSCEN Master of Actuarial Science (Enhanced) AND Completion of a minimum of 100 credit points of study (including 4 core subjects; or equivalent)
Lecturer(s)	Dr David Heath Julian Gribble Donald Campbell
Weekly contact hours	2 × 2-hour recorded lectures
Assessments	Tutorial participation and preparation: 6% Assessable test: 1 × 4% = 4% Individual assignment 1 × 10% = 10% Individual assignment 1 × 10% = 10% 3-hour end-of-semester exam (hurdle) 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 recommended**. I personally did not use it, instead relying on background documents posted on the LMS which were important, useful, and examinable. This included background/fundamental knowledge on general/life insurance and superannuation, which were the building blocks upon which the lecture material expanded.
Lecture Capture	Full (both audio and video)
Year and Semester Reviewed	2021 Semester 1, updated by a student from the 2024 cohort.

Comments

David prefaced the subject – and consistently reminded us – that this was unlike any actuarial subject we would have studied previously. This subject focuses on largely the three lines of general insurance, life insurance and superannuation. It was a movement away from typical actuarial theories and formulas, instead placing us in the shoes of an actuarial consultant, and the considerations and decision making that come with it. David often stressed that in this subject, it was critical to take into consideration different stakeholder perspectives, something that I found to work well in assessments. It was also made apparent to us that there are different ways of viewing and answering a problem.

The content followed a very structured approach, in which the content was delivered covering seven learning objectives, based upon the syllabus of the Actuaries Institute. Throughout the lectures, these objectives would be referred to, to make it easier for us to recognise the relevance of the content, and structure our revision.

Overall, this subject was a welcome change from the standard mathematic-heavy subjects studied prior and gave us an insight into the larger picture of life as an actuary, beyond the theory.

Subject Content

As mentioned, the content covered seven learning objectives, based upon the actuary program of the Actuaries Institute:

- Discuss and apply an Actuarial Control Cycle in a variety of practical commercial situations2.
- Relate the main features within the general environment to medium and long-term commercial decisions.
- Analyse the main features and risks of financial product and contracts, from the point of view of consumers and providers.
- Demonstrate an understanding of Enterprise Risk Management
- Apply a risk assessment framework in a range of situations.
- Discuss and apply the process of product design.
- Understand how models are used to solve client problems.

We were often told that the subject was a balancing of these learning objectives, and that for our assessments, problems would consider an interaction of these objectives.

Personally, I found objectives 4 and 5 the most difficult to understand, however there were a couple of specialised lectures on these to help provide greater understanding, and this part of the content was in my opinion the least interesting. There was a large crossover in these 2 objectives with MULT90014 (Business Risk Management). The only quantitative/mathematical part of the content was one lecture on reinsurance (which did appear on the exam).

Lectures

Each lecturer focussed on different aspects of the unit given their different specialities, with David focussing on general insurance, Julian on life insurance and risk management and Donald on superannuation, although all three also covered more general concepts. David and Donald's lectures were delivered in person and online, and I would recommend attending on-campus as there were many interesting discussions to be had – something that David also stressed. I did find that some of the later lectures were a bit repetitive, but they expanded on topics covered earlier, and were to our benefit as they covered important topics that previous cohorts had struggled on. Julian's lectures were uploaded to the LMS and split into 5 or 6 parts, normally totalling between 1.5 – 2 hours per lecture.

I often found it difficult to take all my notes in a lecture, especially the more content-heavy ones, and there was rarely a break in the 2 hours lectures. I would normally re-watch the uploaded lectures to cover anything I missed. On the occasions which I couldn't attend campus, watching the uploaded recordings was a little tiresome, and I often found myself watching on 2x speed.

Each lecture was prefaced with which learning objective(s) was covered, and the lecturer would highlight this. While they tried to cover each learning objective in sequential order, it got a little bit confusing when moving from one objective to another, especially when a totally new topic was covered in the next lecture.

Tutorials

N/A

Assessment

Assignment

There was one assignment, which was a group assignment (3-4 members) worth 30% of the total grade. Groups were assigned for us. We were positioned as members within the actuarial division of a financial services company, which provided different products. We were tasked to work as a group and write a report which covered the risks faced for each product, following the 'control cycle' and 'enterprise risk management' approach which was taught.

A draft report (worth 30% of the assignment marks) was due within 3 weeks of the assignment release, and feedback was provided on this. The assignment was designed this way to allow us to incorporate this feedback into our final report, which was due around 3 weeks later. I personally found the feedback provided by David to be very helpful, as it highlighted when we were on the wrong path and where we were focussing too much/little attention.

End of Semester Exam

The exam was online on the LMS, open book, and 3 hours as well as 30 minutes uploading time. It was worth 70% of the total unit marks. During the revision lectures, we were given the exam format, as well as suggestions as to which questions would cover which topics. Exam technique was also thoroughly discussed, in which it was emphasised that answering the question directly would be rewarded rather than regurgitating notes, something that I found to be true with the marking scheme. Majority of the marks were awarded for covering the 'major points', and the remaining marks for embellishing your responses with other details. Thus, it was critical to answer every question on the exam and not fine-tune them unless time permitted, otherwise you could be missing out on achievable marks. Other recommended techniques included forming your own exam-style questions (using inspiration from the 2 practise papers provided) and awarding a mark scheme for these devised questions, then swapping with other students. Additionally, each question covered multiple learning objectives, so it was important to practise weaving these different objectives into your answers.

The 3 hours should be ample time to complete the paper, although the luxury of panning through notes and lecture slides would hamper you if the content wasn't thoroughly revised. I would say that over the course of the semester, the lectures helped prepare me for the exam in that my mindset and thought process when viewing a problem shifted by week 12.

ACTL90004 Insurance Risk Models [SM1]

Exemption status	None
Prerequisites	Admission into the MC-COMACTS Master of Commerce (Actuarial Science) OR ACTL30007 Actuarial Modelling III
Lecturer(s)	Dr Enrique Calderin & Prof Shuanming Li
Weekly contact hours	3 x 1-hour lectures, some of which are tutorials
Assessments	1-hour mid-semester exam 10%, Individual assignment (problems) 20% 3-hour end of semester exam (open book) 70%
Textbook Recommendation	Dickson, D. C. M. (2005). Insurance Risk and Ruin. Cambridge, UK: Cambridge University Press. The textbook is ✗ Not recommended. I personally did not use it, instead relied upon the questions sets that were provided by lecturers. These were based on each topic, some of which were from the textbook.
Lecture Capture	Full (both audio and video)
Year and Semester Reviewed	2023 Semester 1, updated by a student from the 2024 cohort.

Comments

This subject is interesting in that a tangible connection between actuarial theory and insurance is a feature, with a big application being re-insurance, which features heavily in many of the units. Most of the units/topics were relatively new to me, including premium principles and stochastic ordering, so it was fascinating to be exposed to this. This subject has a heavy proof and theorem focus, in that most lectures will introduce theories, go through their proofs, followed by applications of these theories. The lectures and units are structured in a way that much of the content builds upon itself and is used later in the subject. Units 1 and 2 were important fundamentals which were picked up and used in later applications of subsequent units.

The professors were very knowledgeable and clear and were happy to take any questions in lectures or on the discussion forums. They also went out of their way to provide detailed solutions to problem sets and tutorial questions, so that even if the speed was quite quick in class, there was plenty of resources on the LMS to follow up on.

Subject Content

This subject is split into 5 units:

1. **Utility Theory:**
   Introduction to how utility theory affects decision making, different types of utility functions, and insurance applications of utility theory including re-insurance. Introduces Jensen's inequality and risk aversion theory
2. **Principles of Premium calculation**
   A crucial part of the subject, which introduces different types of insurance premium calculation methods, their properties and how they relate to re-insurance.
3. **Optimal Reinsurance**
   Quite a repetitive but interesting unit, in which various theories/lemmas are proven to demonstrate the optimal type of reinsurance, including stop-loss, excess of loss and proportional reinsurance. Such proofs are quite like what is expected in assignments and the exam.
4. **Ruin theory**
   In my experience, the most difficult part of the course. Extends on prior knowledge of ruin theory, by demonstrating how it is used in reinsurance. Provides greater insight into the actual application of ruin theory, utilising Poisson process. A bit disjointed in that we were also taught Laplace theorem, and it was initially unclear what the relation to ruin theory was.
5. **Risk measures and stochastic ordering**
   Introduces risk measures such as value at risk, TVaR, conditional tail expectation. Then delves into their properties, and relationships between these risk measures. Stochastic ordering was an interesting part of the unit, where we were taught how to compare different risks. However, theories were quite abstract and took a while to grasp.

