SUBJECT REVIEW

2017 MID-YEAR EDITION

Contents

Preface

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

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

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

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

In the 2017 mid-year edition of the *Actuarial Students' Society Subject Review*, 3 new subjects were reviewed, in addition to updating reviews for each of the core subjects of the Actuarial Studies major. The *Actuarial Students' Society Subject Review* contains up-to-date reviews for all core subjects in the 3-year undergraduate Actuarial Studies major, as well as reviews for the majority of subjects in the Honours-year program. An effort is being made to include more subjects relevant to the *Masters of Commerce (Actuarial Science)* course.

In 2017, there were a few changes to the *Bachelor of Commerce* degree which will affect the experiences of future actuarial students. For instance, with the addition of FNCE10002 *Principles of Finance* as a core commerce subject, future actuarial students will no longer be required to complete FNCE20001 *Business Finance* to be eligible for their CT2 exemptions. This change will shift the breadth/elective subject that was previously available in first year into the second year of the degree.

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

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

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

About the Actuarial Students' Society

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

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

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

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

www.melbourneactuary.com

www.facebook.com/actuarialstudentssociety

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Disclaimer

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

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First-Year Subjects

ACCT10001 Accounting Reports and Analysis [SM1]

Exemption status	Not an exemption subject, but is a prerequisite for ACCT10002 *Introductory Financial Accounting* (CT2 *Finance and Financial Reporting* subject).
Lecturer(s)	Mr Noel Boys (Do not call him professor)
Weekly contact hours	1 × 2-hour lecture 1 × 1-hour tutorial
Assessments	Tutorial preparation and participation 5% 5 online tests 5 × 1% Individual Assignment, due in Week 5 10% Group Assignment, due in Weeks 19 and 12 10% 3-hour end-of-semester exam 70%
Textbook recommendation	Birt, J., Chalmers, K., Maloney, S., Byrne, S., Brooks, A., & Oliver, J. (2014). *Accounting: Business Reporting for Decision Making* (5th ed.). New York, US: John Wiley & Sons. The textbook is referred to in the lectures and tutorials but isn't useful. All content is adequately explored in the lecture slides. However, if you are a first time student of accounting, it may be useful to gain a little bit of context.
Lecture capture	Full (both audio and video).
Year and semester reviewed	2017 Semester 1

Comments

Subject content

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

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

Lectures

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

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

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

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

Tutorials

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

Assignments

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

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

Online Tests

There are weekly non-assessable online quizzes that count towards the tutorial participation mark. These are generally very straightforward. There are also 5 assessable quizzes throughout the semester. These are usually released on 4pm on a Friday and due by Sunday evening. You are given 30 minutes to complete the test which contains around 15-20

multiple-choice questions and is worth about 1% of the overall grade. Answers to most of these questions can commonly be found in the lecture slides.

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

End of Semester Exam

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

Concluding Remarks

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

ACCT10002 Introductory Financial Accounting [SM2]

Exemption status	CT2 *Finance and Financial Reporting*, in conjunction with FNCE10002 *Principles of Finance* or FNCE20001 *Business Finance*. An average of 73 across this subject and one of • FNCE10002 *Principles of Finance* • FNCE20001 *Business Finance* is needed, with no fails.
Lecturer(s)	Mr Warren McKeown
Weekly contact hours	1 × 2-hour lecture 1 × 1-hour tutorial
Assessments	Tutorial attendance and participation 5% Wiley Plus Tests 2 × 5% MYOB Assignment 15% 3-hour end-of-semester exam 70%
Textbook recommendation	Carlon, S., Mladenovic, R., Loftus, J., Palm, C., Kimmel, P. D., Kieso, D. E., & Weygandt, J. J. (2010). *Financial Accounting Building Accounting Knowledge*. Milton, AU: John Wiley & Sons Australia.
Lecture capture	Full (both audio and video).
Year and semester reviewed	2016 Semester 2

Comments

Subject content

Concepts covered included (one lecture per dot point):

- Conceptual framework and company structure
- The Double Entry system
- Accrual accounting
- Inventory
- Bank reconciliation and receivables
- Non-current assets
- Liabilities
- Equity, dividends
- Cash Flow Statements
- Analysis – annual reports, debt/equity decisions
- GST
- Revision

This subject listed ACCT10001 *Accounting Reports and Analysis* as a prerequisite, but I found that there was a lot of crossover between the subjects. Introductory Financial Accounting essentially assumed no prior knowledge of accounting.

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

IFA felt easier than ARA in the sense that the content was mostly the same, apart from the addition of the double-entry system.

Lectures

The lectures were based off the textbook, with slides containing screenshots from it. The lecturer was relatively good at explaining concepts, but sounded dull at times. Thankfully, we were always given 10 minute breaks during lectures and many finished early.

Most lectures had around 60 slides. However, Warren generally glossed over many of these, leaving students to read them at home. Some lectures also had accompanying "lecture illustrations" which were relatively useful. I found that I could get through without watching the lectures. The lecture slides and the textbook proved adequate.

Tutorials

Tutorials were based on weekly worksheets. Students were expected to complete these before each tutorial, but students in my tutorial were not penalised for failing to do so. I had the lecturer as my tutor (for the second accounting semester in a row). My tutor spent the tutorial displaying the answers on the document camera, which I felt wasn't very conducive to learning, since the answers were uploaded at the end of the week anyway. I preferred the discussion-style tutorials from ARA.

Assessments

The two Wiley tests had short answer questions, and required students to fill in the blanks. They were both graded out of 30. They were plagued with issues throughout both assessments. The first assignment also had a faulty "auto-grade" feature. Some students did not press "submit" and as such were not awarded any marks for those questions. Whilst the issue was fixed after several weeks, it was an administrative nightmare for the university. Moreover, students found that some accounts from the drop-down list were too similar, such as "Inventory" and "Merchandise"; "Accumulated Depreciation" and "Truck – Accumulated Depreciation".

On the other hand, the Perdisco assignment ran quite smoothly. Perdisco is the name of the company that designs the questions and data. Students were required to fill in financial statements and answer multiple choice questions about MYOB (the software in which data is entered) and hypothetical companies based on individualised data provided by Perdisco. Perdisco only allowed a limited number of students on the software for two hours each at a time, and only from 12pm–12am. However, by paying $25 students could complete the questions at any time. As for MYOB, students had the option of either using the Bouverie St labs or purchasing it from Perdisco for $20. I strongly suggest you vide the Perdisco Learning Centre before completing tasks. It should take about 10–15 hours, for a total of over 400 marks. I found that it was best to rectify all issues and errors in MYOB once answers to each stage were released.

End-of-Semester Exam

There were three semesters' worth of past exams and answers provided. I found these exams to be quite poorly written, with marks not always proportionate to effort required. Several questions were ambiguous, with answers failing to provide

much clarification. For instance, we were informed that we did not need to remember any of the AASB numbers, however, these showed up occasionally in exams questions and sample answers.

ACTL10001 Introduction to Actuarial Studies

Exemption status	Not an exemption subject, but a great introduction subject which covers the basics of financial mathematics.
Lecturer(s)	Dr Xueyuan (Shane) Wu
Weekly contact hours	2 × 1-hour lectures 1 × 1-hour tutorial
Assessments	2 Microsoft Excel group assignments 2 × 10% 45-minute mid-semester test in Week 8 10% 2-hour end-of-semester exam 70%
Textbook recommendation	Dickson, D. C. M., & Atkinson, M. E. (2011). *An Introduction to Actuarial Studies* (2nd ed.). Cheltenham, UK: Edward Elgar Publishing. I did not find this textbook mandatory for the subject as the lecture slides cover all examinable material, however it does provide more working examples and questions.
Lecture capture	Full (both audio and video).
Year and semester reviewed	2016 Semester 2

Comments

Subject content

Early in the semester, the focus will be on financial mathematics: simple/compound interest and discounts, bonds and coupons, series of payments, future and present values, and mortgages.

During weeks 5 to 8, demography is covered, including material such as population distributions, survival functions, life tables and mortality rates.

After this, the hard material is introduced. Here, we learn about how contingent payments and their associated values are calculated, how to value different types of insurance (life, endowment, term), finishing with some theory about actuarial practices in general insurance, health insurance, and superannuation in the last 2 weeks.

The first assignment tests the knowledge of the first 3 weeks, not including bonds and housing loans. Excel skills are necessary here to add series of payments for evaluating present/future values. Overall, a straightforward assignment.

The mid-semester test was in week 8 and tests the knowledge of the first 6 weeks, meaning all of financial maths and parts of demography. It was out of 35 marks with 45 minutes writing time. This test proved to be very difficult this year, with an average score of around 50%, so don't stress if you score lower than you expected. Memorising formulas and their applications is crucial to receiving marks in this test.

The second assignment tests the knowledge from weeks 4 to 10. This assignment was more difficult and longer than the first one.

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

Other Comments

> You think this subject is easy now — wait a few weeks
>
> Shane Wu

This perfectly describes the subject, as the first few lectures about simple and compound interest would bore anyone, but the first escalation is at the introduction of annuities and calculating present/future values.

Understanding the wording and formula uses are crucial to calculating the correct answers at this stage. There will be an abundance of formulas to remember throughout the semester, so it's better to understand the formula's meanings than to try and rote-memorise the symbols. Population and demography is fairly straightforward, with more formulas and easy theory. The second escalation is during weeks 8-10 when we learn about contingent payments. There is no clear shortcut to mastering this except plenty of practice and references to the lecture slides' worked solutions and formulas. Lecture capture will be your best friend as Shane's explanations are sufficient in aiding your understanding of the questions at hand.

Personally, I did not attend many lectures or tutorials, and still found the subject to be manageable. Tutorial questions have worked solutions, and are very useful to solve and understand before the mid-semester test and end-of-semester exam. Sometimes the worked solutions differ from the lecturer's working, or the solutions won't make sense, so ask your tutor or attend the consults. Overall, the key to this subject is understanding how variables are related rather than memorising the myriad of formulas given throughout the lectures, and know how to apply them in a worded question. There were practice exams given for revision, and closely resembled the actual exam, making great practice as worked solutions are also provided.

Overall, it will be hard to catch up on this subject once you fall behind as the concepts taught require lots of practice and understanding to master. Even worked solutions may be confusing if one does not have adequate understanding of the topic, especially during the later weeks of contingencies. This subject is the closest thing to experiencing work as an actuary in first year, which makes Introduction to Actuarial Studies my favourite subject in first year, with its various real life application examples and interesting proofs.

ECON10003 Introductory Macroeconomics [SM2]

Exemption status	Not an exemption subject, but is a prerequisite for ECON20001 *Intermediate Macroeconomics* (CT7 *Business Economics* subject).
Lecturer(s)	Professor Robert Dixon
Weekly contact hours	2 × 1-hour lectures 1 × 1-hour tutorial
Assessments	Tutorial attendance and participation 10% 2 online multiple-choice tests 10% 2 assignments 2 × 10% 2-hour end-of-semester exam 60%
Textbook recommendation	Bernanke, B., Olekalns, N., & Frank, R. H. (2014). *Principles of Macroeconomics* (4th ed.). North Ryde, AU: McGraw-Hill. ✓ The textbook was very useful and gave more in-depth explanations to concepts than that covered in lectures and often is needed to answer tutorial questions. Get it if you can, or there are copies in the Giblin Euson Library High Use (limited availability). A note on Third Edition of the textbook: Page references to Third Edition were provided. Required readings for chapters specific to Fourth Edition were also provided as PDF on LMS. Can't guarantee that will always be the case. So make your own judgement when purchasing an older edition.
Lecture capture	Full (both audio and video).
Year and semester reviewed	2016 Semester 2

Comments

As an introductory subject, ECON10003 was not particularly challenging but nonetheless, the subject was very interesting and worthwhile and potentially a WAM booster if you are willing to work consistently.

In my experience, the key to doing well in Introductory Macroeconomics is to stay up to date. Every week you should try to get yourself in a position where you are able to answer and understand all tutorial questions for that week, which surprisingly doesn't take much time. And attend all tutorials! If you do that, the final exam will be a walk in the park.

Subject Content

Below is a timeline of the topics covered in 2016 Semester 2. It serves as a rough guide only, please refer to the official subject guide for current information.

1. National Accounts: what is GDP and measurements of GDP.
2. Consumer Price Index (CPI) and inflation targeting.

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

3. Measuring unemployment, equilibrium unemployment, and Okun's Law.
4. Labour market, Cobb-Douglas production function, and Walras' Law.
5. Keynesian cross model: short-term economic activity.
6. Fiscal policy and flow of funds analysis.
7. Money and Banking.
8. Aggregate demand and supply model.
9. Solow-Swan model: long-term economic growth.
10. International trade.
11. Exchange rates.
12. Balance of Payments (not examined).

The majority of topics were simple and well-taught. In this subject, you will learn a lot of different economic models, so it would be a good idea to have a solid and distinct understanding of all the underlying assumptions for each model and understand what would happen if an assumption didn't hold.

Compared to *Accelerated Mathematics 2*, Intro Macro moves like a snail. However, Dixon roughly covers a new topic every week, and with assessments coming up every 3–4 weeks, this is not a subject you want to fall behind in. That being said, it's entirely possible to pass this subject by cramming because all final exam questions are drawn from tutorial questions which can be rote-learnt if desperate.

If you are a little rusty with your calculus, it's a good idea to brush up on your basic differentiation techniques — namely chain rule, power rule and product rule.

Lectures

To put it simply, the lectures were boring and slow but worth attending (or at least viewing). Almost every lecture, I found myself many slides ahead of Dixon and simply tuning out his voice and going through the slides at my own pace. Despite the delivery of the lectures being extremely unengaging, he gave good explanations and explains the content thoroughly. So, have some caffeine beforehand and go to the lectures.

If you are finding it difficult to concentrate during lectures, it might be a good idea to print the slides out and annotate them to keep yourself focussed.

Dixon does not annotate lecture slides. The slides will be uploaded to the LMS before the lectures that week along with extra reading material that the lecturer encourages you to read, but the extra material is not examinable or referred to during lectures or tutorials.

Tutorials

Go to these tutorials, not only for the 10% tutorial attendance and participation marks but also attending tutorials forces you to stay on top of the subject, which is key to doing well.

It is mandatory that you complete the blue sheet questions before attending tutorials and the tutors will be checking them. To best prepare for a tutorial, you should at a minimum complete the blue sheet questions and complete the required readings if you have time.

Tutorials normally begin with a discussion of the blue sheet questions, and then students are given time to work through pink sheet questions and responses are discussed. The class was split into groups of 4–5 students, normally based on

the table you were sitting at. You will be asked to work through pink sheet questions as a group and present to the rest of the class and answer any questions from the audience, including the tutor. You will be assessed on your contribution to the group and presentation for the 'participation' part of your tutorial mark. My tutor's guideline was that everyone should speak.

Pink sheet questions are similar in style to the blue sheet questions but are a little bit more difficult. Answers to blue sheet questions were posted on the LMS, however, no answers are provided for pink sheets other than the discussions during tutorials.

If you miss a tutorial, you were able to attend a make-up tutorial with ease. Due to the large cohort size for Intro Macro, you can find tutorials running in almost all time slots. Make sure you notify your tutor that you have attended a make-up tutorial to have your attendance counted towards your mark.

Assessments

Assignments

There were two assignments each worth 10% and can be done in a group of a maximum of 3 people or individually. Each assignment consisted of 3 questions of short answer style, similar to tutorial questions but are more in-depth and requires a more thorough discussion. However, they were mostly straightforward and it was actually very easy to fall into the trap of overthinking the questions. Most people were able to achieve very high marks on the assignments. Personally, I didn't enjoy the assignments. I found them to be not challenging nor value-adding, but I'm not complaining.

Multiple Choice Tests

As part of the assessments, there were two Online Multiple Choice Tests of 15 questions, each worth 5% of the total mark. The first test was based on content in the first 2 tutorials and was due in week 4. The second one was based on tutorials 3–9 and was due in week 7. These tests were tough, so take your time and prepare for them.

End-of-Semester Exam

Dixon made it very clear throughout the semester that exam questions are "all drawn solely from our 2016 tutorial and/or assignment work", which means if something didn't appear in a tutorial or assignment, it was not examinable (e.g. week 12 content). However, every subject coordinator is different, so don't expect this will always be the case.

For revision, I went through every tutorial question. Make sure you revise every single question, even if it's something that's not covered in lectures — if it shows up in a tutorial sheet, you can be asked about it. Ask people in my cohort about "automatic stabilisers".

In conclusion, I enjoyed this subject. Learning the content felt worthwhile and the teaching staff was to a great extent supportive and knowledgeable. Many thanks to my tutor for his patience and commitment.

Good luck!