Personally, I found units 4 and 5 the most difficult to understand, they were also more theoretical than previous units and the connection to insurance was less material in my view.

Lectures

Units 1, 2 and 3 were taught by Prof Shuanming Li, the last 2 by Dr Calderin. Rather than weekly tutorials, after each unit, one lecture was dedicated as a tutorial session for the lecturer to go through the tutorial questions. For me, these seemed a little rushed, and I found myself having to watch the re-recordings to understand the tutorial questions fully. Overall, both lecturers were excellent, with both providing extra details and techniques which weren't necessarily covered in the lecture material but were useful when answering tutorial questions. These questions were supplemented with both typed and handwritten solutions which went into more detail, personally I found the typed solutions to be too vague, often struggling to see how solutions were constructed.

Tutorials

N/A

Assessment

Assignment

Consisted of 6 questions, each with multiple parts, to be completed individually and submitted in week 12. Contributed 20% of unit mark. The questions encapsulated all 5 units of the subject, which I found a little problematic as we hadn't learnt all of unit 5 by the time the assignment was released, which was needed for the assignment. Difficulty largely followed that of the tutorial questions and extra problem sheets, perhaps a little more complex. The use of programming languages such as R was recommended for one question, despite programming not being part of the subject or being taught. Assignment submission requirements were typed (or handwritten and scanned) solutions, along with any programming code.

Mid-semester test

This was held in week 7 for one hour (including reading time), was open book over the LMS, and was worth 10%. There was a mix of true/false questions, MCQ's and 3 short answer questions. Covered material included units 1, 2 and most of unit 3, with 2 practise papers being uploaded on the LMS. Answers were to be scanned and uploaded within the hour, a time limit that I personally found a little restricting.

Final Exam

The exam was online on the LMS, open book, and 3 hours as well as 30 minutes uploading time and 15 minutes reading time. The exam consisted of around 15 multiple choices or true/false questions, and 8 short answer questions. Marks for these short answer questions weren't distributed evenly, reflecting that some questions were longer and more difficult than others. The open book allowance was very much welcomed, as there was a wealth of theorems, lemmas and proofs that were required to be utilised. This said, it wasn't necessarily the replication of these theorems and proofs that was assessed, rather the underlying techniques that were to be employed when answering questions. A few of these short answer questions required numerical calculations and decimal point answers, however a large proportion of questions were 'show that' questions, proofs or problems which needed you to suggest a possible solution. The time limit should be ample time to complete the paper, although the luxury of panning through and re-studying notes and proofs would limit your capacity to answer all questions. Techniques suggested and covered through lectures and 'tutorials' were applicable and helpful in the exam; however, it is certainly true that there is much assumed knowledge in terms of mathematical techniques that was used, as with most actuarial subjects.

ACTL90020 General Insurance Modelling [SM1]

Exemption status	CS2 Risk Modelling and Survival Analysis, in conjunction with ACCT90006 *Life Insurance Models I* and ACCT90007 *Life Insurance Models II*. Satisfactory performance across the three subjects is required
Prerequisites	Admission into the MC-COMACTS Master of Commerce (Actuarial Science)
Lecturer(s)	Prof Benjamin Avanzi
Weekly contact hours	1 × 1.5-hour lecture 1 × 1-hour tutorial
Assessments	Mid-semester exam (Week 7) 15% Individual video presentation (Week 10) 25% 3-hour, open book, end-of-semester exam 60%
Textbook Recommendation	- [MW]: Wuthrich, Mario V., Non-Life Insurance: Mathematics & Statistics (December 17, 2020) ✓ Recommended. - [TS]: Shumway, Robert H., Stoffer, David S. (2017) Time Series Analysis and Its Applications with R Examples, Springer ✗ Not recommended. - [CS2]: Institute and Faculty of Actuaries, CS2 Core Reading, Unit 3 Copulas and Unit 4 Extreme Value Theory ✗ Not recommended.
Lecture Capture	Full (both audio and video)
Year and Semester Reviewed	2023 Semester 1, updated by a student from the 2024 cohort.

Comments

General Insurance Modelling is a very grounded and practical subject. It does a good job at applying the techniques learned to their real-world applications. It is quite content heavy; however, this is mainly due to the large volume of examples and out-of-scope material. I found that simply understanding the main concepts was enough. The subject was fun, especially when applying what we learned in class, and wasn't too difficult overall.

MAST2004 Probability and MAST2005 Statistics are prerequisites for this subject. Retaining knowledge from these two is important, as much of the content assumes you already know random variables, density functions, and how to use R at a basic level.

Subject Content

The overall content can be divided into two parts.

Part 1 – Claims Modelling

Module 2: Collective Risk Modelling
Module 3: Individual Claim Size Modelling
Module 4: Approximations for compound distributions
Module 5: Copulas
Module 6: Extreme Value Theory

Part 2 – Time Series

Module 7: Characteristics of Time Series
Module 8: Times Series Regression and Exploratory Data Analysis
Module 9: Time Series Models
Module 10: Estimation and Forecasting

Lectures

Benjamin will usually go through the lectures one module at a time, however sometimes devoted two weeks to the longer ones. Although the slides are self-explanatory, his notes and explanations added extra depth and understanding that proved helpful. He also made the effort to remember our names, making lectures worthwhile attending in person.

Tutorials

As our tutorials were two hours long, just about every question we had about the problems could be answered. It also allowed Benjamin to go into detail on the harder questions, which was helpful for our understanding. The extra hour was a huge privilege for us postgraduate students to have, and I therefore highly recommend attending these classes every week.

Assessment

Mid-semester Exam:

This midterm was very standard for most actuarial subjects, and was a one-hour, closed book, written exam held in person. It covered all of modules 2 to 5, and the questions were in a similar format to those in the pretutorials. I found that attending tutorials and answering all the practice questions was sufficient preparation.

Assignments:

This assessment is one of the most unique I have done in the course. We were given a set of claims data and asked to compare two reinsurance policies, which had to be presented in a video format. Despite having to work with the data using R, none of our code was assessed, but rather our conclusions and presentation in the video we created. It was therefore extremely important to not get bogged down in the individual details, but rather holistically conclude what our models achieved, and any limitations they may have had.

End-of-Semester Exam:
The format was a 2-in-3 hour, online, open book exam which was conducted as a quiz on the LMS. Some questions were multiple choice, whereas others were long answer and needed detailed explanations. Most of the problems required us to use R to perform calculations, as well as data analysis on some individual sets provided before the exam started. I found the practice exams and tutorial questions sufficient to help prepare and had no issue with timing due to the extra hour given.

ACTL90002 Economics for Actuaries [SM1]

Exemption status	CB2 Business Economics. Satisfactory performance across this is required.
Prerequisites	Admission into the MC-ACTSC Master of Actuarial Science
Lecturer(s)	Jonathan Thong
Weekly contact hours	1 × 1.5-hour lecture 1 × 1-hour tutorial
Assessments	Mid-semester exam (Week 7) 20% Individual or group assignment due in Week 11 10% 2-hour, closed book, end-of-semester exam 70%
Textbook Recommendation	None
Lecture Capture	Full (both audio and video)
Year and Semester Reviewed	2023 Semester 1, updated by a student from the 2024 cohort.

Comments

This subject covers the most important concepts of micro and macroeconomics and was overall very interesting. Jonathan is very engaging and does a great job at condensing a large amount of content into only 12 weeks. Actuarial students should not find the maths used in this subject difficult, as only basic calculus and algebra is required.

Subject Content

The subject is split into two parts which last 6 weeks each. Microeconomics – Economic decision making, competitive markets, consumer theory, the firm's problem, imperfect competition, price discrimination. Inefficient outcomes & market failure. Macroeconomics – Representing & measuring the macroeconomy, the monetary system, the goods & money markets, labour markets & general equilibrium, the business cycle & long run growth, international trade & exchange rates.

Lectures

Lectures are recorded and uploaded to the LMS; however, attending is recommended as it is easy to fall behind on the content due to its volume. This subject is essentially covering both microeconomics and macroeconomics, which are two separate first year subjects, into one.

Tutorials

Although solutions to the tutorials are uploaded to the LMS, these classes are not recorded. Jonathan does a good job of explaining each of the steps that go into solving the problems, so attendance is recommended.

Assessment

Mid-semester Exam:
While the content in the midterm itself closely followed the tutorials and was not too difficult, there were too many questions for only 50 minutes of writing time. No reading time was provided either, making the exam hard to finish. Luckily Jonathan recognised this afterwards and ended up scaling our grades to compensate.

Assignments:
We were given a macroeconomic assignment in week 9 which could be completed individually, or in a group. It required us to choose a country of interest and write a 2000-word essay about their economy over the last 10- 15 years. This was quite fun, and really gave us an insight into not only the country talked about, but also the state of the world.

End-of-Semester Exam:
The format was a 2-hour, in person, closed book exam with both multiple choice and short answer questions. I found this quite straightforward, and doing the tutorial questions and practice exam was sufficient to prepare.

ACTL90019 Data Analytics in Insurance 2 [SM2]

Exemption status	DSP Data Science Principles. Satisfactory performance in this subject is required
Prerequisites	ACTL90023 Data Analytics in Insurance I ACTL90008 Statistical Techniques in Insurance ACTL30004 Actuarial Statistics
Lecturer(s)	Genevieve Hayes
Weekly contact hours	1 × 2-hour lecture 1 × 1 hour tutorial
Assessments	Assignments 2 × 10% = 40% End-of-semester exam (hurdle) 60%
Textbook Recommendation	Raschka, S. and Mirjalili, V. (2019). Python Machine Learning (3rd ed). ✗ Not recommended. – Did not realise there was a textbook (and so did not need the textbook) until reading the handbook
Lecture Capture	Full (both audio and video)
Year and Semester Reviewed	2023 Semester 2, updated by a student from the 2024 cohort.

Subject Content

Those that have taken Actuarial Analytics and Data I (ACTL30008) will find this subject to be very familiar. The main differences are that this subject is taught in Python (instead of R), and there is a greater focus on details other than the fancy machine learning algorithms.

Machine Learning Models

Covers the main machine learning algorithms you are likely to encounter. Some of these (e.g. Linear Regression, Decision Trees, K-Nearest Neighbours) will be revision from ACTL30008, but there are also some new models like Support Vector Machines and Neural Networks. There is also a revision of hyperparameter tuning and cross-validation.

Data Processing and Feature Engineering

This topic is all about manipulating your raw data before sending it to your machine learning models from topic 1. It may sound straightforward, but it will require significant levels of judgement.

Unsupervised Learning

Again, some of these algorithms have been covered in ACTL30008 (e.g. K-Means Clustering and PCA), but there are some new algorithms to learn (e.g. DBSCAN, Local Linear Embedding). Compared to ACTL30008, there is slightly more emphasis on evaluation metrics for these unsupervised algorithms.

Production-Ready Code
This topic is covered in the final lecture of the semester. It emphasises what makes this subject so different from any other machine learning subject I have taken. The focus is entirely on real-world practicality as opposed to the fine details of each algorithm.

Overall, the content was very high-level compared to ACTL30008 and other machine learning courses from either the Maths or Computer Science departments, but it works. The focus in this subject is more about the interpretation of results and how to communicate these effectively.

Lectures
Taking this subject without watching lectures would be near impossible. The slides are useful but are extremely sparse on their own. However, the way Genevieve structures the lectures makes it clear why the slides are the way they are. The lectures themselves are extremely engaging, with Genevieve providing many examples throughout to make things as relatable as possible. There's plenty of back and forth between theory and code, which is a huge plus. Also, free chocolate is hard to pass up :)

Tutorials
Each week, there was a problem sheet to complete. These were mostly coding-based, however there were a few questions related to the interpretation of results, which was equally important. The tutorials themselves involved going through code required to answer the questions, as well as discussing the interpretations of each result.

Assessment
Assignment 1
Both assignments were very similar. They were both individual assignments that related to a dataset of your choice (the same dataset was used for both assignments). Tip: choose a dataset that you are genuinely interested in. We had over 1 month to work on each assignment: the first was due around week 7, and the second in week 12. They each involved some coding; however, the bulk of the marks were related to the 12- page report describing the coding process and results. Again, there is a major emphasis on being able to explain what you are doing to those from a non-technical background. The focus in Assignment 1 was on the first few machine learning models and hyperparameter tuning. There was a rubric provided, but many students seemed to ignore this and consequently performed poorly. So please read the rubric and follow it closely.

Assignment 2

The structure of this assignment was the same as Assignment 1, however the coding was more focused on the data processing and feature engineering side as opposed to building machine learning models. We used our best performing model from Assignment 1, as well as bagging, boosting and neural networks. Again, the bulk of the marks were in the report. Overall performance on this assignment was significantly better than the first one. Ultimately, I enjoyed completing both assignments. Even though the assignments were very structured, there was plenty of freedom in terms of choosing a dataset, writing your code, and creating a report.

Final Exam

The final exam was a 3-hour exam held in the Royal Exhibition Building. Unlike most other in-person exams, this one was typed. It required you to bring your own laptop (or borrow one in advance from the university) and answer each question on a canvas quiz. The questions were all theory-based and involved no coding or mathematics. They required you to have an in-depth knowledge of each algorithm and metric studied in lectures, as well as the associated hyperparameters for each model. While some questions were very straightforward, there were others that were very open-ended. And even though you could type all your answers, the exam was still very time pressured. Personally, the exam was harder than I was expecting. I believe the highest raw score on the exam was just below 80%. Thank goodness for scaling.

Overall Remarks

Overall, the subject was not too different from ACTL30008. My biggest piece of advice would be to learn Python before taking this subject. A great way to do so is to take Foundations of Computing (COMP10001) as a breadth subject in your undergraduate degree. Otherwise, there are plenty of free resources on the internet for learning the language. The first tutorial provides a very brief introduction to Python, as well as the main packages used in this subject (pandas, numpy, sci-kit learn, maybe matplotlib), but I would strongly recommend learning these before starting this subject. Otherwise, you may find it difficult to keep up with the content. In saying this, make sure to focus equally on the theory behind the code, as this will come in handy on the assignments and the final exam.

Subject Reviews: Breadth and Elective Subjects

Important Note: Regardless of what you have been told, it is **NOT** compulsory for you to complete a coding related breadth subject. Melbourne University offers a wide array of breadth subjects in the Arts, Music, Languages, Education and Sciences and so you should find one that piques your interest.

COMP10001 Foundations of Computing [SM1]

Lecturer(s)	Dr Chris Ewin Dr William Umboh Mr Alex Zable
Prerequisites	None
Weekly Contact Hours	3 x 1-hour lectures 1 x 1-hour tutorial 1x 1-hour assistance for grok worksheets
Assessments	30% Projects (x2). 10% Mid-semester test. 10% Grok worksheets. 50% Final exam.
Textbook recommendation	None
Lecture Capture	Full audio + video
Year and Semester Reviewed	2021 Semester 1

Subject Content

This subject is the most elementary subject in coding and has an extremely large cohort every semester. May not feel like the best WAM booster subject as you might hear but definitely easier compared to most actuarial subjects. Especially to those with some sort of coding background, H1 is definitely attainable. Even to those who are new to coding, the Grok worksheets are very beginner friendly and easy to understand.

Topic 1: Python Basics
The very basics of Python such as naming variables, commenting guidelines, etc.

Topic 2: Variable Types
Week 3 to 6 covers some more types of variables commonly used in Python and their differences. They include sets, lists, dictionaries and more.

Topic 3: Python "Advanced"
This part of the subject is more 'interesting' and a bit more difficult. Each week's content may seem unrelated to each other. This topic will be assessed the most in the exam.

Lectures

There are three lectures every week with 2 different streams to suit your schedule. Majority of the content is also available on the Grok worksheets but there are specific theory questions that you can only answer by going to lectures and taking notes. May be an

efficient use of time to look over the lecture slides beforehand to decide whether to attend the lecture or not.

Tutorials

There is a 1 hour tutorial and 1 'available assistance' per week. The assistance session is not a tutorial but rather a drop-in session at specific times open to all students.
The pace of the tutorial is quite slow so I did not attend any of them myself. The sheets are provided online so can always use them for exam revision.

Grok Worksheets / Projects
Grok is a weekly commitment you have to put in to make sure you consolidate your understanding and also get subject marks. It is an online space where you are given multiple coding-questions related to the week's content. Before quizzing you, an overview of the content is provided. You may have infinite attempts until your program produces the correct output.
You will also get two larger projects that are considerably more difficult than the weekly tasks. Do not be fooled by the level of difficulty of the first few weekly groks. While they can be time consuming, if you enjoy problem solving, the time spent may be enjoyable to some extent. Make sure to comment on every block of code with clear variable names to receive full marks.