ECON10004 Introductory Microeconomics [SM1]

Exemption status	CT7 *Business Economics*, in conjunction with ECON20001 *Intermediate Macroeconomics*. An average of 73 across this subject and ECON20001 *Intermediate Macroeconomics* is needed, with no fails.
Lecturer(s)	Dr Eik Swee Professor John Freebairn
Weekly contact hours	2 × 1-hour lectures 1 × 1-hour tutorial
Assessments	Tutorial attendance and participation 10% 40-Minute online multiple-choice test in Week 5 10% Written Assignment 1 due in Week 7 10% Written Assignment 2 due in Week 10 10% 2-hour end-of-semester exam 60%
Textbook recommendation	Gans, J., King, S., Byford, M., & Mankiw, N. G. (2014). *Principles of Microeconomics: Australia and New Zealand Edition* (6th ed.). South Melbourne, AU: Cengage Learning Australia. Borland, J. (2013). *Microeconomics: Case Studies and Applications* (2nd ed.). South Melbourne, AU: Cengage Learning Australia. ✓ I recommend buying Principles of Microeconomics. See 'Necessary Resources' in the body of the review for more information.
Lecture capture	Full (both audio and video). Handwritten slides are not captured. One of each lecturer's sessions is uploaded.
Year and semester reviewed	2017 Semester 1

Comments

Subject content

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

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

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

Lectures

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

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

Tutorials

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

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

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

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

Assignments and Assessments

The first piece of assessment was a 40-minute multiple-choice test in Week 5. There were 15 questions, each worth 1 mark, covering content from lectures 2 to 6. A practice test was provided, and a review session that went through 10 sample questions was held. The questions and answers of the review session were uploaded to the LMS afterwards. Although

the content was not difficult and time was sufficient, the twisted wording of the questions made it harder to do well. As the test was to be completed at home, students could access notes.

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

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

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

End of Semester Exam

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

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

Necessary Resources

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

Supplementary Resources

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

Concluding Remarks

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

FNCE10002 Principles of Finance [SM1]

Exemption status	CT2 *Finance and Financial Reporting*, in conjunction with ACCT10002 *Introductory Financial Accounting*. An average of 73 across this subject and ACCT10002 *Introductory Financial Accounting* is needed, with no fails.
Lecturer(s)	Associate Professor Asjeet S. Lamba
Weekly contact hours	2 × 1-hour lectures 1 × 1-hour tutorial
Assessments	Tutorial participation 10% Online Assignment due in Week 6 10% 1-hour mid-semester exam in Week 7 20% 2-hour end-of-semester exam 60%
Textbook recommendation	Berk, J. & DeMarzo, P. (2017), *Corporate Finance: The Core* (4th ed.), Pearson Global Edition Brealey, R., Myers, S. & Allen, F. (2017), *Principles of Corporate Finance* (12th ed.), North Ryde, AU: McGraw-Hill. The subject is doable without purchasing any textbooks. See 'Necessary Resources' in the body of the review for more information.
Lecture capture	Full (both audio and video).
Year and semester reviewed	2017 Semester 1

Comments

Subject content

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

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

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

Lectures

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

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

Tutorials

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

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

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

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

Assignments and Assessments

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

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

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

End of Semester Exam

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

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

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

Necessary Resources

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

Supplementary Resources

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

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

Concluding remarks

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

MAST10008 Accelerated Mathematics 1

Exemption status	Not an exemption subject; however, you will need either • an average of at least 60 across this subject and MAST10009 *Accelerated Mathematics 2* or • a total of at least 135 across this subject and MAST10006 *Calculus 2* to continue the major and enrol in ACTL20001 *Financial Mathematics I*.
Lecturer(s)	Dr Craig Hodgson
Weekly contact hours	4 × 1-hour lectures 1 × 1-hour tutorial 1 × 1-hour MATLAB tutorial
Assessments	3 Maple online tests 6% 3 individual assignments 9% MATLAB test 5% 3-hour end-of-semester exam 80%
Textbook recommendation	✓ I recommend the printed lecture notes available from Co-op, which include all the blank lecture slides. Also would recommend for revision a YouTube account "Mathispower4u" which contains many helpful tutorial videos. Anton, H., & Rorres, C. (2013). *Elementary Linear Algebra: Applications Version* (11th ed.). New York, US: John Wiley & Sons. This is the textbook recommended by the uni. Whilst it can be helpful, the textbook is not essential to success, and I found that using other sources like YouTube and Google were a lot more helpful.
Lecture capture	Full (both audio and video).
Year and semester reviewed	2017 Semester 1

Comments

Subject content

This subject covers the following topics:

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

Topic-by-Topic tips

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

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

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

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

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

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

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

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

Functions of Two Variables — Despite being the last topic, which is likely taught in the last week, do not fall in the trap of easing off on your SWOTVAC laurels. Whilst this topic is much easier to grasp than others in AM1, there are many

definitions and formulae you need to be familiar with, so take caution, as letting your guard down may be detrimental.

Lectures

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

Tutorials

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

Assessments

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

End of Semester Exam

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

Concluding Remarks

AM1 is a difficult subject, however, once you learn all the concepts and understand the content, it is very rewarding and enjoyable. You can always seek help from others if you are struggling, and, above all, practice the workbook questions throughout the semester to save yourself from cramming. Should you ever fall behind, do not panic; it is always possible to catch up, as long as you have the dedication, and based on experience, preferably at least four days.

MAST10009 Accelerated Mathematics 2

Exemption status	Not an exemption subject; however, you will need either • an average of at least 60 across this subject and MAST10008 *Accelerated Mathematics 1* or • a total of at least 135 across this subject and MAST10007 *Linear Algebra* to continue the major and enrol in ACTL20001 *Financial Mathematics I*.
Lecturer(s)	Professor Barry Hughes
Weekly contact hours	4 × 1-hour lectures 1 × 1-hour tutorial
Assessments	2 individual assignments 2 × 5% 45-minute mid-semester test 10% 3-hour end-of-semester exam 80%
Textbook recommendation	MAST10009 Accelerated Mathematics 2 — Textbook Matched to the Lectures for 2016
Lecture capture	Full (both audio and video).
Year and semester reviewed	2016 Semester 2

Comments

Subject content

This subject covers content from Real Analysis and Calculus 2, including:

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

This subject was markedly different to MAST10008 *Accelerated Mathematics 1*, with the only notable area of crossover being integration with the complex exponential. This subject, in the lecturer's words is essentially the "purest" take on applied mathematics. There was a vast amount of content covered in AM2. However, we were constantly reminded that AM2 was only the tip of the iceberg. To truly solve all of life's problems, we need to take MAST30021 *Complex Analysis*.

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

Lectures

There were four lectures per week in this subject. Each lecture had accompanying slides (which were mostly the same as the textbook) which covered the main theory in the subject. Each lecture had accompanying examples, to which the lecturer completed working on the blackboard. I found the worked examples highly useful for completing exercises at the end of each lecture, as the textbook mostly covered theory. The lecture capture consisted of the slides and audio. If you do happen to miss a lecture, you may either copy the notes from someone else, or if you are skilled enough you may take notes based on the audio recording. It should be noted that for later lectures there are selected worked examples at the back of the book.

Please do not take photos of the lecturer or the worked examples, as you are sure to be reprimanded.

Barry is a highly entertaining lecturer. He delivers lectures with enthusiasm and confidence. His most memorable lecture comes in lecture 7, the first lecture on functions. You will definitely pick up several new words in your vocabulary, including "lizard brain" and "antisocial mathematics". In response to the previous subject review, we did use decimals precisely once during lectures.

Tutorials

Tutorials ran for one hour, and tutors generally chose several questions from the exercises in the textbook. Students worked in groups on the whiteboards whilst tutors walked around providing guidance. My tutor had a policy where students were forbidden from consulting the textbook while answering questions. I believe this was highly restrictive as many students resorted to standing around the whiteboard clueless. Whilst attendance was recorded for tutorials, it did not contribute towards our grade.

Assignments

In total, there were two written assignments for this subject. The first assignment covered sequences, and the second covered MAST10006 *Calculus 2* concepts including integration and differential equations. Each assignment was graded out of 100 marks, with worked solutions provided. I believe the marking for this subject was largely inconsistent between tutorials. Students from different tutorials with highly similar answers (there is no suggestion of any collusion here) were graded differently. The lecturer stated that any discrepancy in marks would largely be negligible in the long run, which is true to some extent. If you thought that marking for AM1 was tough, marking for AM2 is even tougher.

Mid-semester test

The 45-minute mid-semester test was held precisely half-way through the semester. The lecturer stressed that definitions should be understood and memorised. Sure enough, this test required a strong grasp of the definitions provided in the course.

End-of-semester exam

The exam for this subject is usually worth 150 marks and runs for three hours. There are about six years of past exams in the Baillieu library. Answers were unavailable although Barry ran through some questions in the last two lectures. These past exams were generally good indicators of the standard of the 2016 exam. Students in my cohort were prepared for a Taylor–Lagrange question — however, this failed to materialise.

Barry's consultations were engaging and useful. Even if I did not have questions, I still learned from listening to him explain concepts. Make sure to collect a stamp on your textbook.

Second-Year Subjects

ACTL20001 Financial Mathematics I

Exemption status	CT1 *Financial Mathematics*, in conjunction with ACTL20002 *Financial Mathematics II*. Satisfactory performance in both subjects' end-of-semester exams is needed.
Lecturer(s)	Dr Ping Chen
Weekly contact hours	2 × 1-hour lectures 1 × 1-hour tutorial
Assessments	Group assignment, due start of Week 5 10% Group assignment, due start of Week 11 10% 45-minute mid-semester test in Week 7 10% 2-hour end-of-semester exam 70%
Textbook recommendation	Fitzherbert, R., & Pitt, D. (2012). *Compound Interest and its applications*. Melbourne, AU: University of Melbourne Custom Book Centre. ✓ Recommended to buy for practice problems.
Lecture capture	Full (both audio and video).
Year and semester reviewed	2017 Semester 1

Comments

Subject content

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

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

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

Subject Content

This subject focuses on calculations of cash flows, interest rates, project valuations and some basic financial instrument theory. The slides follow the structure of introducing an idea and then elaborating upon it with exercise questions that

are discussed during lectures. Majority of the subject is calculation focused, and the topics covered were divided into 4 chapters as shown below:

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

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

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

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

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

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

Lectures

There are full lecture recordings for this subject, so the viewing experience at home is similar to attending the lecture, though you can voice your confusions if you actually attend. Actually, I would strongly recommend at least watching the lectures instead of just reading the slides for the first 3 chapters as Ping does write extra information and works through the examples in more detail than what is shown in just the slides. In addition, I found her explanations helpful as the

notation/wording in the slides can sometimes be confusing, such as a variable popping up that hadn't been previously defined. Those who did ACTL10001 will find the lectures quite slow moving for the parts you've already learnt, but the new material is worth paying attention to carefully so you can fully understand the formulae used in order to reproduce them in exam conditions.

Assignments

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

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

Tutorials

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

Mid-Semester Test

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

Final Exam

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

be taken in order to simplify calculations, but these can't be rote learnt, so the only way to recognise a chance to find an elegant solution is understanding and doing a wide range of questions before the exam.

Concluding Remarks

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

ACTL20002 Financial Mathematics II

Exemption status	CT1 *Financial Mathematics*, in conjunction with ACTL20001 *Financial Mathematics I*. Satisfactory performance in both subjects' end-of-semester exams is needed.
Lecturer(s)	Professor Mark Joshi
Weekly contact hours	2 × 1-hour lectures 1 × 1-hour tutorial
Assessments	Microsoft Excel individual assignments 2 × 10% 45-minute mid-semester test 10% 2-hour end-of-semester exam 70%
Textbook recommendation	Fitzherbert, R., & Pitt, D. (2012). *Compound Interest and its applications*. Melbourne, AU: University of Melbourne Custom Book Centre. This textbook is the same as the one used in FM1. It is an excellent resource for the most part; however, it does not cover all the subject material. ✓ It is highly recommended that you acquire a physical copy of this text as it often provides a different explanation of concepts to what lectures would include. Furthermore, there are many supplementary questions that will help solidify the basic knowledge you need to succeed. It is important to note that the textbook questions are quite trivial in relation to tutorial problem sets and exam questions. They are not representational of anything you can expect to be tested on, and should be viewed as a mechanical exercise.
Lecture capture	Full (both audio and video).
Year and semester reviewed	2016 Semester 2

Comments

ACTL20002 Financial Maths 2 is a subject to be wary of. If you truly love applications of mathematics in finance (as you should), this will be the most interesting, challenging and rewarding subject you will complete in your first two years of the degree. Overall, the subject is extremely useful. In terms of technical skill, it extends upon content covered in ACTL20001 *Financial Mathematics I*, while teaching new content that is all broadly applicable in the actuarial industry. From a more abstract perspective, the assessments and examinations are not all different versions of the same paper, and help to develop problem solving skills more than any other subject.

Subject Content

- Discount Securities & Coupon Bonds (Price and Yield Calculations) — Weeks 1–2
- Measures of Investment Performance — Week 3
- Interest Rate Risk, Bond Market Structure — Weeks 4–5
- Derivative Securities (No Arbitrage Pricing, Put-Call Parity) — Week 6
- Valuing with Default — Week 7

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

- Non-Deterministic Interest Rates, Valuation w/ Stochastic Rate of Return, Moments — Week 8
- Life Insurance Applications, The Lognormal — Weeks 9–10
- Simulation, Time Series Models — Weeks 11–12

The first half of the subject (Weeks 1–6) has been appropriately termed "Financial Arithmetic" by some. This half of the subject goes further into detail for concepts covered in FM1.

The first week covers no new concepts, revisiting discounting using i and d. Week 2 increases slightly in difficulty, with the main point of interest being floating rate notes and their valuation. Nothing in the first 4 lectures should cause any problems. Whilst the theory and basic valuations here are relatively simple, Professor Joshi has been known to write variations on these simple questions that prove to be extremely challenging on exams. Thus, it is important to take advantage of the fact that this area of study is relatively easy by making sure you understand it beyond the basic level.

Following on from this, week 3 covers measures of investment performance, namely Time-Weighted Rate of Return vs. Money-Weighted Rate of Return. There are a few formulas and approximations here, but once you understand the fundamental difference between the two you won't have to memorise much at all.

Week 4 introduces concepts such as the duration and convexity of assets and liabilities in the context of portfolio insurance, and is quite interesting when considering real-world applications. There are even more formulae here, but they all have very intuitive derivations, and should prove no problem once understood and applied a few times. What is important here is to understand the mathematical relationship between duration, convexity and delta, which will help save time should you need to compute multiple values.

Week 5 covers bond market structure. This topic is tricky for different reasons. It is not at all mechanically tedious or hard to understand conceptually. However, there are many important distinctions to make with spot rates vs. forward rates vs. yield vs. one-period implicit forward rates. Each has its own use, and confusion will lead to your answers appearing to be **very** close to the correct answer, but entirely wrong. For this reason, covering a broad array of questions will help you recognise which rate to use when. **N.B** If you skim over yield curves because they are boring and you can't think of how they could possibly be examinable you **will** regret it.

Week 6 will seem new to many, unless you are simultaneously taking FNCE30007 *Derivative Securities* (which is frowned upon). Concepts of forward price and put-call parity are covered very briefly, and is likely to be easier to understand if you haven't taken DS because it can be quite confusing to learn the same topic 2 different ways concurrently.

Week 7 will likely have only 1 lecture, covering valuation with default. It is the first time you will be exposed to valuing a stream of payments which is uncertain, and is very interesting to learn. The method of valuation taught here is basically your intuitive interpretation of what you think it would be, and is not very difficult. However, this is another topic which can manifest in a variety of different forms on an exam paper, and you should thus make sure you do not take it lightly.

Weeks 8–12 are when things go downhill quickly for most people. The finance seems to disappear in a sea of maths, and you may wonder whether this is actually a MAST##### subject. From lognormals to life insurance applications all the way to autoregressive time series, these topics are the true core of what actuarial studies is actually about. They are taught with a very practical approach, often including Excel in lectures and tutorials. From anecdotal evidence, this content has proven to be directly applicable to real life work at a certain actuarial firm.

Lectures

The lectures for this subject rank as the highest all-rounder for myself and some others. They are paced very well, meaning you can rewatch it at 1.0x without feeling the need to fast forward. The lectures are 1 hour each, and the slides have some

of the lowest WPS (words per slide) I have encountered. Not having to read through slabs of text is certainly incentive to attend.

Lectures were recorded with video, but I found myself attending whenever possible for a few reasons. Firstly, they were quite interesting (subject content wise but also lots of relevant advice and the occasional joke). Secondly, I found (especially later on) that I was needing to watch each lecture upwards of 3 times to really understand so I'd might as well get one out of the way in person.

Possibly the best thing about attending the lectures is the feeling of achievement when Professor Joshi remarks on the notably smaller cohort who have survived thus far.

Tutorials

Tutorials for this subject are essential due to its difficulty.

Whilst there are no marks explicitly allocated to attendance, it would be unwise not to utilise the resources provided by tutorials. You would be hard pressed to find anybody apart from the tutors who would be able to help you with something you don't understand in this subject. It is also a great time to ask questions from the textbook which may be confusing.

If you do choose not to attend, the worked solutions for the tutorial problem sets are very comprehensive, and will be sufficient for tutorials 1–7.

Assignments

There are two assignments which are almost definitely going to be the development of a self-sufficient Excel model. In my many years of studying, I had never actually enjoyed doing an assignment before these two (no spoilers). There is a certain unique feeling of success that comes with building a working financial model for the first time.

The assignments will require you to build a spreadsheet from scratch, which is supposed to perform a certain valuation or task (there will be plenty of context in the instructions). It will be heavily emphasised that the whole point is for the model to work with **any** inputs, not just the preset ones. Thus, you must ensure your model is **robust**, and can survive whatever Professor Joshi decides to throw at it.

These assignments will drastically improve your Excel skills, and teach you to test and retest your models.

Each assignment contributed 10% towards the final grade.

Mid-Semester Test

The mid-semester is 45 minutes and you are permitted the usual scientific calculators.

It covers everything up to and including derivative securities (the easier half of the subject). Whilst the content covered is not as hard as the second half, the difficulty of the mid-semester is unfortunately not deterministic. Its difficulty function has random variables which depend on the difficulty of the previous year's exam and the number of students who survived FM1 amongst other things.