Mid Semester / End of Semester Exam
The two exams are both hand-written and questions your knowledge of theories and problem-solving skills. Being a hand-written exam, the syntax of your code is crucial. The mid semester exam serves as a good practice for the end of year exam as the format is almost identical. Each year the exam format can change so when revising, do not use very old exams as your reference.

FNCE20005 Corporate Financial Decision-Making [Summer Term]

Lecturer(s)	Bob Li
Weekly Contact Hours	1 x 1.5-hr tutorial 1 x 3-hr lecture
Assessments	Midsemester Test – 25% Tutorial participation – 10% Online Test – 5% Exam – 60%
Textbook recommendation	*Stephen A. Ross, Rowan Trayler, Charles Koh, Gerhard Hambusch and Kristoffer Glover, Fundamentals of Corporate Finance, 8th edition, McGraw-Hill.* ✗ Not recommended. – the content taught in the textbook usually goes beyond the scope of what you're expected to know
Lecture Capture	Full audio + video
Year and Semester Reviewed	2024 Summer Term

Subject Content

CFDM teaches you concepts of capital budgeting, capital structure policy, takeovers and restructuring, risk management and other topics in corporate finance. The content is highly relevant to a career in finance and is quite straightforward as it builds upon what you've learnt in POF.

1. **Options**
   This is a recap of simple options theory learnt in POF, covering how to value options and the drivers of option value.
2. **Raising capital**
   Comparison of equity vs debt to raise capital. The equity portion touches on IPOs and SEOs like placements and rights issue whereas debt looks mostly at leases.
3. **Issues with WACC and capital structure policy**
   Revision on how to calculate WACC and Modigliani and Miller assumptions. It then looks at both tax-induced and non-tax impacts of capital structuring decisions.
4. **Payout policy**
   Payout policy looks at how a company decides whether to issue dividends – from a tax and non-tax perspective – or buy back shares.
5. **Capital budgeting**

This topic explores sensitivity analysis, break-even analysis and decision-tree analysis to understand how investment decisions are made.

6. **Analysis of takeovers**
   This topic looks at the types of acquisitions, methods of payment, cash vs scrip offers, takeover defences and empirical insights into takeovers. It also looks at regulatory rules.
7. **Corporate Restructuring**
   This topic helps you understand why firms undergo restructuring, types of restructuring such as divestitures and spin-offs, and looks at empirical evidence too.
8. **Real options analysis and risk management**
   This topic was the most new/unfamiliar in the subject as it looks at investment decisions from the lens of an options graph. Risk management looks at types of hedging and risk measurement techniques, although it was skimmed over very quickly.

CFDM does not require much prerequisite knowledge, although some skills from POF like NPV calculation and options theory are useful. I found the topic to be very content heavy, especially because the subject was run in Summer, so I relied on ROTE learning a lot of the theory before the exam. Unluckily, the assessments we got in the summer term were difficult and it was hard to prepare for them as the nature of the questions were often unseen before – I would recommend understanding the theory and derivations in this case. Practice material was provided but they often did not prepare students well for assignments.

Lectures

The lecturer for the summer term was okay but I personally found it difficult to understand his teachings at times. I found myself learning most of the content through looking at answers from practice exams and in tutorials rather than from lectures. The worked examples in the lectures also did not compare to those in tutorials or assessments. However, it is worth watching the lectures as Bob Li would often mention examinable topics that weren't on the slides. I found it difficult to hear him through the lecture recordings due to microphone issues and his cadence, so going in person may help.

Tutorials

The tutorials are highly beneficial and have mandatory attendance. The tutor would walk us through the tutorial questions and leave one or two for us to work on in groups, which are then collected and marked as part of our tutorial participation grade. You are encouraged to try the tutorial questions beforehand as it may be jarring seeing these for the first time in a class setting.

Assessments

Mid-semester test:

The MST was held in week 3 for the summer term, and in that week, you do not have any tutorials or lectures. It was an in-person test (calculator allowed, no notes), and all 20 questions were multiple choice. When I took the subject, the MST was abysmal as topics that were only briefly mentioned/not mentioned at all were examined. It was unlike any of the practice material provided or that could be found online.

Tutorial Participation:
There was one tutorial per week, and participation is what gets graded. I was fortunate to have a supportive and laid-back tutor who made the tutorials enjoyable and easy to engage in. As aforementioned, you also will have to attempt some questions within small groups and hand those in for marking by the tutor as part of your grade for this assessment; it is therefore important to try the questions before attending.

Online assessment:
This was a 10-question timed LMS quiz, all multiple choice. The questions were arguably worse than those on the MST as the calculations were complicated and it felt as though we had never been exposed to these problems before. I would suggest being familiar with the formulas and calculation techniques for this assignment.

End-of-semester exam:
The exam was 2 hours and held in-person (calculator allowed, no notes). Again, it was not easy as the calculations were complicated and many of the questions had multiple long parts to them – although consequential marks were given. I would suggest practicing and familiarising yourself with calculations over theory, as the theory questions were easier – although some of the niche topics do get examined so make sure you are over all of it. The exam and the MST I believe got scaled up in the summer I took the subject.

Overall remarks

I enjoyed CFDM as the topics I learnt felt relevant to the real-world and applicable to a career in finance. However, I think it would have been a more pleasant experience had I taken the subject during other semesters as the volume of content was a lot in the summer – especially if you are taking another subject like I was. I still managed to achieve a score I was happy with; although it came as a surprise as the assessments dulled my expectations a lot. Looking back, I would worry less about my grades as scaling is likely, and instead focus on enjoying the content. It helps to do lots of practice problems, ask questions and importantly, do not overthink multiple choice questions.

ECON20003 Quantitative Methods 2 [SM2]

Lecturer(s)	Dr Mehmet Ozmen
Prerequisites	QM1, Probability or Equivalent
Weekly Contact Hours	1 x 1-hr tutorial 2 x 1-hr lecture
Assessments	3 Assignments – 30% Tutorial participation – 10% Mid Semester Test – 5% Exam – 50%
Textbook recommendation	✗ Not recommended. – there were two prescribed textbook – I don't recommend any of these because: if you are mathy then these book's won't have interesting proofs that you'd like to read, if you hate math then then doing a lot of irrelevant and lengthy practice will only kill more of your interest.
Lecture Capture	Full audio + video
Year and Semester Reviewed	2024 Semester2

Subject Content

QM2 is a subject that teaches you data analytics in a business context. It largely focuses on applying statistical models in real-world context. Although quantitative in nature, it also allows you to practice programming in R, report-writing and teamwork. Here are some interesting topics being covered:

1. Properties of Point estimators: Unbiasedness, Efficient etc.

2. Hypothesis testing: natural progression from QM1 and VCE Specialist 3/4. But this is no longer solely about population mean / proportion, you do these on variances as well and you explore the underlying assumptions. You will learn how to perform hypothesis testing using either confidence interval approach or p-value approach, following the rigorous 6-step process. There is obviously a lot of complications here but I will not list all the details out.

3. The Chi-square, t- and F- distribution introduces a couple of profound distributions that might be used as sampling distributions.

4. Normality Assumption: underlying a lot of hypothesis test is the assumption that the population is normally distributed – this unit explores how do we check if this assumption valid.

5. ANOVA: Analysis of variance tests whether the mean is the same across different populations.

6. Linear Regression & General F test: You learn about multiple regression and how to test model's usefulness.

7. Using the **sample regression Equation** to make predictions about future observations.

8. Time-Series Data

Lectures

The lectures are live-streamed. Dr Mehmet is very good at giving intuitive explanations about the mathematical concepts. However, due to the lack of mathematical rigour & proofs I still find the content challenging to understand sometimes.

Tutorials

Tutorial serves as a mini revision of the lecture content and a practice opportunity. There is a tutorial file released every week on LMS and you are expected to complete the homework question to get the tutorial mark. Personally, I found the tutorial file very helpful – everything in the lecture are pretty much summarised in those tutorial notes (in a much concise manner). You can also go through the example questions and R programming in the tutorial file during your own time as a revision.

Assessments

Assignments

You can choose to complete with a group or by yourself. To me, these assignments are very challenging, not because of the content they assess, but because of the formatting etc. You need to understand what the question wants you to do very well, and you must control wordcount at the same time. Making sure that you have a clear presentation is crucial.

Tutorial Participation

As long as you attend the tutorial and complete the homework on time, the tutors won't fuss about whether you actively contribute to the class discussion.

Mid-semester test

This is a LMS test that you can do in 15mins by yourself – consisting of some multiple choice questions relevant to all the content you've learnt.

Final Exam

The exam is held in person at the Royal Exhibition Building. You will also be given practice papers to prepare for it. I found the practice paper very helpful.

Overall remarks

I did this subject as a preparation for Statistics – my final MAST subject for this entire degree. I enjoyed this subject because I had very good teammates. I think for actuarial students, if you've done statistics, there will not be much new content to learn and this subject might be a bit boring for you – however you can still make a large improvement in your report-writing skills through these assignments.

MAST20030 Differential Equations [SM2]

Prerequisites	One of MAST20009 Vector Calculus or MAST20032 Vector Calculus: Advanced And One of MAST10007 Linear Algebra MAST10008 Accelerated Mathematics 1 MAST10022 Linear Algebra: Advanced And One of MAST10006 Calculus 2 MAST10009 Accelerated Mathematics 2 MAST10021 Calculus 2: Advanced
Lecturer(s)	Dr Antoinette Tordesillas Dr Jesse Collis
Weekly Contact Hours	3 x 1 hour lectures, 1 x 1 hour tutorial
Assessments (2024)	2024: Assessment 1 (individual task on Linear ODEs & IVPs + Power Series technique) - 10% Assessment 2 (Laplace Transform, Fourier Series) - 10% Assessment 3 (BVPs & Linear PDEs, Fourier Transforms) – 10% Final Exam (not hurdle) - 70% 2025: Written Assignment- Two written assignments (equally weighted) due at regular intervals amounting to a total of up to 40 pages - 20% Mid-Sem Test - 15% Final Exam – 65%
Textbook recommendation	✗ Not recommended. Lecture Notes are sufficient, and Wikipedia is good to supplement certain content such as Bessel and Green's Functions
Lecture Capture	Full audio + video with good quality. I would highly recommend attending Antoinette's in-person lectures because there are three cameras occasionally in the recording which lowers the

	resolution. Also, she mostly takes questions *during* the lecture.
Year and Semester Reviewed	2024 Semester 2

Subject Content

1. **Linear ordinary differential equations (ODEs) + Initial Value Problems (IVPs)**
3. Classification of ODEs
4. Integrating factor (revision)
5. Connection to linear algebra (eigenvalues, linear transformations and eigenfunctions)
6. Trial solutions for constant coefficient ODEs (revision)
7. Reduction of order
8. Existence and uniqueness of solutions (Picard–Lindelöf theorem)
9. Linear independence and the Wronskian (Abel's differential equation identity)
10. Systems of first-order linear ODEs (matrix method)
11. Sketching phase portraits
12. Diagonalisable systems and diagonalisation technique

2. **Power series solutions to ODEs**
13. Taylor series (revision)
14. Ratio test for power series (revision)
15. The Airy differential equation
16. Airy functions
17. Bessel functions
18. Uniform convergence (revision for those who have done Real Analysis)
    i. Uniform convergence of a series
    ii. Weierstrass test for uniform convergence
    iii. Theorems on: Integrating a series & Differentiating a series
19. Formal and genuine solutions

3. **Laplace Transforms**
20. Improper integrals
21. Comparison test (revision for those who have done Real Analysis)
22. Laplace Transform
    i. Convergence
    ii. Inverse Laplace Transform
    iii. Partial fractions (revision)
    iv. Derivatives
    v. Application to ODEs
    vi. Discontinuous functions
23. Dirac delta
24. Convolution
    vii. Laplace transform of the convolution: Arbitrary inhomogeneous term; Integro-differential equation

viii.Laplace transform of an antiderivative

4. Fourier Series

25. Real and symmetric matrices (revision)
26. Eigenfunction expansions
27. Inner products (revision)
28. Self-adjoint linear transformations
29. Fourier series (eigenfunction expansion)
30. Pointwise convergence of a Fourier series
31. Fourier series for evaluating sums.
32. Convergence of Fourier series
    I. Uniform convergence
    II. Rate of convergence
    III. Gibbs phenomenon
    IV. Differentiating a Fourier series
    V. Differentiating a uniformly convergent sequence
33. Even and Odd functions, Even and odd extensions
34. Forced harmonic oscillator.
35. Parseval's identity
36. Complex Fourier series

5. BVPs and Linear PDEs

37. Dirichlet and Neumann boundary conditions
38. Classification of PDEs
39. Separation of Variables
    i.Heat equation.
    ii.Wave equation
    iii.Laplace equation
40. Steady-state and transient solutions
41. Inhomogeneous terms
42. Formal vs genuine solutions

6. Fourier Transforms

43. Fourier transform
44. Existence and inversion of the Fourier transform
45. Fourier transform of a convolution.
46. Shift theorems (non-assessed in 2024)
47. Differentiation
48. Fourier transforms to find the solution to ODEs + PDEs
49. Heat equation with Fourier and Laplace transforms.

Lectures

The lectures are generally detailed and almost all of the content in the lectures came up either in an assignment or on the exam. There were three lectures a week with Antoinette

taking the first seven weeks or so, and Jesse taking three or so weeks following until Antoinette came back for the last couple of weeks. This is going to change in 2025 and onwards since Jesse is no longer working at the University of Melbourne.

Tutorials

Tutorials serve as a revision of previous week's lecture content, providing exercises for students to apply techniques learned in lectures. The assignment and lecture content is similar to tute questions but obviously harder especially in the assignments. I highly recommend attending because the assignments are the longest I've ever had for a subject and they are due in 10 days each where some content is only taught during the tute of the week the assignment is due.

Assessments

Each assignment took my friends and I around 20 pages of writing, and given three assessments that's 60 pages overall (the handbook said 50 pages is the expected amount but of course this can vary). You shouldn't be surprised to have more pages in your own assignments depending on the amount of computation required to solve certain differential equations. Each assignment took roughly 20-25 hours at most which is still a relatively high amount for some people for a math subjects' assignment.

Final exam:

The final exam is computationally much easier than the assignments due to time limitations. The entire three hours are often not enough for most people, so focus on solving questions with a healthy pace to prepare for the exam. A large proportion of lecture content will be covered on the exam including relatively esoteric parts which are likely to reward those who have studied the curriculum well – I found some of the solutions I had using the lecture techniques to give interesting yet correct results during the exam, so knowing the techniques for this subject is the crux of doing well. It is also essential to have an intuition for many parts such as in Separation of Variables and Fourier Series to avoid mistakes that come from simply memorising formulae.

Overall remarks

Practice is really all I want to emphasise for this subject, and also gaining an intuition for the techniques taught in lecture. In the second assignment I was one of very few people to get a question right because most people copied the techniques from lecture without understanding the physical implications of their solution to a certain ODE. It is then that you must question yourself and think about this subject as an applied math subject, as this is how it is taught by Antoinette (she emphasises this from the very first lecture). You should also have a strong intuition for how to extend a technique or why a certain transform is useful for solving a question, for example. This all depends on a good basis in Linear Algebra, Calculus 2, and Vector Calculus to some extent but I would say knowing basic Real Analysis especially Uniform Convergence, Taylor Series and the "Weierstrass-M Test" are key to doing well on assignments.

MAST20032 Vector Calculus Advanced [SM2]

Prerequisites	One of MAST10007 Linear Algebra MAST10008 Accelerated Mathematics 1 MAST10022 Linear Algebra: Advanced And One of MAST10006 Calculus 2 MAST10009 Accelerated Mathematics 2 MAST10021 Calculus 2: Advanced
Lecturer(s)	Dr Gufang Zhao
Weekly Contact Hours	3 x 1-hour lectures 1 x 1-hour tutorial
Assessments (2024)	2024: Four written assignments (5% each) - 20% Final Exam – 80%
Textbook recommendation	Vector Calculus: Advanced Student Notes (Barry Hughes, former lecturer) Calculus on Manifolds (Michael Spivak) Vector Calculus (Marsden and Tromba) I ✓ highly recommend all of the aforementioned resources. Calculus on Manifolds is useful for the proofs especially for (Riemann) integration in multiple dimensions, whereas the "official" textbook by Barry Hughes served as a basis for my understanding outside of lectures for the rest of the content other than differential forms which aren't present in the book and were introduced this year.
Lecture Capture	Full audio + video with good quality. I would highly recommend attending in-person lectures to ask questions as some proofs are non-trivial and a lot of story-telling is done in-person if you have Gufang as your lecturer.
Year and Semester Reviewed	2024 Semester 2

Subject Content

1. **Functions of Several Variables**
2. **Topology in Rn**
   a. Open balls

b. Continuity
c. Compact sets

3. Differentiability
a. Clairaut's Theorem
b. Order of Cn
c. Chain rule for functions of several variables
d. Derivative matrix
e. Matrix version of chain rule
f. Gradient vector and level set