End-of-Semester Exam

The final exam is a 2 hour paper, with around 8–10 questions depending on difficulty. As this is an actuarial subject, you will not have the privilege of being asked any multiple choice questions.

The usual rules apply for subjects with a mid-semester — i.e. the topics which have already been examined will be less heavily focused upon in the final. Unfortunately for this subject, that means less easy questions and more hard ones.

Preparation: Professor Joshi is notorious for his challenging exams. The questions asked in his papers are **never** simple. There will always be some need for outside-the-box problem solving to do well in these exams. In certain subjects, you can just memorise the general form of a question and regurgitate it on the day. This method will be extremely ineffective in FM2. Past exams will prove to be a valuable resource, but only to serve as a test of how well you tackle seemingly impossible questions. The best way to prepare for (relative) success in this subject is to complete **all** the textbook and tutorial questions on time and consistently (increases speed and accuracy), before proceeding on to past papers (practice problem solving). For past papers, absolutely do not look at worked solutions until you have attempted the paper with 100% effort. They are your best resource and you would be wasting it by cheating and looking at the solutions.

As a final note, **do not** let yourself fall behind. As I said above, this is likely to be the hardest subject you will have to take in second year. It is absolutely **not crammable**! The latter topics take many more hours than just the 1-hour lectures to truly understand, and merely understanding it is nowhere near enough knowledge to tackle an exam question. If you try and cram, you will almost certainly fail. Source: I have lost many mathematically brilliant friends to this beautiful subject.

ECON20001 Intermediate Macroeconomics

Exemption status	CT7 *Business Economics*, in conjunction with ECON10004 *Introductory Microeconomics*. An average of 73 across this subject and ECON10004 *Introductory Microeconomics* is needed, with no fails.
Lecturer(s)	Dr Mei Dong
Weekly contact hours	2 × 1-hour lectures 1 × 1-hour tutorial
Assessments	Tutorial attendance and participation 10% Online multiple-choice test 5% Group assignment, due in Week 7/8 12.5% Group assignment, due in Week 10/11 12.5% 2-hour end-of-semester exam 60%
Textbook recommendation	Blanchard, O., & Sheen, J. R. (2013). *Macroeconomics Australasian Edition*. Frenchs Forest, AU: Pearson Education Australia.
Lecture capture	Full (both audio and video)
Year and semester reviewed	2016 Semester 2

Comments

This subject is very similar to ECON10003 *Introductory Macroeconomics* in terms of the big picture concepts covered. You will find some overlap between the two subjects especially in the graphs shown. This subject just contains more variables and there is a greater focus on manipulating these variables mathematically rather than just understanding how the graphs lead to real life economic changes.

As there is a greater emphasis on using maths to manipulate variables, actuarial students should have an advantage over other commerce students.

Subject content

For students who haven't started the subject, don't be worried if you don't recognise many terms below. The difficulty of the models taught will not exceed *Introductory Macroeconomics* (except for DAS/DAD model)

1. Short-run macroeconomics
   (a) Output, investment and savings
   (b) Financial markets, background on the financial crisis
   (c) IS/LM model
2. Labour markets and unemployment
   (a) Labour market dynamics
   (b) Natural rate of unemployment

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

3. Macroeconomic adjustment
   (a) Inflation, unemployment relation (Phillips curve)
   (b) AS/AD model
   (c) Dynamic AS/AD model
   (d) Rules vs discretion in policy making
4. Long-run macroeconomics
   (a) Solow–Swan model
   (b) Convergence and conditional convergence
   (c) Endogenous growth
   (d) Productivity and institutions
   (e) Productivity, wage and inequality
5. Open-economic macroeconomics
   (a) Interest rate, exchange rate, output
   (b) Exchange rate regimes

Lectures

The lectures were well structured and directly covered the content on the assessments. They were highly conceptual and mathematical. There is an emphasis on calculating values rather than just qualitatively explaining economic trends. Hence formulae are a lot more important in this subject than *Introductory Macroeconomics*. As these formulae are hard to memorise and there is no formula sheet, Mei often uses the projector to derive the formulae on the slides. It is highly recommended to learn these derivations as this adds meaning to the concepts taught and makes remembering formulae easier for the final exams.

Personally, the focus on algebra and mathematical derivations in the slides made the subject more tedious and less enjoyable. However, you are sometimes required to use graphs and models to justify your numerical solutions in the exams. The graphs used are very similar to those in *Introductory Macroeconomics*. For example, the Solow–Swan Model, AS/AD model, PAE diagram and the money demand/supply diagram is almost exactly the same as in *Introductory Macroeconomics* (except for a few more variables). You will only learn a few new diagrams in this course making it conceptually easy to understand.

Tutorials

Tutorials are just like every other ECON subject with blue and pink sheets. Blue sheet completion before every tutorial contributes to participation scores and personally, they were very simple to complete. The pink sheet questions in class are a lot harder (sometimes even harder than most exam questions). They test your knowledge of concepts as well as finding numerical solutions. There is a focus on finding general solutions before applying numbers. I found pink sheet questions hard to do straight away because it was very conceptual and the lectures didn't focus on this too much.

As pink sheet questions are harder than exam questions, it is not an issue if you struggle to do them by yourself. However if you understand pink sheet questions after someone has shown you the solution, you are ready for the exam.

Assessment

The assignments are very useful for actuarial students because they use Excel. In both assignments, the task was to create a graph of economic values over time using Excel iterations. There were pretty challenging because you needed to do derivations by hand first before coming up with the appropriate recursive formula. You were then required to use economic models and graphs to explain trends in your solution. In the assignments, the questions are very structured so you don't really need to think creatively to come up with solutions.

The final exam was extremely methodical and based on manipulating variables by algebra; it reminded me of high school maths. Because the exam is very mechanical, you could get away with just memorising the derivations of the formulae and knowing the economic models to the same depth as in *Introductory Macroeconomics*. Unlike other subjects for second year actuarial students, the final exam was very similar to past exams. A few questions in the exams were very similar to past papers except for a few numbers and variables.

Tips for Success

My main tip is to learn the derivations of the formulae used rather than just memorising it. It adds a lot more value to this subject and also makes doing the exam easier as you will need to manipulate formulae to find general rather than specific solutions.

There is not a big focus on real life events so the textbook doesn't add any more value than the lectures. I recommend just reviewing the lectures continuously and drawing the models and graphs for yourself rather than just looking at them.

MAST20004 Probability

Exemption status	CT3 *Probability and Mathematical Statistics*, in conjunction with MAST20005 *Statistics*. An average of 73 across this subject and MAST20005 *Statistics* is needed, with no fails.
Lecturer(s)	Dr Nathan Ross Dr Mark Fackrell
Weekly contact hours	3 × 1-hour lectures 1 × 1-hour tutorial 1 × 1-hour computer lab session
Assessments	4 individual assignments 4 × 5% 3-hour end-of-semester exam 80%
Textbook recommendation	Ghahramani, S. (2005). *Fundamentals of Probability, with Stochastic Processes* (3rd ed.). Upper Saddle River, US: Pearson Education. The content covered in the lectures are explored in depth in the textbook, with more examples and questions. Although the textbook is not available in Co-op, a pdf version can be easily found online. Copies are also available in the ERC library (High Use).
Lecture capture	Full (both audio and video).
Year and semester reviewed	2017 Semester 1

Comments

Subject Content

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

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

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

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

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

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

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

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

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

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

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

Lectures

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

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

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

Tutorials

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

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

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

Assignments

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

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

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

End of Semester Exam

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

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

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

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

MAST20005 Statistics

Exemption status	CT3 *Probability and Mathematical Statistics*, in conjunction with MAST20004 *Probability*. An average of 73 across this subject and MAST20004 *Probability* is needed, with no fails.
Lecturer(s)	Dr Davide Ferrari
Weekly contact hours	3 × 1-hour lectures 1 × 1-hour tutorial 1 × 1-hour computer lab session
Assessments	3 individual assignments 20% 45-minute computer laboratory test 10% 3-hour end-of-semester exam 70%
Textbook recommendation	Hogg, R. V., & Tanis, E. A. (2014). *Probability and Statistical Inference* (9th ed.). Harlow, United Kingdom: Pearson Education Limited. 7th and 8th editions are also acceptable. Lecture notes and examples seem to be based quite closely on the book and hence will suffice. If you want additional questions (beyond tutorial sets and past examination papers), ✓ I would recommend investing in the textbook.
Lecture capture	Full (both audio and video).
Year and semester reviewed	2016 Semester 2

Comments

Subject content

MAST20005 Statistics begins with some basic revision of probability then quickly proceeds to cover methods of estimation, descriptive statistics and linear regression (these are all covered quite quickly but a solid understanding is very important in the following weeks). The majority of the 12 week course covers hypothesis testing and finishes with order statistics and a basic introduction to Bayesian methods.

As with MAST20004 *Probability*, the content in this subject is relatively easy to start with, however, it rapidly becomes more difficult as the semester progresses. Be prepared to work hard throughout the year, however a very high score is certainly not unattainable with the appropriate level of effort.

Lectures

Dr Davide Ferrari is a reasonably entertaining lecturer and is always looking to improve his lecturing style in order to help facilitate the learning for his students. One fantastic aspect of this subject is his use of the lecture capture — he changes the screen between the slides and the document camera effectively making home viewing no different from

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lecture attendance (an invaluable resource, especially for those who experienced Dr Barry Hughes' use of the lecture capture during MAST10009 *Accelerated Mathematics 2*).

Course content is divided into several sections (of very uneven length) which are effectively independent of one-another. You will find that between topics there is a fair bit of overlap. It is still possible to complete one section without having studied a previous section, though it will be considerably more challenging. Within a single topic it is very easy to get lost if you don't understand everything that has gone on throughout the rest of topic. For this reason, even if you are watching them online, I would recommend keeping up to date with lectures from week to week.

One downside of the lecture notes in this subject is the number of errors in the slides. It is not uncommon to come across one or more typos in any given lecture, despite Davide usually picking up on it, he makes little effort to fix the mistakes from year to year. This is especially problematic if you're reading through slides without the lecture recording.

Tutorials

As with *Probability*, a set of questions is released at the beginning of the tutorial week. During the tutorial, you will break into smaller groups and complete the questions on the whiteboard. Usually they are not too challenging, but from time to time there are some very tough ones that you will struggle to complete by yourself.

One great aspect of this subject is that Davide releases the solutions at the same time as the questions. This means that if you're a stickler like me who needs to get one question correct before you move onto the next, you won't be stuck on one question for a week (which then leads to you never actually doing the tutorial questions).

If you are able to complete and understand all the questions at home, there is little need to attend tutorials.

Computer Labs

Each week there is a one-hour computer lab using R, a programming language which provides invaluable resources for analysing data. You only use inbuilt commands with no understanding of the programming behind what is happening.

Personally, I found these labs to be quite dull and uninteresting. I found that learning MATLAB was far more stimulating as lab-sheets gave you a set of tasks to complete which required the understanding of code and simulations. R, on the other hand, requires simplistic copying from lab sheets to get results which are already printed for you. Beyond the muscle memory of typing in commands, there is really no difference between reading through the lab sheet and actually using a computer.

R software is free to download on your computer at home, that's to say you can complete the computer labs in your own time without too much difficulty.

Assignments

Personally, I found the assignments to be long and tedious. Admittedly, I always seemed to be behind on coursework which made things a little more challenging, however I was able to do all the questions given enough time.

It is worthwhile having a good understanding of R as many of the assignment questions can be easily solved using the computer software. Whilst it can be completed by hand, you will find it takes considerably longer.

Assignment questions are a very good reflection of what you will get in the exam (in fact many of the questions are taken from past papers) so it's worthwhile understanding the theory behind all the questions.

Laboratory Test

Not much to say. You get to take all your lab sheets as well as several pages of hand-written notes. Davide also provides you with a practice test so there's no reason you shouldn't get a good mark with some effort.

End-of-Semester Exam

The exam is three hours long with 15 minutes of reading time.

You will be allowed to take in a number of handwritten cheat sheets (2016 Semester 2 allowed three double-sided sheets, although there seems to be changes between years, so ask Davide yourself!!). Since there are so many formulas in this subject these cheat sheets are an invaluable resource, so make sure you leave enough time to make them legible and detailed. The process of making the cheat sheets is good revision in itself so I'd recommend doing this before you start completing practice exams.

You are provided with a number of past exams. The only problem is that solutions are not only very brief, but seem to be littered with errors. This makes it very difficult to accurately correct your work. However, be content that you have something as many other lecturers won't provide you with solutions (@barrydhughes #takeahint). On the up side, exams tend to be quite repetitive so a proper understanding of previous years' examination papers will lay the foundations for a great score.

Davide likes to include R output on his exams to save you from doing tedious calculations yourself. This can be very daunting at first (especially for ANOVA tables) so it is vital that you complete some past papers so you know what you're up against.

All the best ◡̈

MGMT20001 Organisational Behaviour [SM1]

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

Comments

Subject Content & Lectures

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

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

Lectures were delivered through two methods: traditional lectures delivered in a theatre, and online lectures. In weeks

with traditional lectures, there were three streams. Graham delivered the "micro" lectures and Vicky delivered the "macro" lectures in the first two streams, whilst Karthyeni delivered both "micro" and "macro" lectures throughout the semester in the third stream. I only attended lectures by Graham and Vicky.

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

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

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

Tutorials

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

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

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

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

Online tutor was available during the semester. It was run by Vicky. However, it did not seem to gain much traction among

students. Also, consultations with tutors were only by appointment, even during SWOTVAC, which may have also explained low consultation attendance.

Readings

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

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

Assignments

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

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

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

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

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

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

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

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

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

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

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

End of Semester Exam

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

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

Macro topics revolved around cases studied in tutorials, with strategy and structure counting as one macro topic. Likewise, one case and one topic were eliminated in week 12. Moreover, the combinations listed above were eliminated as they were already covered in tutorials. In 2017, Automakers of Australia and culture were eliminated. This left a total of twelve possible assessable combinations. In the exam, one topic and one case (provided) was selected. Whilst all four questions related to the topic (organisational change) and case (Solaris & Supernova), there was scope to bring in theories from

other macro topics, such as the 7S model. The primary source of revision for these questions should be understanding the theory. If there is still time during semester, it may be wise to perform sample case analyses on all the potential combinations alone or with friends. Whilst it is not advised to memorise these, it will at least make analysis faster during the exam.

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

MGMT20001 Organisational Behaviour [SUM]

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

Comments

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

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

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

Subject content

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

The first section, micro, consists of:

1. Perception, Attribution, and Decision-Making
   Actually interesting and fun if you see how they relate to you personally. You will find yourself realising you can relate to a lot of these perceptual biases.
2. Values, Attitudes, and Behaviour
   Difficult subsection; it is easy to understand the basics of this topic, as it is simply following a process of how values lead to attitudes, resulting in behaviour. The second aspect of this topic is where things begin to get confusing.
3. Leadership and Teams
   Fun subsection. If you really get into it, you will start joking with your friends about what stages of team development you are currently in. The teamwork aspect I found more enjoyable personally compared to the leadership aspect.
4. Motivation
   Not a hard topic, but definitely need to get your head around how it works.
5. Conflict and Negotiation
   Probably the most difficult and content-heavy topic of the micro section.

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

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

1. Organisational Change/Sanrizz
   Fun and easy to apply; hope that you get this for the exam.
2. Organisational Communication/Enron
   This was difficult to write about, and while the content isn't hard, try writing 1500 words on it in an exam.
3. Organisational Culture/Solaris and Supernova
   Fun topic. A lot of content, but not difficult.
4. Organisational Power/Automakers Australia
   Easy topic to apply. There are three dimensions of power, and once you know them, things are smooth sailing from there.
5. Organisational Strategy and Structure/Apple
   If this appears on the exam, writing about everything will probably mean you will run out of time. This has the most content and the most information to process.

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

Lectures

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

In terms of the lecturer, Victoria was great, and I believe it was her first time lecturing. She was enthusiastic and excited — very passionate about what she was doing. Sometimes she would give her own examples of how the management topics

were applicable, which was very insightful. Overall, she was a very fun lecturer and really tried to make sure her lectures were simply crammed with content. I remember watching *The Simpsons* and *Big Bang Theory* in her lectures — great times!

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

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

Online tutorials

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

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

Readings

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

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

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

Tutorials

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

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

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

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

Individual assignment

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

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

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

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

Group assignment

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

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

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

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

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

Usually, the group assignment is also based on a micro topic, is 5000 words (with 10% leeway), and is supposed to be evenly divided between the group. From personal experience, while this sounds fair logically and ethically, having different people write different sections will result in a mess of different writing styles and will probably detract from the overall consistency of your assignment. Have the best writer either do the final write-up or a thorough edit at the very end.

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

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

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

End-of-semester exam

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

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

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

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

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

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

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

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

Concluding remarks

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

Third-Year Subjects

ACTL30001 Actuarial Modelling I (1)

Exemption status	CT4 *Models*, in conjunction with ACTL30002 *Actuarial Modelling II*. Satisfactory performance in both subjects' end-of-semester exams is needed.
Lecturer(s)	Professor David Dickson
Weekly contact hours	1 × Set of online videos (adding up to roughly 1 hour) 1 × 1-hour workshop 1 × 1-hour tutorial
Assessments	50 minute mid-semester test, held in Week 8 10% Group assignment, due in Week 10 10% 2-hour end-of-semester exam 80%
Textbook recommendation	Dickson, D. C. M., Hardy, M. R., & Waters, H. R. (2013). *Actuarial Mathematics for Life Contingent Risks* (2nd ed.). Cambridge, UK: Cambridge University Press. The textbook is ✗ not necessary as all required material is provided in the slides. However a few chapters are relevant to this subject and provide some extra reading.
Lecture capture	Online lecture is recorded with video. However, workshops are not recorded.
Year and semester reviewed	2017 Semester 1

Comments

Subject content

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

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

6. Simulation; Looks at the theory of simulating values using random numbers as well as application of simulation under discrete and continuous distributions.