4. Parametric Paths
a. Velocity, acceleration, speed
b. Differentiation rules
c. Tangent and normal vectors

5. Parametrised surfaces
a. Tangents and normals on surfaces
b. Orientation of a surface
c. Tangent plane to parametrised surface
d. Vector fields and flow lines

6. (Not in 2024) Frenet–Serret formulas

7. Taylor's Theorem
a. Remainder estimation theorem
b. Taylor's theorem for the remainder
c. Taylor polynomials

8. Extrema
a. Hessian test
b. Generalised Extreme Value Theorem
c. Lagrange multipliers

9. Differential operators
a. Div, grad, curl
b. Gradient field (scalar potentials)
c. Vector potentials
d. Polar, spherical and cylindrical coordinates
e. General curvilinear coordinates
f. Unit vectors

10. Integrals over paths
a. Differential forms
   i. n-forms
   ii. Rules
   iii. Practical applications in solving vector calculus problems
b. Arclength
c. Arclength parameter
d. Integrating a function on a path
e. Path integral of a vector field
f. Conservative vector fields
   i. Irrotational fields

11. Multi Integrals
- a. Volume, surface area, arc length elements
- b. Pseudo-differential form
- c. Double and triple integrals
- d. Fubini's theorem
- e. Double and triple integrals
    - i. Over rectangular domains
    - ii. Over general domains
    - iii. Horizontal and vertical "strips"
- f. Proofs using Darboux integrals

12. Change of Variables in Multi-Integrals
- a. Jacobian
- b. Volume element
- c. Polar, spherical and cylindrical coordinates
- d. Centre of mass, moment of inertia

13. Integrals over surfaces
- a. Integral of a 2-form on an oriented surface
- b. Surface area
- c. Integral of a vector field on a surface
    - i. Flux

14. Integral Theorems
- a. Green's Theorem
    - i. Area of Region in the xy -Plane
- b. Stokes' Theorem
- c. Divergence Theorem in the Plane
- d. Gauss' Divergence Theorem
    - i. Volume via Surface Integrals

15. Applications of Integral Theorems (mostly physics)

16. Revision (proofs and key concepts)

Lectures

The lectures are generally detailed and a large percentage of the content in the lectures came up either in an assignment or on the exam (except for differential forms which we did spend a long time covering, which wasn't in tutorials either in 2024 perhaps because it was a new addition). There were three lectures a week with Gufang and most of them were done using a document camera projecting a paper that he worked on and so the slides are not sufficient to cover all the content – all of the proofs were done either on paper or on a blackboard.

Tutorials

Tutorials serve as a revision of previous week's lecture content, and included additional questions which were in the scope of examinability but were significantly harder. The tutorials for the advanced version of this subject contain all of the questions from the

regular class and those make up around a third of the tutorial, and the other two thirds are proofs and challenging formulas that you are tasked with deriving.

Assessments

Each assessment had around four questions (one) of which about one was in the regular vector calculus class and the rest were proofs. These proofs can take significant time to think about and sometimes required 'tricks' which took some time to discover. The proofs both in-tute and on the assessments (and honestly also in the exam) will be greatly challenging for students especially those who did not do Real Analysis prior to studying Vector Calculus: Advanced since it is partly assumed knowledge. Each assessment is due two weeks after release which is sufficient time to work through everything.

Final exam:

The final exam was a mix between computation that you might find in the regular Vector Calculus half along with around half being proofs that were similar to lecture and tutorial content. It is also recommended that one practices proof-writing and covers lemmas that were mentioned in class but not proven to improve their skills in preparation for the exam.

Overall remarks

This class is definitely not suitable for all students and will be extremely taxing to those who are not committed to proving everything they do. The tutorials are likely the hardest out of any Level 2 math subject but still definitely doable if you have understood lecture content and work through problems with a strong idea of what you want to achieve and what facts you know to get there. I will say that the cohort of this class is likely one of the strongest you will find, academically at this university. I found this one of the most satisfying subjects I've taken because it immediately helps with MAST30024 (Geometry), MAST30021 (Complex Analysis), MAST30026 (Metric and Hilbert Spaces) as well as being (technically) applicable in Commerce subjects I've done such as in economics (the details would obviously be brushed over in Commerce).

MAST30024 Geometry [SM2]

Prerequisites	One of MAST20009 Vector Calculus MAST20032 Vector Calculus: Advanced And One of MAST20026 Real Analysis MAST10009 Accelerated Mathematics 2 MAST20033 Real Analysis: Advanced
Lecturer(s)	Dr Scott Mullane
Weekly Contact Hours	3 x 1-hour lectures, 1 x 1-hour tutorial
Assessments (2024)	2024: Three written assignments (6.67% each) - 20% Final Exam – 80%
Textbook recommendation	N. Hitchin, Geometry of surfaces, Oxford University lecture notes, available online. M. do Carmo, Differential geometry of curves and surfaces, Prentice-Hall, 1976. F. Kirwan, Complex algebraic curves, Cambridge University Press, 1992. ✗ Not recommended. however, Hitchin is a sufficient text if you want to study any content ahead of time. The tutorial questions should be sufficient otherwise for exercises, and the lectures for key concepts.
Lecture Capture	Full audio + video with good quality. I would personally recommend lecture attendance however this subject's recordings were recorded well other than one that failed to record, within the first week.
Year and Semester Reviewed	2024 Semester 2

Subject Content

Chapter 1: Introduction to Topology

1. Continuity in vector calculus
2. Some topology on Rn
3. Topological spaces
4. Topological properties
5. Manifolds and surfaces
6. Classification of surfaces

Chapter 2: Differential Topology

1. Differentiability
2. Smooth manifolds
3. Tangent spaces
4. Algebraic curves

Chapter 3: Differential Geometry

1. Lengths and areas in R3
2. Abstract Riemannian manifolds
3. Isometries
4. Introduction to curvature
5. Geodesics
6. The Gauss-Bonnet Theorem
7. Hyperbolic geometry

Lectures

This course is very rich in content and each lecture used the entire 55 minutes whereas most subjects only use 50 minutes and end 5 minutes before the lecture ends recording. This was the only subject I've had where we'd actually gone for longer than an hour even and the other class' recording was beginning, which comes to show how much is fit into the subject. The lectures provide both theory and examples which will allow you to solve assignments and the exam.

Tutorials

These are significantly harder than the assignments and exam contents for many questions. Do not expect to finish even a quarter of the week's tute within an hour or even two. These are also used as homework and provide intuition and motivation towards many of the things within this subject however are not directly relevant to the exam or assignment for the vast majority of questions. However, these serve as an excellent time to ask questions to your lecturer or tutor (there were only two tutes in total for the subject so it was also helpful to attend consultations, which were generously frequent, to get an intuition for many concepts).

Assessments

There were three assessments in Semester 2 of 2024. The first was quite lengthy whereas the second two were less time-consuming and significantly less challenging. However the

grade distribution among myself and those I knew was highest for the first assignment and then monotonically decreasing onwards. These will usually require some creativity and a strong understanding of lecture content and often require application of lemmas and proof of small details to make sure a theorem is applied correctly.

Final exam:
The final exam was a mix between computation (much of which was non-trivial for the first time in this subject as there was a polynomial which couldn't be factorised conventionally) and a larger proportion of proofs compared to previous year's most of which I'd never come across before, however they weren't too out of reach to come up with at least an informal proof (many of the proofs in this subject seem non-rigorous as topological proofs can be done through stating lemmas and using diagrams oftentimes).

Overall remarks

This was definitely the hardest subject I've ever taken and also required the most work in understanding out of any subject that I've done before. However I still found it enjoyable and even enlightening in many aspects. It's a very small class, of around 30 students so there is a lot of opportunity to leverage help from the lecturer. It would've been helpful if my tutor had consultation hours too because they were incredibly insightful and also provided a lot of practical techniques in solving tute questions wherein the lecturer mostly focused on theory and the big-picture of geometry as a mathematical field.