Lectures

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

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

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

Tutorials

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

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

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

Assignments

In 2017, there was one assignment that was to be completed in groups that were allocated by David. The assignments in this subject are known to be somewhat open ended and can therefore be difficult. For example, our assignment was rather

qualitative, where we were told to find the correct and incorrect aspects of number of hypothetical student responses to an exam question, as well as providing a mark out of ten for the provided answer and then justifying this mark. Whilst not computational, this requires judgement which can still be difficult.

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

Mid-Semester Test

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

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

End-of-Semester Exam

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

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

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

Concluding Remarks

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

In addition, there are several proofs in this subject. I would recommend that you derive these mathematical results by yourself as these not only assist your understanding, but the mid-semester and end of semester exam might ask you to

derive a result, or show a mathematical proof that has been studied during the semester. Once the concepts and proofs are understood, most questions, if not all, are doable and make sense as you work through to the solution step by step.

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

ACTL30001 Actuarial Modelling I (2)

Exemption status	CT4 *Models*, in conjunction with ACTL30002 *Actuarial Modelling II*. Satisfactory performance in both subjects' end-of-semester exams is needed.
Lecturer(s)	Professor David Dickson
Weekly contact hours	1 × Set of online videos (adding up to roughly 1 hour) 1 × 1-hour workshop 1 × 1-hour tutorial
Assessments	50 minute mid-semester test, held in Week 8 10% Group assignment, due in Week 10 10% 2-hour end-of-semester exam 80%
Textbook recommendation	Dickson, D. C. M., Hardy, M. R., & Waters, H. R. (2013). *Actuarial Mathematics for Life Contingent Risks* (2nd ed.). Cambridge, UK: Cambridge University Press. The contents of the textbook are not quite similar to what is provided in the lecture notes. Purchasing the textbook for additional study resources is thus ✗ not recommended (More in section on Lectures).
Lecture capture	Online lectures are uploaded well in advance. Workshops are not recorded.
Year and semester reviewed	2017 Semester 1

Comments

Subject content

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

- **Modelling Mortality**
  Future lifetime as a random variable, life tables, expectation(s) of life, laws of mortality and fractional age assumptions. This section is largely independent of the rest of the subject, and is examined as such, with the exception of fractional age assumptions.
- **Non-Parametric Methods (Estimation)**
  This section aims to teach you non-parametric approaches to estimating mortality rates. You will learn the assumptions and necessary conditions which underpin the Kaplan–Meier and Nelson–Aalen methods of estimation, their derivations (very mathematically intensive), the relationship between the two, and estimate likelihoods based on both methods. The section ends with proportional hazards.
- **Estimating Mortality Rates**
  This section takes the alternative approach to the previous method, using familiar probabilistic models to estimate the likelihoods of death. You will learn 3 models: Two-State Markov, Binomial and Poisson. The content of this module relies on knowledge of fractional age assumptions (Section 1). It is important to be able to understand

and apply different fractional age assumptions to each model, and understand the difference between the 3 models (assumptions, information used, practicality, results etc.)

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

Lectures/Workshops

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

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

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

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

Mid-Semester Exam

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

Assignments

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

End of Semester Exam

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

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

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

Concluding Remarks

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

ACTL30002 Actuarial Modelling II

Exemption status	CT4 *Models*, in conjunction with ACTL30001 *Actuarial Modelling I*. Satisfactory performance in both subjects' end-of-semester exams is needed.
Lecturer(s)	Dr Xueyuan (Shane) Wu
Weekly contact hours	2 × 1-hour lectures 1 × 1-hour tutorial
Assessments	Mid-semester exam 10% Group assignment 10% 2-hour end-of-semester exam 80%
Textbook recommendation	Lecture Notes for Actuarial Modelling 2 (AMII). This is purchasable at the Co-op store, and is simply a printed set of lecture notes. The textbook is mandatory, as all tutorial questions, progress check questions and practice exam are located within and are unobtainable anywhere else. There is literally no other material for this subject elsewhere, so not having the book makes it almost impossible to study.
Lecture capture	Full (both audio and video).
Year and semester reviewed	2017 Semester 1

Comments

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

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

- **Unit 1** focuses on exposed to risk calculations, by applying census and deaths data to calculate exact and approximated figures. This is definitely the most difficult unit in the entirety of the subject.
- **Unit 2** is similar to MAST20004 *Statistics*, whereby students are given a set of tests that are simply applied for different data sets. Unlike *Statistics*, students can also be asked to develop their own tests and should know the strengths/weaknesses of the tests.
- **Unit 3** covers methods of graduation. Assuming we have a set of observed data points (e.g. number of deaths over 2 years for a population of 1,000 people), we can take the crude rates and graduate them to remove sampling bias while smoothing them.
- **Unit 4** is mostly on matrices, teaching a method called 'first step analysis' to solve certain probabilities and expectations.

Unit 1 is hard due to the lack of material and practice questions. The most difficult questions in Unit 1 are not necessarily step-by-step mechanical calculations like in AMI, but are instead questions which should be considered on a case-by-case basis. When calculating exposed to risk estimates, deaths and population data may have different definitions (e.g. age labels are recorded age x last birthday for deaths data, and age x next birthday for population data).

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

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

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

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

Lectures

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

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

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

Tutorials

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

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

Group assignment

Pretty straightforward, teams were randomly allocated.

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

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

Mid-semester exam

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

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

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

End of Semester Exam

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

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

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

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

Concluding Statements

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

ACTL30003 Contingencies (1)

Exemption status	CT5 *Contingencies*. Satisfactory performance in this subject's end-of-semester exam is needed.
Lecturer(s)	Dr Ping Chen Dr Kevin Fergusson
Weekly contact hours	2 × 2-hour lectures 2 × 1-hour tutorials There are 2 extra hours of lectures in the first week.
Assessments	Group assignment 30% 3-hour end-of-semester exam 70%
Textbook recommendation	Subject notes are available for purchase from Co-op. ✓ It is recommended because the tutorial exercises are in these notes.
Lecture capture	Full (both audio and video).
Year and semester reviewed	2016 Semester 2

Comments

Double subject, hooray! Before taking the subject, people warned of the intense workload and difficulty of the subject. After taking it, it was already apparent from the first week of lectures that staying on top of lectures and the material was going to be very important. However, as the semester went on, it was quite difficult to be completely on top of the course given the speed and amount of content (and the time it takes to complete exercises).

Nevertheless, the subject is manageable if time is taken to understand how formulas come about. In doing so, you will find that many other formulas follow the same pattern, and are tweaked versions of one another. Having said that, there are still many formulas, and abundant practise is highly recommended. This is not a subject that you can cram for.

Subject Content

Life Insurance – 4 weeks

This part takes up most of the Contingencies course, covering topics like annuities, death benefits, provisions and premium calculations. Whilst there are many different formulas, trying to understand the derivations of the formulas will help you realise that many formulas follow the same idea.

Joint Life Theory – 2 weeks

This topic extends what is learnt in the first four weeks to insurance contracts covering two lives. Whilst the first part of the course is more tedious and computational, this part of the course is quite challenging.

Multiple Decrement Models – 1 week

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

The idea behind the content here is very similar to the multiple state models topic in ACTL30001 *Actuarial Modelling I*. It is important to understand the difference between the independent state case, and the multiple state case to avoid confusion when tackling questions. You should be able to understand and convert between independent rates and dependent rates.

Pension Funds – 1 week

This topic combines multiple state models and life insurance, exploring how to calculate the expected present value under different pension schemes. Again, the expressions for the EPVs can be very long, so understanding is key.

Demography – 1 week

Very similar to the demography section learnt way back in ACTL10001 *Introduction to Actuarial Studies*. Relatively straightforward content if you try to understand the formulas instead of memorising them.

Discounted Emerging Cost Techniques – 1 week

This topic explores how insurance offices would assess and design products that meet certain profit criterion. The nature of the exercises is similar to those done in financial accounting. Again, it is imperative that you try to understand which cash flow goes where and when because the scenario can be slightly different, causing issues if you just memorise the procedure.

Lectures

The first few weeks covering Life Insurance and Joint Life Theory are taken by Dr Ping Chen. Ping has a lot of experience teaching this subject, and is very good at delivering the material at a suitable pace. Initially some people may have found the lectures a little slow, however, this is done to make students comfortable with the material (and not feel overwhelmed). Later on, the lectures move a little faster. At the start, or end (or sometimes both), Ping would give summaries of the concepts or formulas taught thus far, allowing students to see how everything fits together.

The second half of the semester is taken by Dr Kevin Fergusson. Kevin's pace is much faster than Ping's, but this may be because the material in the second half is not as difficult to process as what is covered in the first half of semester. Kevin is also good at drawing connections between the material and real life work scenarios.

Overall, attending lectures is highly recommended as there is a lot of information in this subject. For those who prefer watching lectures online, it is imperative to be disciplined and not fall behind lectures because you can be overwhelmed by the number of formulas very quickly.

The lecture material can be quite dry at times making it hard to stay focussed for two hours straight. Lecturers are very aware of this, and do give us a break in between, so bringing snacks and water (or coffee) to rejuvenate yourselves may be a good idea!

Tutorials

There are two one-hour tutorials every week. At the start of semester, the tutorial questions are distributed (they are just a select few questions from the exercises in the subject notes). During tutorials, the tutors go through how to tackle these. Questions do not seem long, but can take a long time to work out if attempting them for the first time. Two hours of work is often required per set of tutorial questions. Handouts (lecture summaries, tutorial answers) were distributed at the end of tutorials, but this may vary from year to year.

Group Assignment

This year's assignment focused on valuing reverse mortgages using hypothetical data provided. The assignment was split into three parts. The first part of the assignment involved research into the actual reverse mortgage product so we all understood what it was. The second part required us to fit the data we were given to the Lee–Carter Model to project mortality rates. For the final part of the assignment, we derived a formula for the EPV of a reverse mortgage portfolio, and proceeded to use it to calculate the EPV for the hypothetical data. We were then required to submit a written report, and make a presentation on our findings.

Overall, this assignment was very challenging, but allowed students to learn a lot. Kevin was very understanding of the difficulty of the assignment, and gave us many hints along the way.

End-of-Semester Exam

The exam is 3 hours, and advice given to us by tutors and students who had taken the subject revolved around 'practise practise practise' because the exam was generally tight for time. Unfortunately, the exam was extremely difficult in our year, and time really was not the problem. It felt as if the lecturers pooled together the hardest concepts from each topic, and made that our exam (*cry*). Having done all the textbook questions and the specimen exam, none of what I had done to practise made me feel ready for that particular exam. The pensions section was particularly worrying because there were few tutorial questions on that topic to begin with. Nevertheless, students who took time to understand the material were somewhat successful at making decent attempts at certain questions. It is also important to work carefully as questions are often consequential.

Good luck, and may your exam be not-as-intense!

ACTL30003 Contingencies (2)

Exemption status	CT5 *Contingencies*. Satisfactory performance in this subject's end-of-semester exam is needed.
Lecturer(s)	Dr Ping Chen Dr Kevin Fergusson
Weekly contact hours	2 × 2-hour lectures 2 × 1-hour tutorials There are 2 extra hours of lectures in the first week.
Assessments	Group assignment 30% 3-hour end-of-semester exam 70%
Textbook recommendation	*ACTL30003 Contingencies* workbook ✓ The workbook is essential. All tutorials problems, and the specimen exam are available in the workbook.
Lecture capture	Full (both audio and video).
Year and semester reviewed	2016 Semester 2

Comments

It's the big scary capstone subject of the degree — Contingencies! This subject can be seen as the fusion between ACTL20001 *Financial Mathematics I* and ACTL30001 *Actuarial Modelling I*. Be prepared for one of the most challenging subjects (for various reasons) of the entire degree.

For students who have decided they do not want to become an actuary but still want the actuarial major, I strongly recommend that you forgo this subject in favor of other actuarial subjects like ACTL30004 *Actuarial Statistics* or ACTL30006 *Financial Mathematics III*, as the content in this course is highly specialised for the actuarial profession, and I imagine it would be of little use outside the profession.

Subject content

Contingencies is mainly about pricing insurance products, taking into account the present value of cash flow (FM1) and the probability that the payment actually occurs (AMI). The content is categorised as follows:

- Life Insurance Mathematics

  Combining knowledge from probability and financial mathematics, how does one find the "expected present value" (EPV) of the cash flows from a life insurance product? How does one calculate a "fair premium" for this product? This was briefly touched upon in ACTL10001 *Introduction to Actuarial Studies*. A life insurance company must also set aside a certain amount of money (provisions) to pay out to policy holders if a benefit must be paid out. How much should they set aside? Calculating profit is a bit more complicated for a life insurance company. How do we go about calculating that?

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

- Joint Life Theory

  The first part of the course focusses solely on policies that are contingent on the life of a single person. However, some contracts are dependent on two lives. How does one answer the questions laid out above when two lives are involved? This is easily the hardest part of the course.

- Multiple Decrement Models

  Above, we only consider the decrement of 'death'. However, sometimes a benefit is paid out for multiple reasons (e.g. death and disability). How do we calculate the probability of a person dying when they also have the risk of becoming disabled? The content here is similar to Multiple State Models from AMI.

- Pension Funds

  Here, you apply your knowledge in life insurance mathematics and multiple decrement models. The 'EPV' of various superannuation benefits are explored here.

- Demography

  A nice breather after all of the complicated content. Remember the 'crude death rate' and 'crude birth rate' stuff from *Introduction to Actuarial Studies*? Those things make a return here. This unit also contains the only 'theory' part of the entire course, where a number of different factors for mortality and different types of selection are explained in detail.

- Discounted Emerging Costs Techniques (DECT)

  The DECT is another way of calculating the EPV of a number of insurance products. In this subject, the technique is mainly applied to 'Unit-Linked' products (where the benefit paid out is dependent on some other investment).

Overall, the content for Contingencies is extremely dry. Students are expected to work with life tables the entire semester, which can become very tedious to work with. Unfortunately, there is no substitute until electronic exams become feasible, so you will just have to make do. If you love memorising and working with formulae, you may enjoy this subject.

Lectures

The first 6 weeks cover Life Insurance Mathematics and Joint Life Theory, and was taught by Ping Chen. Weeks 7 to 10 cover the rest of the course, and was taught by Kevin Fergusson. There are no lectures for the last two weeks. Group presentations are held in the last two lectures of the semester. More details regarding these presentations can be found later in the review.

Ping goes through each lecture slowly and meticulously, carefully explaining each step of the derivations of formulae and the solutions to each lecture example. Such a teaching style is incredibly helpful for the earlier parts of the course and some of the harder concepts in Joint Life Theory. The vast majority of students found this approach to teaching the subject incredibly helpful for absorbing the content. I personally wished it went a bit quicker, but going too slow is not necessarily a bad thing.

Kevin's delivery of the content was quite speedy, and his explanations were not nearly as detailed or in depth as Ping's were. However, Kevin was able to draw upon his experience in the industry and make connections between the concepts and real life work which was interesting. Despite this, Kevin took extra time to explain some of the more challenging ideas introduced in lectures, such as the DECT topic at the end, which was very helpful.

The slides for Life Insurance Mathematics are much better than the workbook (for example, some important details regarding the calculation of mortality profit are missing from the workbook). Apart from Life Insurance Mathematics, lecture slides are essentially a copy of the workbook. While I strongly recommend using the slides for Life Insurance Mathematics, feel free to use either the workbook or slides to revise the course content during SWOTVAC.

Tutorials

There were two tutorials per stream during the semester, and a different tutor took each of them. Each tutorial stream had the same two tutors.

Tutorials consisted of a very brief summary of the content covered in the previous class, followed by discussion of a few selected questions for the week. The list of questions to be discussed is sent out at the start of semester. Worked solutions for the questions discussed are handed out at the end of each tutorial, which may help in understanding the methods used to answer each problem. Solutions to each chunk of exercises in the workbook (not just the questions discussed) are uploaded to the LMS at the end of each week.

Compared to other subjects, I personally found this subject's tutorials to be the least helpful. Whether that was because I was too brain-dead to follow along with the tutor, or whether it was because the content was uninteresting is a mystery.

Your tutorial experience will ultimately depend on your tutor. Tutorials commence in week 2, and finish in week 11 — there is no tutorial in week 12.

Exercises

There is an absolute mountain of exercises in the workbook — more than the average actuarial subject. The sheer number of questions each week makes it quite intimidating to begin, as well as a huge pain to catch up if you fall behind (even one week of exercises will take ages). It will be in your best interest to keep up each week to avoid spending an entire week catching up (like this reviewer did).

Exercises were a mixture of proof questions, standard calculation questions, more complex calculation questions, excel questions, as well as interesting theory questions. The overwhelming majority of questions required the use of the life tables located at the back of the workbook. Flipping back and forth between reading the question and grabbing the appropriate values from each table was a huge pain, so I decided to print off each life table (which are provided on the LMS) and create a separate binder at OfficeWorks. You should definitely do this ASAP to save yourself a lot of hassle.

Group Project

Being a capstone subject, this subject's group assignment is unlike any other group assignment in the major. Much like all the other group assignments in 3rd year, students are grouped together based on their "capabilities" (i.e. strong students tend to get grouped with other strong students). The group project is worth 30% of the overall subject score.

In 2016, the group project dealt with reverse mortgage contracts — a type of product which, while not explicitly taught in the course, can be priced using the concepts from Life Insurance Mathematics and Joint Life Theory. Groups were expected to produce a report, presentation slides, and an excel spreadsheet showing any calculations. The report was to cover the background of the product, an explanation of the models used and numerical figures showing the portfolio value and the

profit made over the financial year. In addition to this, groups were to give a 10 minute presentation about the project. The 10 minute time limit is very strict, with penalties for groups going over this time limit.

The project was a large source of stress for many students in the latter half of the semester due to the open ended nature of the project. The project also introduced a large number of new concepts that extended on what was taught in lectures. For example, the use of the Lee–Carter model of mortality (i.e. stochastic mortality rates) instead of the usual "static" mortality rates. However, the project was designed to give students a taste of what it was like in an actual job (e.g. ambiguity and open-endedness) rather than working with artificial scenarios, and the project succeeded in doing just that. Any experience in VBA for Excel will be very helpful for the project (and was somewhat necessary).

I recommend that you start as soon as possible. The deadline might seem like a long way away from the time the assignment is actually released, but trust me on this one. Do not be afraid to ask questions to the lecturer(s) if your group needs any clarification on the project.

Kevin spent a large amount of time during lectures giving hints for the assignment. Summary statistics for the project were not provided, and your mark is not given to you unless you ask for it personally (e.g. e-mail). Unfortunately, as interesting as the project was, it did not offer much in terms of revision for the exam.

End-of-Semester Exam

In the past, the exam was usually quite predictable, being similar in style and difficulty to tutorial problems. However, the 2016 exam was arguably the hardest exam in the entire degree (at least, for the cohort of 2016).

The first half of the exam (life insurance mathematics and joint life theory) surprised the vast majority of students. You had to work extremely hard for every single mark. I felt that the exam really tested one's attention to detail, as the types of annuities used required a lot of manipulations of normal annuity numbers. If I were to compare the questions on the exam to the workbook questions, the exam questions would probably be in line with the most difficult questions in the book.

Other parts of the exam were relatively okay. The superannuation question was a huge curveball, as many of the workbook exercises and in-lecture exercises primarily used Excel. However, as the entire superannuation unit is essentially an application of life insurance mathematics and multiple decrement models, the question itself was do-able.

The specimen exam was vastly different to the actual exam in both length and difficulty. Fortunately, the exam was scaled appropriately.

There is also no formula sheet.

Tips for Success

I can not offer you any tips for success, but I can offer you tips to avoid failure. The one thing you do not want to do in the subject is fall behind in your exercises, as it will be almost impossible to catch up without sacrificing your study time in other subjects, as well as your sanity. Like most other subjects, understanding what each term in each formula does will greatly reduce the burden of memorisation. Luckily this is relatively easy to do for the first two topics due to Ping's teaching style.

Honestly, there is no secret to success in Contingencies. Just grind out question after question and it should eventually become second nature (...hopefully). Best of luck!

ACTL30004 Actuarial Statistics

Exemption status	CT6 *Statistical Methods*, in conjunction with ACTL40002 *Risk Theory I*. Satisfactory performance in this subject's end-of-semester exam and a satisfactory final grade in ACTL40002 *Risk Theory I* are required.
Lecturer(s)	Dr Enrique Calderin
Weekly contact hours	2 × 1-hour lectures 1 × 1-hour tutorial
Assessments	2 group assignments 2 × 10% 2-hour end-of-semester exam 80%
Textbook recommendation	ACTL30004 Actuarial Statistics workbook Much like in ACTL30002 *Actuarial Modelling II*, ✓ getting the workbook is essential. All tutorial problems, and the specimen exam are available in the workbook. The workbook is available on the LMS if you choose to print it instead of purchasing it from Co-op.
Lecture capture	Full (both audio and video)
Year and semester reviewed	2016 Semester 2

Comments

This subject predictably extends on the content covered in MAST20005 *Statistics*. Though it has 'Actuarial' in front of its name, this subject covers content that is very applicable in all fields outside of just actuarial studies. Therefore, it is probably the most useful subject in third year. Whether or not you intend to be an actuary at this point of your degree, be prepared to learn a lot of useful skills for any quantitative work.

Subject content

This subject introduces a number of different models and tools to aid in statistical analysis. The subject's content is categorised as follows:

- Unit 1 — Introduction to R

  In order to effectively study the following units, the subject starts with a brief introduction to the programming language of R.

- Unit 2 — Likelihood Theory

  In order to fit a set of data to a probabilistic model, one must find the correct parameters. Using Maximum Likelihood Theory, the parameters are chosen by assuming that the outcome that has occurred is the most likely outcome. Different properties of Maximum Likelihood Estimators (MLEs) are covered in detail. The content covered here is just enough to study the next unit.

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

- Unit 3 — Generalised Linear Models (GLMs)

  A normal regression model assumes that the response variable is normally distributed, and that the mean is a linear combination of a set of explanatory variables. What if the response variable was not normally distributed, or the mean is a **function of the linear combination** of explanatory variables? Then you have a GLM.

- Unit 4 — Simulation

  Some of the more complicated models are unable to be analytically examined. In these situations, simulation (using a computer to perform a large number of experiments) is used. This extends upon knowledge from second year mathematics subjects and ACTL30001 *Actuarial Modelling I*.

- Unit 5 — Outstanding Claims Provisions

  In order to calculate the amount of money that should be held for future claims payments, run-off triangles are used. This unit covers a number of different methods that utilise these run-off triangles.

- Unit 6 — Experience Rating Systems

  A very short unit that applies markov chains to a 'No Claim Discount' system — a system where policyholders with no claims in a year have a lower premium in the following year.

- Unit 7 — Time Series Analysis

  There are situations where the 'residuals' of a variable observed over time follow some sort of pattern. This unit explores these patterns, with a focus on stationary processes. The autoregressive and moving average processes from ACTL20002 *Financial Mathematics II* makes a return, as well as a new process — ARMA(p,q): the autoregressive and moving average process.

While it may look like there are a lot of units, the majority of the semester will be spent covering Units 2, 3, 4 and 7. Unit 3 is far and away the hardest unit of the subject, so bring your A-game for that.

Lectures

As the lecturer for this subject returns from ACTL30002 *Actuarial Modelling II*, the style of lectures between the two subjects are very similar. However, given the more challenging course content, I felt that there was a greater need to attend lectures in this subject.

Students are expected to follow along with Enrique in their workbooks. Sometimes lecture slides were released before the lecture time, but the workbook is more than enough. Unfortunately, this subject suffers from the same problem that often there is not enough time to copy down worked solutions for the in-lecture exercises. However, slides are posted as soon as lectures finish, allowing you to copy what you have missed afterwards. Like before, feel free to use either the workbook or the complete set of slides for revision during SWOTVAC.

Enrique is very clear in explaining the statistical concepts. He regularly asked questions to keep us on our toes and helped us understand some of the more complicated concepts relating to GLMs and R output. This was very helpful throughout the course.

Tutorials

Tutorials generally consisted of a brief recap of the previous week's lectures, followed by the solutions for tutorial problems.

Unfortunately, there were times during the semester where the tutorial problems used content that had not been covered in lectures yet. Tutors were generally aware of this, so it was not really much of an issue. My tutor saved these questions for the following week.

Solutions for the tutorials are unavailable outside of tutorials, where a printed copy is handed to you.

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

Assessments

Much like in the first semester modelling subjects, students are placed into groups of four (or three for leftover students). Both assignments require groups to produce a report. The first assignment covered Unit 2, while the second assignment covered Units 3 and 4. Tasks included applying the Fisher–Scoring algorithm, calculating maximum likelihood estimates, and using simulation to perform a statistical test.

While you were able to get through past assignments using Excel, it will be a huge struggle to get through these assignments without the use of R, so it will be in your best interests to familiarise yourself with the programming tool well before the assignments are released. The average for the cohort was roughly 34 for the first assignment, and 38 for the second assignment.

For this subject's exam, marks are typically lost for silly mistakes rather than a lack of understanding due to the number of small things that must be considered. For example, you might forget a negative sign, or glance over a small detail in the question that changes the numerical solution ever so slightly (e.g. expected *failures* vs. expected *trials*).

For practice, the specimen exam is a very good indication of the difficulty of the questions for the exam. However, the specimen exam does not cover every unit that is taught in the subject (in particular, there was no question on Unit 6). Like always, it is best to save the specimen exam until after re-attempting all the tutorial problems. It might also be wise to save a question in Unit 6 to add to the specimen exam when you attempt it. There is a checklist at the end of the workbook, listing the expectations related to each unit, which will aid your revision immensely.

In 2016, all of the units were assessed (unlike the specimen exam). Surprisingly, there was no question requiring students to interpret R code. Overall the exam was very fair and doable.

Tips for Success

It goes without saying that your knowledge from *Statistics* will be a huge boon for this subject — there is a large amount of overlap between the two subjects, particularly in Unit 2.

A bit of background knowledge in programming will definitely help a lot with assignments and the occasional tutorial problem. Take the time during the first week to familiarise yourself with R, whether that is through the notes in the workbook or your notes from second year mathematics subjects (though, the notes in the workbook are sufficient for the subject).

ACTL30005 Models for Insurance and Finance

Exemption status	Not an exemption subject, but is a prerequisite for ACTL40004 *Advanced Financial Mathematics I* (CT8 *Financial Economics* subject).
Lecturer(s)	Professor Daniel Dufresne
Weekly contact hours	$3 \times$ 1-hour lectures The third lecture each week is a discussion of the provided exercises.
Assessments	2 group assignments $2 \times 10\%$ 2-hour end-of-semester exam 80%
Textbook recommendation	No external texts required. An electronic set of lecture notes (formatted more like a textbook) is provided by Daniel and is all you will need.
Lecture capture	Full (both audio and video).
Year and semester reviewed	2016 Semester 2

Comments

Do all of the following apply to you?

- You are not considering Honours.
- You are not considering the MC-COMACTS *Master of Commerce (Actuarial Science)*.
- You do not like abstract theory.
- There is another subject which you would rather study in Semester 2, and you believe it is worth submitting an enrolment variation form to change your study plan.

If yes, I would highly recommend withdrawing from ACTL30005 Models for Insurance and Finance.

Otherwise, this subject might be for you!

MIF is different from all other actuarial subjects because of its style. First of all, you are not going to find simple practical applications of the theory in this subject (there are practical applications, but they are beyond the undergraduate student). Moreover, the structure of this subject is more like a pure maths subject: there are several results and techniques shown throughout MIF, all of which may be useful in solving a problem. Is it obvious which one will be useful? Maybe. But probably not.

When you are presented with a problem in MIF, it is a joint question of

- Can you recognise that there is a result or technique which might be of use?
- Can you identify which result or technique might be of use?
- Can you use the result or technique and solve the question?

In a subject which covers a variety of general results, the hardest part is ostensibly the first.

In other actuarial subjects, the first question is essentially moot, because there are not many mathematical results covered, and the ones that are covered are normally very specific in their area of use, to the point that in students' minds they become

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

directly associated with problems in that area.

That is not the case for MIF. Despite the mentions of *insurance* and *finance* in its name, both of which sound fairly practical, MIF can be likened to MAST10009 *Accelerated Mathematics 2*. There was a variety of results in AM2, and hardly any were highly obvious in their utility for solving problems.

MIF studies some basic measure-theoretic probability theory and proceeds to explore basic concepts in stochastic calculus (calculus for dealing with stochastic processes) and some new concepts regarding stochastic processes. A good result in MAST20004 *Probability* should inspire some confidence, because many of the computational tools make a reappearance, although do be prepared to be awakened to the measure-theoretic perspective of probability theory, of which you probably have been unaware unless you studied MAST30020 *Probability for Inference* (on a personal note, fantastic subject, would highly recommend for the abstract-minded).

The role MIF plays in the tertiary education of an aspiring Honours or MCom student is preparation for ACTL40004 *Advanced Financial Mathematics I*, which is required for exemption from CT8 *Financial Economics*. The theory in MIF provides a foundation for studying derivative pricing in AFM1.

MIF lacks some of the rigour which you might expect from such a mathematical subject, particularly in the introduction of stochastic calculus — it is far less rigorous than the introduction to calculus in AM2. To be fair, the rigour of the theory in MIF is largely far beyond a third-year actuarial student, and if the rigour were examinable I would simply have told everyone to withdraw from this subject immediately.

On the other hand, MIF holds the status of being the only undergraduate subject in the entire university to discuss Brownian motion (in the mathematical sense) and stochastic differential equations (i.e. differential equations with randomness). Neither is mentioned in *Statistics and Stochastic Processes* subjects taught by the School of Mathematics and Statistics, because Brownian motion has sadly been removed from the syllabus of MAST30001 *Stochastic Modelling* (apparently, as of 2016 Semester 2), where it was formerly taught.

A minor note: From 2017 onwards, MIF will no longer be delivered by Professor Daniel Dufresne. Please keep this in mind when reading this review.

Subject content

There are six topics in MIF:

1. an introduction to measure-theoretic probability theory
2. conditional expectations (in particular those conditional on σ-fields)
3. random walks and Brownian motion
4. a new type of integral for stochastic processes called *Itô's integral*
5. stochastic differential equations
6. martingales (a type of stochastic process with special properties)

Introduction to measure-theoretic probability theory You have finally made it: the ultimate semester of your BCom. Having survived the merciless slaughter that was the FM3 exam, you are honestly just glad you still have a chance of graduating on time.

You look at the name of the first topic: *Probability Spaces, Random Variables, Simulation, Expectations*. All are familiar terms, except for maybe *spaces*. Vector spaces maybe? Covered in AM1, although you may be a bit rusty. Everything

else sounds like a revision of *Probability*. You kick back and prepare for a cruisy first few lectures. Maybe you should have stayed at home.

You kick back a bit too far, and the sensation of falling wakes you abruptly. You are met with a barrage of jargon which you have never heard of before. Did you misread the timetable? What are measures? What are fields doing indoors? Who is Lebesgue and why is he measuring things? Where did all the probability densities go? Is this a Greek class?

You awaken to the reality that this was not revision at all. Your concept of probability is being completely rewired.

What a grand welcome to the final semester of your BCom.

This first topic serves to set up the theoretical environment in which you will study probability theory in MIF, and, accordingly, there is a lot of new terminology. Fortunately a decent amount of time is spent on stabilising your foundation here. You are introduced to many new concepts along the way which are clear signs that there must have been ridiculous advances in probability theory over the last two semesters, surely.

Not really. This has been the true face of probability theory all along.

In this first topic, your knowledge of random variables, events, and expectations will completely change (for the better). Events with a probability of 0 are actually made distinct from impossible events, and you even have a completely new type of integral, the *Lebesgue integral*. The Lebesgue (pronounced something like *leh-bek*) integral is different from the Riemann integral, but the exact distinction is not made clear in MIF.

The main takeaways from this first topic are that

- the σ-field contains subsets of the sample space to which we can sensibly assign probabilities (the subtlety being that not all subsets of the sample space can be sensibly assigned a probability);
- a random variable is a function whose domain is the sample space; and
- the expectation of a random variable is the Lebesgue integral of the random variable over the entire sample space.

Close to the end of the topic are two seemingly arbitrarily placed theorems: the dominated convergence theorem and Fubini's theorem (which may have been given a passing mention in AM1). These theorems deal with the finiteness of Lebesgue integrals, and you need them because the distinction between finite and infinite is now relevant again!

Conditional expectations Your expectations adjusted, you are now ready to accept that MIF is going to be hard. In the wry humour of Daniel, even a broken clock is right twice a day, and this time you are right. (And how many times is a functional, accurate clock right in a day? This is the sort of question present at the beginning of MIF.)

Conditional expectations in this subject are random variables just like they were in *Probability*, but the conditional part is now different — it is now a σ-field instead of a single random variable.

At this point it must be stressed that the intuition behind σ-fields is that they represent information or information potential. The conditional expectation is a random variable whose value depends on exactly what information is present (i.e. a function of an element in the sample space).

This new take on conditional expectations is introduced with a very basic example of a σ-field (one that is generated by a partition of the sample space). For the rest of MIF, the σ-field is usually one that is generated by a collection of random variables, in which case the conditional expectation is just like it was in *Probability*, but be aware that all of the results for conditional expectations do in fact hold for general σ-fields.

Three properties of conditional expectations are discussed (one more is given later). You will use these somewhat frequently in solving problems in MIF, and they will also be important in understanding lecture content.

From a computational perspective, conditioning on a collection of random variables is all you will need to handle in MIF (think "find the expression for the conditional expectation"), ergo you are well prepared from *Probability* to handle computations involving conditional expectations.

In terms of conditioning on generic σ-fields, again, what is most important is an understanding that you are essentially conditioning on information [potential]. You will not really deal with computations for conditional expectations given general σ-fields.

Random walks and Brownian motion With a corrected perspective on probability theory, the next topic in MIF begins your journey through stochastic processes and an associated calculus.

Random walks are defined with some small properties shown, including an application of the newfangled conditional expectation. Long-term behaviour of random walks is discussed, with a short application to risk theory, validating the use of "insurance" in the subject's name.

The discussion on random walk ends rather quickly in favour of introducing Brownian motion. Make sure you take in this moment, because Brownian motion truly is something to behold (and something that will be everywhere from this point onwards).