MUSI20164 Free Play New Music Improvisation Ensem [SM2]

Prerequisites	None
Lecturer(s)	Coordinator: Alex Pertout There are a variety of different teachers depending on the session you attend.
Weekly contact hours	1 × 2-hour class (lectorial style)
Assessments	Classroom participation (50%): • via weekly attendance (10%), • performances and discussions (20%), • free play journal (10%), • soundbites (10%) Final individual performance (35%): • video (3–4-minute, 25%) • PDF document that includes a graphic score and a written description of your structured improvisation (10%) 500 to 1000-word reflective essay (15%)
Textbook Recommendation	N/A
Lecture Capture	No recording
Year and Semester Reviewed	2024 Semester 2

Subject Content

- Sound vs noise: what differentiates sound/music from noise? What is deep listening, focal attention vs global awareness.
- Pierre Schaeffer on sound objects & reduced listening: understanding musique concrete and the elements of sound.
- Francisco Lopez on Profound Listening & Sound Matter: how can we define music, how does context effect that definition?
- Technique: how is technique important to improvisation?
- Form: what are some different forms of improvisation?
- Rhythm: understanding rhythm, its types and its use in improvisation
- Tonality: notes-melody-pitch, how sounds are made, basics of scales
- Texture/Timbre of music.
- Narrative and Expression: how can an improvisation explore an idea or tell a story without it being rehearsed?

- Graphic scores: how can music be written graphically (aside from traditional scores)
- Electronic and digital improvisation
- Aleatoric music - music in which some element of the composition is left to chance (great for actuarial students)

Classes

The classes in free play were not really lectures, more akin to collaborative classes or lectorials and there were several lecturers depending on the time and day of your class. I had Ronny Farella who I'd highly recommend. The class would focus on a topic and the lecturer would present some information and history on the idea, have classroom discussions and we would listen to some different example pieces. We would then be given a group or individual task to create an improvisation exploring that idea. This would be the "soundbite" for that week. We would then listen to the other groups recordings and discuss. Finally, we would write a reflection of what we learnt or on our piece which would be our journal entry for the week. Since classroom participation makes up the majority of the marks, it's important to contribute to discussions.

Assessment

For the classroom participation component, make sure to keep up with your journal entries as that is what is submitted in the final week. Leaving it all to then end would make it difficult as you'd have to remember what you did for each class. Similarly, sound bites are recorded in class so make sure to submit. Note that you cannot miss more than 2 classes without a valid reason or risk failing the unit.
The reflective essay is 500–1000 words and is about your experience from the subject. I'd focus on one or two main things you've taken away and relate it to your overall feeling on the subject.
The final performance is 4-5 minutes of a recording and you have an opportunity in week 11 to record a draft and get feedback. If you think about an idea for the final performance throughout the semester it'll make it easy for you in the final weeks. I'd recommend having an idea or concept to explore or a story to tell that can make the listener engaged with the story.
You also need to submit a graphic score and a written description. I'd go for a wordy but precise description and very broad but creative score, staying away from traditional scores. The goal is to be creative so look at any examples and think outside of the box.

Overall Remarks

Free play is a very different from all the subjects we study in the Actuarial degree as it focuses on classroom participation and creative expression. The aim of the class is to get you comfortable with improvising musically without limiting you to an instrument, style or even conventional musical norms. The "free play" aspect comes from the fact that you could use anything as an instrument: a bowl and a stick, a cup and a pencil or even a box. This also means that this is accessible to students with no musical background.

While this is a bit strange when you start, if you do engage with the class, it really is an enjoyable experience, especially compared to the other third year actuarial subjects that I did this with. Additionally, if you engage with the subject, it's quite easy to do well, with 50% of the marks coming from classroom participation. I really enjoyed free play, I learnt more than I expected about musical improvisation, and I would recommend it to anyone interested in non-tadeonal music and an enjoyable subject.

MUSI20206 The Business of Music [SM1]

Lecturer(s)	Andrew Watt
Weekly Contact Hours	1 × 2-hour lecture
Assessments	10 x weekly quizzes 40% Written Assignment 60%
Textbook recommendation	*N/A*
Lecture Capture	Full audio + video
Year and Semester Reviewed	2024 Semester 1

Subject Content

Business of Music is a great subject detailing the history of music production, the modern process, and brief introduction to intellectual property.

1. **Live and recorded music industry**
2. **Role of copyright**
3. **Evolution of the music industry**
4. **Music marketing theory and practice**
5. **Business of the music industry (agencies, business of live music, contracts)**

Lectures

There was a 1 x 2-hour lecture delivered online every week. Andrew was very engaging and friendly, often bringing positive, informal sentiment to the lectures. Watching the lectures every week was basically a proxy to watching his dog grow over the 12 weeks.

Tutorials

No tutorials!

Assessments

weekly online quizzes:
The weekly online quizzes were very manageable, and often tested you on concepts highlighted in the lecture slides. Since they were open-book, I highly recommend having the lecture slides to reference during the quizzes.

Written Assignment:
The written assignment was meant to be written over multiple weeks and was quite broad in its requirements. You are allowed to write on any topic in the music industry and weave in the topics learned throughout the semester. Despite the freeing nature of the assignment, it is important to realise that this assignment is about **the business of music** and not a monologue detailing their admiration for their favourite musician!

Overall remarks

This subject is a very easy-going subject in comparison to actuarial subjects, and I highly recommend it to anyone with an interest in music and a need for a relaxing breadth subject. Since 60% of your mark depends on the final assignment, it is important to allocate appropriate time to the task. Time management is of crucial importance for this subject, as the written assignment is also released during swotvac/peak assignment season.

Appendix

Exemptions Guide

The University of Melbourne allows you to fulfil the Actuaries Institute accreditation requirements for all of **the Foundation Program** and half of the **Actuary Program** — the other half of which is obtained through the Institute. Exemptions are obtained by completing groups of university subjects with satisfactory grades, which allow you to be exempt from the exam of the corresponding Institute subjects shown in Table 4 and Table 5.

Exemption Marks

Exemption marks are used to calculate whether an exemption is awarded. These marks are calculated after the corresponding subject is graded, and is chosen by the Centre for Actuarial Studies based off the strength of the cohort and distribution of the final scores with the following formula:

$$exemption\ mark\ =\ subject\ score\ -\ exemption\ cutoff$$

From 2021, for university subjects involved in the exemption of Foundation Program subjects, the final subject score will be used to calculate the exemption mark; for university subjects involved in the exemption of Actuary Program subjects, only the score achieved in the final exam counts towards to the exemption mark. Although the exemption cut-off mark varies across cohorts, the marks shown in Table 3 can be used as a reference for the marks needed to obtain exemptions.

To secure the exemption for a particular institute subject, the weighted average of the exemption marks associated with the institute subject must be above zero:

$$exemption = (\sum_{i\ \in A} exemption\ mark_i\ \times\ weight_i)\ \ >\ 0$$

Where A is the group of university subjects that contribute towards the institute subject.

E.g., ACTL20001 and ACTL30003 count towards the CM1 exemption (and are equally weighted). These weights and groupings can be viewed in Table 4 and Table 5.

Example: Grace would like to determine her eligibility for the CS2 exemption.

1. She received 71, 82, 74 for ACTL30001, ACTL30002 and ACTL30007.
2. She calculates her exemption marks using the 2020 exemption cut-offs as -4, +9 and +4 for the three subjects respectively.
3. The weighted average of her exemption marks is: –4 × 0.3333 + 9 × 0.3333 + 4 × 0.3334 = 3.0001, which is greater than zero.

Grace is eligible for the CS2 exemption.

List of Core Principles Exemptions

Undergraduate Exemption Subjects

Table 4: Actuaries Institute Core Principles subjects and corresponding undergraduate university subjects

Table 1: Actuaries Institute Core Principle subjects and corresponding undergraduate university subjects

Institute subject	University subject(s)		Weight
Foundation Program			
***CM* Actuarial Mathematics**			
CM1 *Actuarial Mathematics I*	ACTL20001	Introductory Financial Mathematics	50%
	ACTL30003	Contingencies	50%
CM2 *Financial Engineering and Loss Reserving*	ACTL20004	Topics in Actuarial Studies	33.33%
	ACTL30006	Intermediate Financial Mathematics	33.33%
	ACTL40004	Advanced Financial Mathematics	33.34%
***CS* Actuarial Statistics**			
CS1 *Actuarial Statistics I*	MAST20004	Probability	33.33%
	MAST20005	Statistics	33.33%
	ACTL30004	Actuarial Statistics	33.34%
CS2 *Risk Modelling and Survival Analysis*	ACTL30001	Actuarial Modelling I	33.33%
	ACTL30002	Actuarial Modelling II	33.33%
	ACTL30007	Actuarial Modelling III	33.34%
***CB* Business**			
CB1 *Business Finance*	ACCT10002	Introductory Financial Accounting	50%
	FNCE10002	Principles of Finance	50%
CB2 *Business Economics*	ECON10004	Introductory Microeconomics	50%
	ECON20001	Intermediate Macroeconomics	50%
Actuary Program			
***ACC* Actuarial Control Cycle**	ACTL40006	Actuarial Practice and Control I	50%
	ACTL40007	Actuarial Practice and Control II	50%
***DAP* Data Analytics Principles**	ACTL40012	Actuarial Analytics and Data II	100%

Source: *Centre for Actuarial Studies* and the *Actuaries Institute*
Current as of 17th December 2020.

Postgraduate Exemption Subjects

Table 5: Actuaries Institute Core Principles subjects and corresponding postgraduate university subjects

Table 2: Actuaries Institute Core Principle subjects and corresponding postgraduate university subjects

Institute subject	University subject(s)	Weight
Foundation Program		
***CM* Actuarial Mathematics**		
CM1 *Actuarial Mathematics I*	ACTL90001 Mathematics of Finance I	50%
	ACTL90005 Life Contingencies	50%
CM2 *Financial Engineering and Loss Reserving*	ACTL90021 Topics in Insurance and Finance	33.33%
	ACTL90002 Mathematics of Finance II	33.33%
	ACTL90003 Mathematics of Finance III	33.34%
***CS* Actuarial Statistics**		
CS1 *Actuarial Statistics I*	MAST20004 Probability	33.33%
	MAST20005 Statistics	33.33%
	ACTL90008 Statistical Techniques in Insurance	33.34%
CS2 *Risk Modelling and Survival Analysis*	ACTL90006 Life Insurance Models I	33.33%
	ACTL90007 Life Insurance Models II	33.33%
	ACTL90020 General Insurance Modelling	33.34%
***CB* Business**		
CB1 *Business Finance*	ACCT90042 Accounting and Finance for Actuaries	100%
CB2 *Business Economics*	ACTL90022 Economics for Actuaries	100%
Actuary Program		
***ACC* Actuarial Control Cycle**	ACTL90010 Actuarial Practice and Control I	50%
	ACTL90011 Actuarial Practice and Control II	50%
***DAP* Data Analytics Principles**	ACTL90019 Data Analytics in Insurance 2	100%

Source: *Centre for Actuarial Studies* and the *Actuaries Institute*
Current as of 17th December 2020.

Exemption Cut-Offs for 2024

Table 3: Summary of the exemption cut-off scores for all ACTL subjects in 2024.
Note: These cut-offs change every single year and are up to the Centre for Actuarial Studies

Level 2 Subjects

University Subject	Exemption Subject	Cut-off
ACTL20001 Introductory Financial Mathematics	CM1	72
ACTL20004 Topics in Actuarial Studies	CM2	70

Level 3 Subjects

University Subject	Exemption Subject	Cut-off
ACTL30001 Actuarial Modelling I	CS2	70
ACTL30002 Actuarial Modelling II	CS2	69
ACTL30003 Contingencies	CM1	72
ACTL30004 Actuarial Statistics	CS1	71
ACTL30006 Intermediate Financial Mathematics	CM2	70
ACTL30007 Actuarial Modelling III	CS2	70

Level 4 (Honours) Subjects

University Subject	Exemption Subject	Cut-off
ACTL40004 Advanced Financial Mathematics	CM2	71
ACTL40006 Actuarial Practice and Control I	ACC	71
ACTL40007 Actuarial Practice and Control II	ACC	70
ACTL40012 Actuarial Analytics and Data II	DSP	65

Level9 (Masters) Subjects

University Subject	Exemption Subject	Cut-off
ACTL90001 Mathematics of Finance I	CM1	70
ACTL90002 Mathematics of Finance II	CM2	70
ACTL90003 Mathematics of Finance III	CM2	71

ACTL90005 Life Contingencies	CM1	72
ACTL90006 Life Insurance Models I	CS2	70
ACTL90007 Life Insurance Models II	CS2	69
ACTL90008 Statistical Techniques in Insurance	CS1	71
ACTL90010 Actuarial Practice and Control I	ACC	71
ACTL90011 Actuarial Practice and Control II	ACC	70
ACTL90019 Data Analytics in Insurance 2	DSP	65
ACTL90020 General Insurance Modelling	CS2	70
ACTL90022 Economics for Actuaries	CB1	73

**** Note: for ALL 'non-Actuarial' subjects (i.e., do not have the subject code ACTL), the exemption cut-off mark is 73.****

Mathematics Prerequisites for the Actuarial Major

The second-year subjects that sets the foundation for all subjects in the Actuarial Studies major are MAST20004 Probability and ACTL20001 Introductory Financial Mathematics – the prerequisites for every ACTL subject can be traced back to these two subjects. To be eligible to enrol in MAST20004 and ACTL20001 in your second year, you must have fundamentals in both linear algebra and calculus, shown through your satisfactory performance in the University of Melbourne subjects or equivalent.

Linear Algebra	Calculus
MAST10007 Linear Algebra	MAST10006 Calculus 2
MAST10022 Linear Algebra: Advanced	MAST100021 Calculus 2: Advanced
MAST10007 Accelerated Mathematics 1	MAST10009 Accelerated Mathematics 2

Whilst the requisite conditions for MAST20004 Probability is fairly straight forward:

50. Obtaining a pass in any subject from the list of Linear Algebra subjects, and;
51. Obtaining a mark of 60 or greater in any subject from the list of Calculus subjects

Meeting the requisite conditions for ACTL20001 Introductory Financial Mathematics can be confusing and the Actuarial Students' Society have tried to summarise these conditions with Table 6. To meet the requirements of ACTL20001, you must complete one of the Linear Algebra subjects and one of the Calculus subjects and receive a combined mark greater or equal to the cell that corresponds to the associated row and column.

Example:
Rose received a 68 and 83 for MAST10008 and MAST10006 respectively. As the combined score is 151 and is greater than 135, Rose can enrol in ACTL20001.

Ineligible for MAST10006/MAST10007

If you have not met the high school prerequisites for MAST10006 and/or MAST10007, you may replace ACTL10001 with MAST10005 (Calculus1) in your study plan to meet the prerequisites for MAST10006 and MAST10007.

University of Melbourne Extension Program (UMEP) Mathematics

If you have completed MAST10018 Linear Algebra Extension Studies and MAST10019 Calculus Extension Studies

52. with a combined score of 150 or more, you are eligible for ACTL20001.

53. with a combined score above 135 but lower than 150, you must pass MAST20026 Real Analysis to be eligible for ACTL20001.

Summary of Mathematics Prerequisite Conditions for ACTL20001

Table 4

Subject Combinations	Total Score Required (Out of 200)	Condition
MAST10006 or MAST10021 AND MAST10007 or MAST10022	150	None
MAST10008 AND MAST10009	120	Pass in each subject
MAST10007 or MAST10022 AND MAST10009	135	Pass in each subject
MAST10008 AND MAST10006 or MAST10021	135	Pass in each subject
MAST10018 AND MAST10006 or MAST10021	150	None
MAST10013 AND MAST10009	120	Pass in each subject

Example: Rose received a 68 and 83 for MAST10008 and MAST10006, respectively. As the combined score is 151 and is greater than 135, Rose can enrol in ACTL20001.

DISCLAIMER: These prerequisite cut-offs are strict; for example, if you obtain a combined 149 for MAST10007 and MAST10006, then you will **NOT** be eligible for ACTL20001 (as a combined score of at least 150 is required). **NO exceptions will be made.**

Sample Actuarial Course Plans and Other Resources

Note: If any issues arise with planning your course, please seek advice from Stop 1

Sample Actuarial Course Plans

Bachelor of Commerce (Actuarial Major) Sample Course Plan
https://study.unimelb.edu.au/find/courses/major/actuarial-studies/structure/

Graduate Studies (Master of Actuarial Science) Sample Course Plan
https://study.unimelb.edu.au/find/courses/graduate/master-of-actuarial-science/structure/#sample-plans

Doctoral Program in Actuarial Studies Sample Course Plan
https://study.unimelb.edu.au/find/courses/graduate/doctoral-program-in-actuarial-studies/

University of Melbourne Course Planner
https://course-planner.unimelb.edu.au/
(Input the Bachelor of Commerce and load the "Actuarial Studies (Major), Actuarial Studies Major with Accreditation" template.)

Centre for Actuarial Studies Student Resources

Centre for Actuarial Studies Website
https://fbe.unimelb.edu.au/economics/act

Undergraduate and Honours Students' Guide 2025
https://fbe.unimelb.edu.au/__data/assets/pdf_file/0006/5201673/StudentGuide2025_UndergraduateHonours_final.pdf

Master of Actuarial Science Students' Guide 2025
https://fbe.unimelb.edu.au/__data/assets/pdf_file/0004/5201680/StudentGuide2025_MasterActuarialScience_final.pdf

(Credit: The University of Melbourne)

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