Standard Brownian motion is a continuous-time stochastic process and is introduced as the limit of a random walk (by scaling the frequency and size of the steps appropriately). It is (almost surely) continuous when graphed, but has some very peculiar properties. If your position along a straight line were described by the value of a standard Brownian motion, then the ways in which these peculiar properties manifest (almost surely) include that

- over any time period you have travelled an infinite distance; and
- you have transcended the concept of velocity (your velocity does not exist).

Indeed, standard Brownian motion is very complex.

There are some other properties regarding how to construct new standard Brownian motions from existing standard Brownian motions (which you will need to know), but the most important property which is fundamental to stochastic calculus is that the quadratic variation of standard Brownian motion (a way of measuring the amount of change) is equal to the length of the time period over which you measure. This may come in use when computing basic limits involving standard Brownian motion, so you will have uses for it outside of understanding what is discussed in the next few topics.

Regarding the *standard* descriptor in *standard Brownian motion*: There are other types of Brownian motion (arithmetic, geometric), but they are all based on standard Brownian motion.

Itô integrals Things certainly do not get any less weird with the introduction of a type of random integral. What about the integral is random? The differential. This is probably difficult to grasp, but you will be led slowly through the (heuristic) construction of the Itô integral.

The Itô integral, like the Riemann integral, is the limit of a sequence of sums. Of course, this limit is not the same one you encountered in AM2, because the sums are all random too! The sums all involve a single standard Brownian motion, which is the reason you studied them before this topic. Taking the limit (in a special sense) you will arrive at the Itô integral, which is naturally also a random variable.

The Itô integral possesses some familiar properties associated with normal Riemann integrals, such as linearity, but gains some new ones from its proud status as a random variable, many of which hold analogously with the random sums of which the Itô integral is the limit.

Unfortunately, its proud status as a random variable also means you often cannot find closed expressions for Itô integrals. Your normal methods for integrating deterministic functions like polynomials or exponentials in Riemann integrals sadly hold no weight in this newer stochastic world.

The Itô integral leads to the introduction of a type of stochastic process called *Itô processes*, and these can be differentiated (in a sense). There are even analogues of the much-loved product rule and chain rule, but the expressions are slightly more complicated. You will need to be able to use these, and fortunately they will appear on a formula sheet in the exam.

I recommend practising these new rules for differentiation quite heavily, because they are difficult to become accustomed to (yes, these new rules are that much more complicated). Relatively speaking (compared to the rest of the content in MIF), they are just as mechanical as the product and chain rules in normal differentiation, so it would be a shame to make mistakes when using them.

Stochastic differential equations Having infused integration (and differentiation) with randomness, we now proceed to do the same to differential equations. Stochastic differential equations are equations relating the change of an Itô process to itself (what you are solving for is a particular Itô process). There are far fewer techniques to solve these equations compared to those available for solving deterministic differential equations.

Pay special attention to the two types of stochastic differential equations which are shown in this subject to have analytical solutions. The solution to one is geometric Brownian motion, while the solution to the other is something called the *Ornstein–Uhlenbeck process*. The method of obtaining these solutions is shown in lectures but effectively amounts to trial and error.

The expressions for the analytical solutions are fairly horrendous. In 2016, many students did not memorise the expressions, which unfortunately was required for a question on the exam.

At the end of the topic you are shown how to obtain deterministic differential equations for the moments of the solution to a stochastic differential equation. These you are expected to be able to solve analytically, as they are first-order linear ODEs. (Use integrating factors to solve them.)

Martingales The final topic is martingales. The origin for the name lies within a type of betting strategy whereupon one continually doubles his bets after a loss to eventually make a profit. For this to be feasible, however, you must be infinitely rich and somehow care about becoming more rich. Anyway please gamble responsibly.

Martingales are a type of stochastic process which is the mathematical model of a fair game; that is, it is impossible to form strategies based on historical outcomes of the game which will result in profits on average. The classic example in finance is the price of a stock in a market which exhibits weak information efficiency.

The definition of a martingale is essentially all that is examined in this topic. The discrete-time martingale transform is also introduced (barely) as well as an associated theorem, but I would say that they are highly insignificant in MIF. (Over five years of exams the theorem has not been necessary, but there has been potential to use it.)

The way this topic is assessed is usually by providing several stochastic processes and asking which (if any) are martingales. They can all be done by testing the parts of the martingale definition, but often there are faster ways, such as testing whether certain properties of martingales hold.

Fun fact: Did you know the Society of Actuaries in the USA has a main office located on North Martingale Road?

Lectures

Keep in mind that the following comments are specific to the lectures delivered by Daniel.

Lecture notes were made completely available at the beginning of the semester. They were formatted more like a textbook and would be on display on a projector screen in lectures. Daniel also mentioned he was in the process of making them available as a series of web pages (currently the first topic is located at http://www.ozdaniel.com/IntroStochCalc/Chapter1.php).

Lectures followed the sequencing of the notes, although in 2016 there was occasionally some skipping or backtracking. However, not everything delivered in lectures was part of the notes. Often Daniel would spend time verifying that all conditions were satisfied when applying a result, even the auxiliary ones (usually involving finiteness of certain quantities). Daniel would also expand on some aspects which were only given passing mentions in the notes or begin explaining areas which were related to the topics in MIF (but nevertheless outside the scope of the subject).

In 2016 we were mostly ahead in the lecture schedule, so nothing was rushed. In MIF, despite the foreign nature of the content, there is not a lot of it, which gave Daniel flexibility to discuss other related topics. Of note were the several times the focus of a lecture temporarily became the history behind some of the results (there was sufficient time to do this and not hinder the content delivery).

Lectures were recorded, with the video feed being the document camera that was displayed next to the lecture notes in lectures. Daniel would occasionally show more working or details for some of the steps in examples through the document camera.

There were three lectures each week, but the third lecture was dedicated to discussing solutions to the exercises.

Exercises

The full set of exercises and all the solutions were made available on the LMS at the beginning of the semester.

As is characteristic of Daniel, the exercises supplemented the lecture notes with extra insights and results. Aside from these were simple applications of definitions and results in lectures, some problems investigating the results in lectures, and some more involved problems which required some ingenuity or acute observations. The more involved problems were not always directly relevant to the content discussed in lectures, however. Nevertheless, the solutions to these were always rather interesting.

The extra material introduced in the exercises, such as some inequalities (Markov, Chebyshev, Cauchy–Schwarz), was considered examinable, and various novel techniques were showcased in solutions, such as the use of moment-generating functions and characteristic functions (these in particular made few appearances in the lecture notes). Some of the problems were explicitly marked as not examinable.

Daniel discussed the solutions in the third lecture each week. The solutions themselves were fairly comprehensive, often including multiple different approaches. Daniel mostly presented the solutions as-is during the third lecture while commenting on subtleties along the way.

Assignments

The two assignments are worth 10% each. Both are done in groups of three to five of your choice.

In 2016, the first assignment was more difficult, requiring some ingenuity. The second was more straightforward but discussed some new concepts and required some programming for simulating random walks and standard Brownian motion (R code was acceptable).

Like the exercises, the assignments were not always directly related to the lecture content, and the difficulty of the problems was overall quite similar to those in the exercises.

Bonus marks for solutions to bonus questions were available in the first assignment. These could be used for insurance in the second assignment, but total marks from assignments could not result in a contribution of more than 20 to the final grade.

End-of-semester exam

Historically, in contrast to other actuarial subjects, the exam for MIF has been of a fairly consistent length (perhaps to compensate for the more abstract nature of MIF). Problems on the exam usually test some creative or critical thinking in using the definitions and results discussed over the course of the subject; this immediately distinguishes it from the exams in other actuarial subjects.

As mentioned at the very beginning of the review, a good performance in the MIF exam will require a competent memory of the variety of definitions and results in the subject as well as an ability to discern which of them are useful in solving a problem. Problems in MIF often can be solved in various ways, and some will use far less precious writing time than others will.

The best way to prepare for the exam would be completing past exams in timed conditions. In 2016, Daniel provided past exams from 2012 to 2015 accompanied with short answers (not really full solutions). The style of the exam questions was largely similar to those of the exercises, but the exam questions were of course all related to the lecture content. Comparing specifically to the problems in the exercises which are directly related to the lecture content, I would say the exams are generally more difficult.

I would advise attempting all the exercises to grasp the variety of techniques that can be used for problem solving in probability theory. In a subject like MIF, you can never have too many techniques at your disposal.

Be mindful of the auxiliary conditions for results and more obscure parts of definitions, such as those involving finiteness of certain quantities. It is easy to overlook these aspects since they are clearly not the primary concern of the result or definition. In the exam it is of course your responsibility to carefully examine them; indeed it is quite possible that they may not be satisfied, which can substantially change your approach to the question. For placing upper bounds on expectations, you will probably use the dominated convergence theorem or the Cauchy–Schwarz inequality.

The 2016 exam was slightly more computational than the past exams were; I certainly used my scientific calculator far more than I had for the past exams. The exam required the analytical solution to one of the types of stochastic differential equations shown in lectures — this was the first exam in five years that had done so. The exam also made use of the inequalities introduced in exercises. The MIF exam clearly has potential for some surprises, so preparation is key.

Concluding remarks

Free from the reins of an Institute syllabus, MIF has the rare privilege of focussing slightly more on critical thinking in mathematical problem solving. Tractable actuarial subjects have their place, but MIF is, in my opinion, a very welcome departure.

ACTL30006 Financial Mathematics III (1)

Exemption status	CT8 *Financial Economics*, in conjunction with ACTL40004 *Advanced Financial Mathematics I*. Satisfactory performance in the end-of-semester exam of this subject and satisfactory performance in the mid-semester test and end-of-semester exam of ACTL40004 *Advanced Financial Mathematics I* are required.
Lecturer(s)	Dr Jane Paterson
Weekly contact hours	2 × 1-hour lectures 1 × 1-hour tutorial Additionally, there is possibly an additional lecture, depending on content progress/public holidays.
Assessments	Mid semester exam 10% Individual assignment, due in Week 10 10% 2-hour end-of-semester exam (hurdle requirement) 80%
Textbook recommendation	Joshi, M. S., & Paterson, J. M. (2013). *Introduction to Mathematical Portfolio Theory*. Cambridge, UK: Cambridge University Press. The textbook is very similar to the slides, but it has some additional examples and theory. However, only lecture slide content is examinable. It is a costly book at over $100 but ✓ I would highly recommend purchasing it as it provides another source of clarification and a majority of tutorial questions are drawn from it.
Lecture capture	Full (both audio and video).
Year and semester reviewed	2017 Semester 1

Comments

Subject Content

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

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

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

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

Lectures

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

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

Tutorials

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

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

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

Mid-Semester Test

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

Assignment

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

enjoyed the assignment.

End of Semester Exam

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

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

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

Conclusion

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

ACTL30006 Financial Mathematics III (2)

Exemption status	CT8 *Financial Economics*, in conjunction with ACTL40004 *Advanced Financial Mathematics I*. Satisfactory performance in the end-of-semester exam of this subject and satisfactory performance in the mid-semester test and end-of-semester exam of ACTL40004 *Advanced Financial Mathematics I* are required.
Lecturer(s)	Dr Jane Paterson
Weekly contact hours	2 × 1-hour lectures 1 × 1-hour tutorial Additionally, there is possibly an additional lecture, depending on content progress/public holidays.
Assessments	Mid semester exam 10% Individual assignment, due in Week 10 10% 2-hour end-of-semester exam (hurdle requirement) 80%
Textbook recommendation	Joshi, M. S., & Paterson, J. M. (2013). *Introduction to Mathematical Portfolio Theory*. Cambridge, UK: Cambridge University Press. The content of the textbook is almost identical to the slides and any additional textbook information will not be examined. I only recommend getting the textbook for the questions (they are aimed to introduce the topic and are a lot easier than exam questions). Tutorial questions are mostly taken from the textbook.
Lecture capture	Full (both audio and video).
Year and semester reviewed	2017 Semester 1

Comments

Subject Content

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

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

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

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

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

Lectures

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

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

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

Tutorials

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

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

Mid-semester exam

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

Assignments

The assignment was an excel task that tests your understanding of the lecture topics in a more realistic way. It involved the lecturer giving a set of investments and investor behaviours and you have to analyse what option the investor should

best take. My advice is to make sure you consider extreme outcomes in order to make sure your excel model holds well.

End of semester exam

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

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

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

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

Concluding tips/remarks

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

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

Honours and Masters Subjects

ACTL40002 / ACTL90004 Risk Theory I

Exemption status	Completion of this subject and ACTL30004 *Actuarial Statistics* with satisfactory performance across both will lead to exemption from professional exam CT6 *Statistical Methods*.
Lecturer(s)	Dr Xueyuan (Shane) Wu
Weekly contact hours	3 × 1-hour lectures
Assessments	50-minute mid-semester exam 20% Individual assignment, due Week 12 10% 2-hour end-of-semester exam 70%
Textbook recommendation	Dickson, D. C. M. (2005). *Insurance Risk and Ruin*. Cambridge, UK: Cambridge University Press. ✓ It is recommended that students get their hands on a copy as some problem sheet questions come out of this textbook. The book will also be used in Risk Theory II/Insurance Risk Models II.
Lecture capture	Full (both audio and video)
Year and semester reviewed	2017 Semester 1

Comments

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

Subject Content

Distributions in Non-Life Insurance — 2 weeks

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

The Collective Risk Model — 3 weeks

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

The Individual Risk Model — 2 weeks

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

Introduction to Ruin Theory — 2 weeks

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

Credibility Theory — 3 weeks

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

Lectures

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

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

Tutorials

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

Assessments

Assignment

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

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

Mid Semester Exam

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

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

End of Semester Exam

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

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

ACTL40003 / ACTL90014 Risk Theory II

Exemption status N/A; this subject does not constitute any exemption requirement but is instead an elective upon satisfactory completion of ACTL40002 *Risk Theory I* (which comprises part of the exemption requirement for CT6 *Statistical Methods*).

Lecturer(s) Shuanming Li

Contact hours 2 × 1.5-hour lectures

Assessments

	Honours	Masters
Mid-Semester Exam (Week 8)	20%	20%
Assignment	—	10%
3-hour Final Exam	80%	70%

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

The same text as the one used in ACTL40002 *Risk Theory I*. It is referenced but ✗ not essential.

Lecture capture None

Year and semester reviewed 2016 Semester 2

Comments

Subject content

The subject covers 4 units relating to risk theory:

1. Utility Theory

   The utility theory concepts learnt in ACTL30006 *Financial Mathematics 3* are applied to the setting of insurance premiums by considering the maximum premium that individuals are willing to pay for insurance and the minimum premium insurers are willing to receive to offer insurance.

2. Principles of Premium Calculation

   We consider various principles for premium setting such as the Esscher premium or the P–H transform and the properties of various premium principles.

3. Reinsurance Problems and Optimal Reinsurance

   This unit goes through various theorems and proofs regarding optimal reinsurance types under different criteria.

4. Ruin Theory

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

Finally, we examine the classical risk model, looking at Lundberg's inequality and the adjustment coefficient, reinsurance applications of the classical risk model and methods of solving for the ruin probability, including the use of Laplace transforms.

Lectures

The lecture slides are very comprehensive and contain all the content that is required for the course. There are blanks in the slides which are filled in during lectures.

Shuanming provides very detailed annotations of slides in the lectures and goes through the content at a fairly steady pace. The slides are very dense though and the calculations aren't always the most obvious, so it is often necessary to review slides after lectures to get a proper understanding of the content.

Tutorials

Like all other honours year subjects, there are no weekly tutorial classes. Instead, the lecturer sets aside some lecture time to go through tutorial problems. In all, there were 5 tutorials during the semester. The questions in the tutorials tended to be quite difficult and solutions aren't the most straightforward.

A series of problem sheets with solutions are posted throughout the semester. The questions in these problem sheets tended to be more on the easier side.

Combined, the tutorial sheets and problem sheets provide ample exercises for the subject. There are of course questions from the textbook that can also be used as additional practice.

Mid-Semester Exam

The mid-semester exam covered Units 1, 2 and most of Unit 3. Shuanming is very generous in his supply of past mid semester exams and we received 6 past exams in the lead up to the mid-semester exam.

In 2016, our mid-semester exam was of a very reasonable level of difficulty with most students scoring very high marks. The exam covered fairly standard questions including determining an insurer's minimum acceptable premium under utility theory, applications of premium principles and proving a relationship between expectations of stop loss reinsurance.

Final Exam

The final exam was quite long and most students found themselves very pressed for time. The majority of the questions were of reasonable difficulty but there were a few questions in the exam that were a lot more difficult. Shuanming provides a specimen paper and a past paper in the lead up to the exam which I felt were a fair reflection of the difficulty of the final exam.

Concluding Comments

I would highly recommend taking Risk Theory II if you enjoy the maths side of actuarial studies. In particular, if your other two subjects are APC2 and APC3 (which are very qualitative in nature), having a subject with a familiar quantitative feel to it was great — when my brain couldn't handle anymore of APC, doing risk theory calculations was almost like a comforting break. However, that is not to say Risk Theory II is an easy subject. The calculations and proofs require deep thought, but having made it this far in your actuarial degree, I'm sure you would already assume this of all actuarial subjects.

ACTL40004 / ACTL90003 Mathematics of Finance III

Exemption status	CT8 *Financial Economics*, in conjunction with ACTL30006 *Financial Mathematics III*. Satisfactory performance in the mid-semester test and end-of-semester exam of this subject and satisfactory performance in the end-of-semester exam of ACTL30006 *Financial Mathematics III* are required.
Lecturer(s)	Dr Zhuo Jin
Weekly contact hours	3 × 1-hour lectures
Assessments	Individual assignment, due around Week 8 10% 1-hour mid-semester test in Week 8 20% 2-hour end-of-semester exam 70%
Textbook recommendation	Joshi, M. S. (2008). *The Concepts and Practice of Mathematical Finance* (2nd ed.). Cambridge, UK: Cambridge University Press. It is difficult to reconcile lecture content with the textbook, and the textbook goes a lot deeper than lectures. It is not necessary, but may help flesh out some of the trickier concepts.
Lecture capture	Full (both audio and video)
Year and semester reviewed	2017 Semester 1

Comments

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

Subject content

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

- **Binomial Trees / Two Step Models** — After a brief review of the principle of no arbitrage and the law of one price, you learn to price derivative contracts using binomial trees — a basic model where the stock can only take 2 possible values in successive time frames.
- **Martingales and Brownian Motion** — is familiar territory for those who did ACTL30005 *Models for Insurance and Finance*. A martingale is typically used to model a "fair game", and Brownian motion is an incredibly important stochastic process that is involved in pretty much everything in this subject. It would do you good to become familiar with these concepts ASAP.
- **Stochastic Differential Equations** — more familiar territory from MIF. Imagine differential equations, but applying them to stochastic processes. Many ideas from MIF are revisited, as well as some discussion on techniques to solve

some SDEs.

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

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

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

Lectures

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

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

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

Assignment

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

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

Mid-Semester Exam

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

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

End of Semester Exam

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

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

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

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

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

Tips for Success

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

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

ACTL40005 / ACTL90013 Actuarial Studies Projects

Exemption status	None.
Lecturer(s)	Daniel Dufresne Zhuo Jin Shane Wu
Contact hours	3 × 1-hour meeting (at time of project release) 2 × Optional Q&A sessions
Assessments	Project 1 25% Project 2 35% Project 3 40%
Year and semester reviewed	2016 All Year

Overview of Projects

Each project has an 8 week time frame. That is, Project 1 is issued in week 1 of semester 1, Project 2 is issued in week 9 of semester 1 and Project 3 is issued in week 5 of semester 2.

Project 1

The first project was written by Daniel Dufresne and involved simulating annuity payments with random rates of discount. The distribution of the present value of these payments was then approximated using lognormal and extended skew lognormal distributions. Comparisons between the accuracy of the various approximations were required to be discussed.

Overall, this project was probably the most structured out of the three, with clear steps in the project instructions outlining what was required and was a good way to ease into Honours.

Project 2

The second project was by Zhuo Jin and was financial maths based. It was in many ways applying ACTL30006 *Financial Mathematics 3* knowledge to real data. For the project, we were required to pick a selection of 10 stocks from the US stock market with stock symbols that were closest to our surnames. Using these stocks, we were required to apply a single factor and three factor model to determine expected returns and a covariance matrix for the stocks. Next, we had to plot the efficient frontier from these stocks both when short selling is allowed and when it is not. Finally, the last part of the project required us to use option market implied data to calibrate the covariance matrix and compare it with the original single factor and three factor models.

Personally, I found this project to be very broad in its scope and the most time consuming, which was fortunate, given that for the second project you get the extra winter holidays to complete it. Much of the project could be completed by digging up your *Financial Mathematics 3* notes. However, there were also parts of the project that required reading academic papers.

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

There is also a lot of judgement required (e.g. choosing what factors to use in the three factor model) but remember, as is often the case, there is no single right answer and it is more a matter of how well you explain and justify any choices you make.

Project 3

The final project by Shane Wu was *Risk Theory* based. It involved determining ruin probabilities in the classical continuous time risk model using discrete inter-observation times as well as randomised inter-observation times and studying the rate of convergence as the scale of discretisation was varied. There was also an optional bonus task of numerically verifying an identity shown in a paper by Albrecher and Ivanovs (2016). Concise explanations about simulation methodology as well as comparisons of outputs were required.

The running of simulations for this project was very time consuming, with some simulations taking hours to run (and then after all that waiting, you often end up realising you actually had an error in your code somewhere). Therefore, it would definitely be advisable to start a project like this very early. I found this project overall to be quite interesting and if you like coding, you might even find it fun.

Comments

The first thing to note with doing these projects is that you will need to decide on what software you wish to use for the projects. For all three projects, I used R. However, many peers successfully used Mathematica. Excel can also be alright. However, when large numbers of simulations are required as is the case for many of the projects, then Excel may get annoyingly slow. Other programs may also be used but it is best to first check with the lecturer if you want to use anything outside of the normal three. It is also possible to switch the program you use for each of the projects. However, I would recommend using one and getting yourself really familiar with it instead of having to relearn a new program for each project.

Secondly, I would say learning to use LaTeX makes your projects look cleaner (it is also easier to write equations). However, using LaTeX of course is not compulsory and many students did just fine using Word instead. However, the overall look of your report is one of the marking criteria.

Thirdly, the projects welcome you to use your own judgement and imagination to expand your analysis of the problem. However, the projects have strict word count restrictions so make sure this extra analysis does not mean you are sacrificing content that is required to meet the basic requirements of the project.

Finally, in terms of submission, all the projects require a report to be submitted as well as the code you used for the project. Make sure your code is neat and well commented and that your project is within the word limit. Note that the word count is sometimes different between Honours and Masters students, so don't just trust what your friend says if they aren't doing the same course as you.

I would say that doing these projects has been a valuable learning experience and in particular it has helped to develop my ability to write concise and structured reports. They have also helped to improve my R and general coding skills which no doubt will be useful in the future. However, since you don't have regular lectures, it is often easy to just forget about the project for a few weeks and then suddenly realise it is due in a few weeks, so I would say setting aside a certain amount of time each week for doing your project is a good way to avoid last minute stress that might reduce your life expectancy by a few years.

ACTL40006 / ACTL90010 Actuarial Practice and Control I

Exemption status	Part IIA *The Actuarial Control Cycle* and Part IIB *Investment and Asset Modelling*, in conjunction with ACTL40007 *Actuarial Practice and Control II* and ACTL40009 *Actuarial Practice and Control III*. Satisfactory performance in all three subjects' end-of-semester exams will lead to exemption from both Part IIA and Part IIB.
Lecturer(s)	Mr David Heath — Subject coordinator; General Insurance Mr Andrew Brown — Life Insurance Mr Donald Campbell — Superannuation Mr Peter Worcester — Investments
Weekly contact hours	2 × 2-hour lectures
Assessments	Group assignment — 30% 3-hour open-book end-of-semester exam — 70%
Textbook recommendation	Bellis, C., Lyon, R., Klugman, S., & Shepherd, J. (Eds.). (2010). *Understanding Actuarial Management: the actuarial control cycle* (2nd ed.). Sydney, AU: The Institute of Actuaries of Australia. ✗ The textbook is not essential.
Lecture capture	Full (both audio and video).
Year and semester reviewed	2017 Semester 1

Comments

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

Subject content

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

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

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

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

Lectures

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

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

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

Tutorials

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

Assessments

Assignments

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

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

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

End of Semester Exam

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

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

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

Tips for Success

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

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

ACTL40008 / ACTL90015 Advanced Financial Mathematics II

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

Comments

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

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

Subject content

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Lectures

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

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

Mid-semester exam

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

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

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

NB: THERE IS NO FORMULA SHEET FOR EITHER EXAM.

End-of-semester exam

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

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

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

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

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

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

Concluding thoughts

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

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

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

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

ACTL40009 / ACTL90009 Actuarial Practice and Control III [SM1]

Exemption status	Part IIA *The Actuarial Control Cycle* and Part IIB *Investment and Asset Modelling*, in conjunction with ACTL40006 *Actuarial Practice and Control I* and ACTL40007 *Actuarial Practice and Control II*. Satisfactory performance in all three subjects' end-of-semester exams will lead to exemption from both Part IIA and Part IIB.
Lecturer(s)	Dr Kevin Fergusson
Contact hours	1 × 2-hour lecture 1 × 1-hour workshop
Assessments	Individual Assignment 20% 3-hour end-of-semester exam 80%
Textbook recommendation	Investment Bridging Course Notes (IAAust) — made available online Course Texts and Extracts — available from Coop, contains extracts from BluePrint for Investment (Fitzherbert), Investment Principles for Actuaries (Fitzherbert) and Compound Interest and its Applications (Fitzerbert & Pitt) Course Notes — available from Coop, contains various readings and also the workshop problems for the course
Lecture capture	Full (both audio and video). Caters for both university and distance education students.
Year and semester reviewed	2017 Semester 1

Comments

Subject Content

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

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

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

Subsequently, students are introduced to the history of technical and fundamental analysis (and how this stands against the efficient market hypothesis) and speculative bubbles (particularly on whether they can only be recognised in hindsight).

There are two accompanying case studies examined. The first is the collapse of Long Term Capital Management and the second looks at US mutual funds in the mid-1990s.

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

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

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

Lectures

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

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

Workshops

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

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

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

Discussions

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

Assignments

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

End of Semester Exam

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

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

Concluding Comments

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

Breadths and Electives

CHIN20026 Advanced Chinese Translation

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

Comments

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

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

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

Lectures

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

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

Lecture slides usually start with concise concept definitions, followed by comments from translators and academics that further explain the topic, and then an abundance of examples are extracted from various translation work to illustrate the concepts in practice. However, because each week there's a lot of information to cover in the slides, it leaves little time for the lecturer to insert any extra value-adding content. Hence, I don't find going to lectures particularly useful except consulting problems encountered with the lecturer, who has well-rounded experience, since there's no official office hours (You might be able to arrange one with him via email though). Having said that, it should be noted that lectures are not recorded, and based on my personal experience, the lecturer did do some random roll checks in certain weeks in the second half of the semester.

Seminars

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

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

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

Assessments

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

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

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

be able to contact your tutor for more specific comments.

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

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

Conclusion

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

COMP20005 Engineering Computation [SM1]

Exemption status	None.
Lecturer(s)	Semester 1 Professor Alistair Moffat Semester 2 Dr Jianzhong Qi
Weekly contact hours	3 × 1-hour lectures 1 × 2-hour workshop
Assessments	Mid-semester test 10% Individual assignment 1 10% Individual assignment 2 20% 2-hour end-of-semester exam 60%
Textbook recommendation	Moffat, A. (2012). *Programming, Problem Solving and Abstraction with C* (2nd ed.). Frenchs Forest, AU: Pearson Education Australia. The textbook is written by Alistair Moffat, the lecturer for this subject for semester one. The lecture slides are merely summaries of selected chapters from the textbook. The textbook also provides an abundance of exercises and example code. It will be your holy bible for this subject. ✓ Get it!
Lecture capture	Full (both audio and video).
Year and semester reviewed	2017 Semester 1

Comments

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

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

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

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

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

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

The C Programming Language

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

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

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

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

Subject Content

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

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

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

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

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

Lectures

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

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

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

Workshops

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

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

Mid Semester Test

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

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

Projects

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

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

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

End of Semester Exam

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

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

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

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

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

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

Closing Remarks

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

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

ECON20002 Intermediate Microeconomics [SUM]

Exemption status	None.	
Lecturer(s)	Summer Semester	Ms Svetlana Danilkina
	Semester 1	Dr Reshad Ahsan
Weekly contact hours	Summer Semester	2 × 2-hour lectures 2 × 1-hour tutorials
	Semester 1	2 × 1-hour lectures 1 × 1-hour tutorial
Assessments	Tutorial attendance and participation	10%
	30-minute online multiple-choice test	10%
	2 individual assignments	2 × 10%
	2-hour end-of-semester exam	60%
Textbook recommendation	Pindyk, R. S., & Rubinfield, D. L. (2013). *Microeconomics*. Harlow, UK: Pearson Education. The textbook is a very good complement to the slides to gain further understanding of the concepts that are discussed. However, I do not believe it is essential and students can still achieve exceptional results without the textbook.	
Lecture capture	Full (both audio and video).	
Year and semester reviewed	2016 Summer Term	

Comments

I saw ECON20002 Intermediate Microeconomics as an extension of ECON10004 *Introductory Microeconomics*, where all the topics from first year were touched upon and explained further. However, do not get complacent as there are still new topics covered. This subject contains much more maths based problems compared to its first year counterpart, which included algebra, partial differentiation and tangency.

Subject content

1. Introduction — Lectures 1–2
2. Consumer Preferences — Lectures 3–10
3. Theory of the Firm — Lectures 11–16
4. General Equilibrium — Lectures 17–18
5. Monopolies and Oligopolies — Lectures 19–22
6. Review — Lectures 23–24

The subject is well structured and aims to build upon the content that is taught in each lecture. Bear in mind, since I did this in the summer, some of the content that is taught during semester is taken out due to time constraints. However I do not believe it would change the way in which the subject is taught.

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

The first couple of lectures eases into the subject, discussing the administrative aspects. Svetlana then gets straight into the content, discussing consumer preferences. This topic highlights how consumers have constraints and how a limited budget is allocated amongst two goods whilst taking consumer satisfaction into account.

Following on from this, Svetlana delves into the theory of the firm. Here it is discussed how a firm will allocate their limited resources between capital and labour to optimise production. How a firm minimises cost given a set output as well as profit maximisation of a firm is also discussed.

Theory of the Firm was followed by the topic in which I found most tedious and somewhat difficult; General Equilibrium. This area of Economics is concerned about the notion that, when welfare is gained by a consumer, there is a loss in welfare for another. Whilst this seems straightforward, it takes most students some time to understand this conceptually. However, do not fear; if required, resort to the textbook and some extra online reading to gain another perspective. This will solidify what Svetlana explains in lectures and assist students in grasping this idea.

Finally, I thought Monopolies and Oligopolies were quite similar to that of this subject's first year counterpart. This area discusses how monopolies maximise profits, market power as well as game theory, concepts that should not be new to most students. The subject was then shortly wrapped up with a revision lecture or two which skimmed through the main concepts.

Whilst the subject was well taught, the nature of doing this subject in the Summer Semester is that it is fast paced. From memory, my final lecture was on a Friday and the exam was held on the following Monday. So there is not much of a SWOTVAC. I cannot stress how important it is to be on top of the content from day one because come final lecture, you should be close to being ready to sit an exam.

Lectures

As mentioned earlier, I completed this subject in the Summer Semester which involved 2-hour lectures twice a week. I personally find sitting through a two hour lecture quite difficult, especially during the nice summer days. However, I must say that Svetlana appreciates the fact that her students attend lectures and endeavours to make lectures as engaging as possible, encouraging students to make economics related jokes as well as holding live quizzes concerning the content.

Whilst the lectures were fully recorded, I attended each and every lecture as I enjoyed listening to Svetlana's explanations in person. Svetlana talks through the lecture slides and explains each concept by providing an example, helping students grasp concepts immediately. Nevertheless, keep in mind that these examples are rather simplistic and that exam questions will be of a greater difficulty.

I personally really enjoyed attending the lectures. Even during the wonderful summer days, I genuinely looked forward to attending Svetlana's classes as I thought she was a brilliant lecturer who was able to explain concepts in a clear way, which allowed me to grasp new material immediately.

Tutorials

Like all other first year economics subjects, Intermediate Microeconomics also follows the method of "blue sheet" and "pink sheet" where the blue sheet is the pre-tutorial work that should be completed prior to the tutorial and the pink sheet is completed in the tutorial itself.

Given the scarce amount of practice exams for the syllabus taught in the semester I completed this subject, these tutorial questions were my main method of preparing for the exam.

Like all other subjects, the ways in which these tutorials work will depend upon your tutor. My tutor allocated most of the time to work with other students to discuss the pink sheet questions. He would then write up the solutions closer to the end of the class. More often than not, there was not enough time to go through the solutions. Therefore I recommend answering these questions to the best of one's abilities and making use of the consultation hours to ensure that concepts are being fully understood.

Assignments

In my semester of this subject, there were two assignments which were to be completed individually. I must say, the assignments were quite a jump in difficulty relative to the tutorial questions and the lecture examples. Whilst tedious and difficult, if students understand concepts well, they should be able to utilise what is taught in class to answer assignment questions to a high standard.

The assignments primarily require students to work with variables rather than plugging numbers into equations, stressing the importance of understanding the intuition behind the economic concepts taught in lectures rather than just rote learning. Some questions required students to sketch certain graphs followed by an economic explanation.

Each assignment contributed 10% towards the final grade.

Mid-semester test

The mid-semester is conducted online and is purely multiple choice with a time limit of 30 minutes. This also contributed 10% towards the final grade. A practice test is provided in preparation for the mid-semester test. However, I found the practice test quite simple compared to the actual test.

The test is tricky and requires students to really think. There was a good mix between theoretical questions and questions that required calculations. The mid-semester test focused primarily on the concepts of consumer preferences, which made it easier to study for as students knew what exactly would be tested.

End-of-semester exam

The exam consisted of 10 multiple choice questions. There were three short-answer questions where students were to pick two of their liking. There were three extended response questions where again, students were to pick two of their liking. This was advantageous as students could stay away from areas which caused them difficulty. However, I personally think it is good to prepare for every topic as you can then go into the exam and have the luxury of choosing questions based upon your taste rather than difficulty.

It has been said that the difficulty of Intermediate Microeconomics exams fluctuate from semester to semester. In the Summer Semester of 2016, I felt that the exam closely followed the harder tutorial questions. This in fact caused a bit of trouble for students who purely focused their exam preparation on previous exams. The moral here is that whilst it is good to complete previous exams as practice, do not neglect blue or pink tutorial sheets as similar questions may arise in the actual exam.

Concluding remarks

As a student who has always enjoyed university economics, this was a great subject to undertake as an elective. For a student who doesn't mind putting in effort for an elective, enjoys maths but more importantly enjoys economics, this will be a wonderful subject choice. It is a good subject to complete over the Summer Semester as the workload is not too heavy and it will allow students to under-load in the later periods of their degree, which is useful when subjects are of greater difficulty.

Overall, this was one of the most enjoyable subjects of my university degree thus far. Wishing you all the very best! ☺

ECON20005 Competition and Strategy

Exemption status	None
Lecturer(s)	Dr. Jun Xiao
Weekly contact hours	2 × 1-hour lectures 1 × 1-hour tutorial
Assessments	3 Individual Assignments 30% 2-hour end-of-semester exam* 70% *If your exam mark exceeds the score you would receive with these weightings, then your exam will count for 100% instead.
Textbook recommendation	A. Dixit and S. Skeath, Games of Strategy, 2nd Edition or later. I didn't find the text useful, although it does have a broader range of examples and covers more special cases compared to the lecture slides.
Lecture capture	Full (both audio and Video).
Year and semester reviewed	2016 Semester 2

Comments

Before reading this review, please note that the content taught in this subject and how it is assessed may vary significantly between different lecturers. Judging by past exams, Dr. Jun Xiao's approach (2016 Semester 2) was much more numerical and application-focused compared to Professor Harry Clarke's (2015 Semester 2), which consisted of more theory and definitions.

In Dr. Jun Xiao's semesters, this subject makes a great elective for actuarial students wanting to take a break from hardcore probability and statistics without having to learn much new content.

A downside is that the content learnt will not help directly with the actuarial course (although a small chapter in CT6 is Decision Theory), nor later on in actuarial work. But working through tutorials sets, assignments and practice exams will definitely stimulate logical and strategic thinking, which are skills that can be taken anywhere.

Subject content

This subject delves into the Game Theory topic introduced in ECON10004 *Introductory Microeconomics* by exploring different types of games and their implications. Although ECON10004 is a prerequisite, all game theory concepts (such as Nash Equilibria) will be taught from the ground up. The only knowledge that needs to be carried over is an understanding of Demand/Supply and how to represent it graphically.

Competition and Strategy is broken up as follows:

1. Basic game theory concepts: Nash equilibria, two–player sequential/simultaneous games

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

2. Application of concepts to:
    (a) Repeated games: collusion, cheating
    (b) Monopoly and different types of Oligopoly competition
    (c) Rent seeking
    (d) Location models
    (e) Asymmetric information and adverse selection
    (f) Collective action games
    (g) Auctions
    (h) Contracts
    (i) Wars

Although the course guide only mentions topics up to Auctions, Jun ended up providing relatively brief introductions on two extra topics which were also assessable, but did not end up being assessed. As mentioned before, the focus of the subject (at least up to Auctions) is to apply basic techniques to arrive at quantitative results for different scenarios, e.g. *What strategy should each player adopt or how much should each player produce/invest/bid in order to maximize their payoff?* Fortunately, expected values (used to set up the required function) and partial differentiation/solving simultaneous equations (used to find critical points for said function) from VCE Mathematical Methods/Calculus 2 are all you need to solve this type of problem. This is why I believe there is limited new content to learn here, especially for actuarial students.

Furthermore, since Jun's focus is on application, he will never ask for a definition or a regurgitation of a theorem. Hooray!

Things do, however, become more complicated for the topics towards the end of the semester and when special boundary cases arise — this is where a solid understanding of the basic game theory concepts are required. And, as with all Economics subjects, intuitive explanations for numerical results are often required, so understanding the context of questions given in the assignments/exam is also important.

Lectures

Dr. Jun Xiao is a mindful, clear, and engaging lecturer. The lecture structure is quite standard, with Jun first introducing the context of a new topic and thereafter going through one or two examples with the class, often ending with a discussion of a real-life case study. At the beginning of the semester, the pace of the lectures was quite slow, but Jun acted on the feedback he received as a part of the interim subject survey and spent less time on basic ideas, allowing for the addition of two extra topics at the end of the semester. Along with the case study examples, Jun also encouraged the class to be actively involved in discussing key proofs/results. If you find this type of engagement effective, definitely attend lectures.

With that said, the lecture slides themselves are quite comprehensive to the point where the core content could be learnt by simply reading them.

Tutorials

The tutorials for this subject should definitely be attended. There is a set of tutorial questions each week which the tutors (attempt to) work through, giving explanations of how to approach each type of question before providing a step-by-step solution, usually with the amount of working you would need for full marks in an assessment. Only brief answers (without explanations/working) are posted online, so the majority of learning how to do well in the subject comes from the tutorials.

For certain weeks, the set questions were repetitive and purely computational. I found it very helpful when my tutor (Daniel) recognized this and simply went through one example of this type of question, explaining the ideas behind each

computational step, leaving us to do the set questions in our time. He used the remaining time to cover more interesting questions on the topic and revised concepts for other topics. In the end, some of the interesting cases he went through even appeared on the exam! Either way, the tutor explaining concepts from his own point of view really helped to consolidate my understanding.

The only problem with the set questions is that sometimes there are simply too many to go through. The tutors recognize this and do select their questions carefully for the tutorial, but a lack of detailed solutions online may still leave question marks around small things.

Assignments

Assignments should be attempted individually before checking with others, as they are a great source of practice as exam-style questions. In fact, as mentioned in the overview of this subject, a good exam will override worse assignment marks, so it doesn't really matter whether marks are dropped here.

The assignment questions in my semester were an extension of lecture examples, and were at the same level or harder than tutorial questions. The questions were largely computational, long and tedious most of the time, and to get full marks all reasoning and working steps had to be shown – even intermediate algebraic steps. This does help you get comfortable with all the math in the subject, though. Intuitive explanations were also always required, some of which had to be produced using logic as they hadn't been covered in lectures or tutorials. Overall, there were many places where marks were easily lost, but I felt that collecting assignments and understanding exactly where things went wrong helped my understanding in this subject and increased my confidence coming into exam.

End-of-semester exam

If Daniel is still one of the tutors of the subject, exam revision material will be plentiful. He provides three of his own practice papers, a question bank with plenty of questions for each topic, and even his own guides. His guides explain each topic from the ground up, and are a pretty safe fall back if you ever miss a lecture and don't have time to go back and watch it. Along with this, Jun provides one past paper as a sample.

The exam itself follows the same structure as the samples — 120 minutes for 120 marks, with about 5–6 questions of similar length. The exam consists mainly of the standard questions found in tutorial sets and assignments, with only 20 to 30 marks worth being "new" and designed to challenge students. These challenging questions usually require logical thinking and a theoretical approach to answer. As with most other subjects, understanding concepts in depth and learning from mistakes made in assignments will make you much better off compared to just memorizing particular examples.

Depending on how quickly the calculus, algebra, and number crunching are done, there should be enough time to finish the exam even after factoring in the extra thinking time required for the harder questions. However, it is probably wise to be careful with the computational bit, as this does make up more of the exam and will probably be penalized more harshly if incorrect.

FNCE30007 Derivative Securities [SM1]

Exemption status	None.
Lecturer(s)	Professor Federico Nardari
Weekly contact hours	1 × 2-hour lecture 1 × 1-hour tutorial
Assessments	Mid-semester test 25% 3-hour end-of-semester exam 75%
Textbook recommendation	Hull, J. C. (2013). *Fundamentals of Futures and Options markets* (8th ed.). Harlow, UK: Pearson Education. I am yet to learn what the textbook looks like.
Lecture capture	Full (both audio and video).
Year and semester reviewed	2017 Semester 1

Comments

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

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

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

General Comments

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

Lectures

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

Tutorials

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

Mid Semester Exam

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

Final Exam

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

Conclusion

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

MAST20022 Group Theory and Linear Algebra

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

Comments

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

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

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

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

A common example would be the integers $\mathbf{Z}$ under addition: addition is associative, permits an identity element (namely 0), and naturally gives rise to an inverse for every integer (just negate the integer). Such properties seem like fairly simple properties to come about, and, indeed, in GTLA you will come across a variety of groups.

Group theory forms a natural foundation for the field of *abstract algebra*, which, loosely, is the study of the structure of sets in mathematics. In this sense, GTLA opens students to further studies in algebra at the university. Unfortunately, aside from MAST30005 *Algebra*, these subjects are taught at the graduate level. The field of algebra enjoys the reputation of being a rather beautiful field of mathematics, and this same sentiment manifests in the university environment: MAST30005 *Algebra* is widely reputed to be one of the most enjoyable undergraduate maths subjects. Personally I believe its beauty lies in the fact that groups are introduced with only the simple properties mentioned above, but as more structure (read: conditions and properties) is imposed on the groups, the results become increasingly rich and eye-opening (at least that happens to be my take on GTLA). If ever there was anything I would call "mathemagic", this would be it.

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

So far I have yet to mention linear algebra. Why exactly is this subject a combination of both group theory and linear algebra, and where is the relationship between them? The group theory and linear algebra topics in GTLA happen to be fairly disjoint; one could outright label each topic as either "group theory" or "linear algebra" without hesitation. However, there are a few parallels between the structures of vector spaces and groups, the most obvious of which is that a vector space over a field satisfies all the aforementioned properties of being a group! As you will see, there are more parallels (bases and generating sets, (normal) subgroups and linear subspaces, homomorphisms and linear transformations); some of these are mentioned, so rest assured that, despite the abstract nature of the group theory topics, many phenomena you have in fact encountered in earlier linear algebra studies. The only other connection that was obvious to me was that some of the groups we worked with directly involved matrices and their properties.

Being a pure maths subject, you might expect the content in GTLA (particularly the group theory topics) to be quite separated from "real world" applications. To an extent this is true (please do not enrol into the subject expecting the content to be as tangible as insurance mathematics often is in the ACTL major); however, Alex does present some highly intriguing applications of both group theory and linear algebra, such as in computer cryptography, special relativity, chemistry (brief mention), and even stochastic processes! Some of these have entire lectures dedicated to them (but are not examinable), in case a passing mention of applicability is not convincing enough.

I would say that students studying GTLA tended to be maths students (no surprise here) but also physics students who might be considering further studies in quantum physics. Quantum physics, to my knowledge, relies on the theory of metric spaces and Hilbert spaces (cue MAST30026 *Metric and Hilbert Spaces*, although it is not a prerequisite for the university subjects on quantum physics), which, in turn, relies on some of the content in GTLA.

The difficulty of GTLA lies in its breadth of content. The lectures are very proof-based, and there are many smaller results and properties presented aside from the main ones, some of which you will need to recall very quickly and use frequently. It is a style of mathematics rarely found outside pure maths and is understandably a struggle for students for which GTLA is a first exposure to pure maths beyond first-year linear algebra and real analysis. Alex takes a very structured approach to this subject (teaching theory and then giving **many** examples), and consequently it was far easier learning this subject than one might expect from its content.

Subject content

There are five major areas of discussion in the subject, and they are conveniently allocated (usually) one question in Part B of the examination (more on that later). These are:

1. the Jordan normal form;
2. an introductory discussion on groups with a slight focus on normal subgroups;
3. inner product spaces;
4. group actions; and
5. the Sylow theorems (or, more generally, classifying groups).

Introductory topics Alex begins with a short illustration on what sorts of problems motivate the study of abstract algebra. From this short lecture alone it was quite easy to see that this subject was going to be different from first-year maths subjects. With uses in studying symmetry, geometric properties, and number systems, the main theme was that abstract algebra is quite literally the abstraction of ideas that are present in various mathematical objects.

The first point of call (even before the Jordan normal form) is the discussion of the principle of mathematical induction (which should be familiar from MAST10008 *Accelerated Mathematics 1*) and something called the *well-ordering property*, which

states that a non-empty subset of the natural numbers $\mathbf{N}$ always has a smallest element. The principle of mathematical induction and the well-ordering property are shown in lectures to be equivalent.

At a glance it is probably unclear why the well-ordering property is important or even why it is a result on its own (it sounds "obvious"). Perhaps this is more an example of the fragility of mathematical logic: In AM1 you may have used the principle of mathematical induction several times without questioning its validity. It turns out that when setting up the theoretical environment for studying mathematics, either the principle of mathematical induction or the well-ordering property needs to be introduced as an *axiom*, that is, something accepted as true without proof. Once this is done, the other is immediately true due to their equivalence, and you can use them to your heart's desire.

This delicate and rigorous approach to logic is somewhat characteristic of studies in pure mathematics, and at various points throughout GTLA and further pure maths studies, you will probably come across proofs for things which you deemed intuitive or obvious.

Following this is some basic number theory and definitions of some types of groups. Number theory is the theory surrounding integers and investigates aspects such as divisibility or factorisation. Admittedly it is not a very prominent topic in GTLA; the areas discussed are the Euclidean algorithm (arising from the division algorithm), Bezout's identity, some properties regarding divisibility, some modular arithmetic, and the fundamental theorem of arithmetic. The results here are discussed in the context of the integers, but some generalise (to an extent) to other sets, such as the set of polynomials. In fact, you will encounter Bezout's identity applied to polynomials later on.

The $\mathbf{Z}/n\mathbf{Z}$ class of groups is carefully defined during the discussion of modular arithmetic (even though you have not been told what a group is). This class of groups reappears frequently in GTLA and is probably the type of group with which you will become most familiar.

Following the number theory topics, some types of groups are defined. Starting with the most general, these are:

1. rings,
2. commutative rings,
3. fields, and
4. algebraically closed fields.

All algebraically closed fields are fields, and all fields are commutative rings, and so on. The purpose of this short section is to define fields and algebraically closed fields, which is necessary to understand the next topic on the Jordan normal form, as they are mentioned in some definitions and results.

Properties specific to these types of groups are not really discussed in GTLA, but it is important to know what the definitions of these types of groups are. Admittedly it might be easier to revisit these definitions once you are taught the definition of a group (which is yet to take place at this point).

The Jordan normal form The first major topic, the Jordan normal form, essentially occupies the lectures in Weeks 3 to 6. The main result can be stated quite easily, but there is a myriad of intermediate results leading up to it. In fact, you do not even discuss all the intermediate results completely (an important one is left for MAST30005 *Algebra*).

The motivation behind studying the Jordan normal form is that many square matrices, when interpreted as linear transformations, are actually the "same" linear transformation but expressed with respect to a different basis. Equivalently, a linear transformation interpreted for different bases gives you many different matrix representations, but they are fundamentally really one and the same. Imagine, in $\mathbf{R}^3$

- a dilation by a factor of 2 from the x–y plane; and
- a dilation by a factor of 2 from the y–z plane.

These are really quite similar — they are the same linear transformation but for different bases.

The Jordan normal form of a matrix is the simplest square matrix among all those which can be said to be the same linear transformation as the original (the basis will generally be different). Notably, the Jordan normal form is unique up to permutation of the basis vectors, and its simplicity comes in the form of being almost diagonal.

This topic comes under linear algebra, and you will need to be familiar with first-year linear algebra content to understand this topic, as there is **very** little time for revision, and new ideas are introduced fairly quickly. Make sure you know what these are: subspaces, spans, bases, row reduction, the rank–nullity theorem, linear transformations, change of basis, eigenvalues, and eigenvectors. Alex includes thorough notes for these first-year topics, but they are hardly discussed in lectures.

The number of intermediate results for this topic is quite remarkable, and it will probably be overwhelming to be familiar with all of them. I would recommend being familiar with properties of *invariant subspaces* (subspaces which are invariant under a linear transformation), as they are most easily examined; there are quite a few tricks involved with the other intermediate results.

Overall this topic is a very involved and instructive exposure to the Jordan normal form; there are numerous defined stages, and the way it is delivered certainly feels like you are stepping through history (the stages are something like: square matrices → block diagonal matrices → upper triangular block diagonal matrices → almost diagonal matrices i.e. the Jordan normal form).

The topic concludes with lectures discussing applications of these results to special relativity and Markov chains.

Introduction to groups After 6 weeks of lectures, you are finally properly introduced to the foreign half of the namesake of this subject. Several definitions and properties are immediately thrown at you; as a completely new mathematical object, it is bound to be overwhelming at the offset.

My recommendation is to study these new definitions, properties, and concepts in the context of a single group. This is done in many examples in lectures, but if you find this to be insufficient in consolidating these concepts, then isolating a single group (maybe a dihedral group or $\mathbf{Z}/n\mathbf{Z}$) and studying all the discussed concepts (subgroups, orders, finding generators, finding homomorphisms to other groups, normal subgroups, applying the first isomorphism theorem, and so on) in the context of that group may help.

In becoming familiar with these concepts, I also found it invaluable linking group concepts with those in vector spaces. There are some very obvious parallels, and your greater familiarity with vector spaces may mean that drawing parallels allows you to grasp the group concepts more quickly.

There are several classes of groups appearing frequently throughout GTLA. You definitely need to know what these are by their symbolic representations, as they may not be defined in the questions that use them. These include

- $\mathbf{Z}/n\mathbf{Z}$ for natural n under addition (for $n > 1$ but especially prime n);
- the dihedral group D_n consisting of symmetries of a regular n-gon for $n > 2$;
- the symmetric group S_n consisting of permutations of n distinct elements;
- the general linear group $\mathrm{GL}_n(K)$ consisting of invertible $n \times n$ matrices with entries in a field K (with the operation being matrix multiplication); and
- the special linear group $\mathrm{SL}_n(K)$ consisting of $n \times n$ matrices with determinant 1 with entries in a field K (with the operation being matrix multiplication).

With algebra being the study of structures of sets, some concepts are introduced in this topic to study the structure of groups. The existence of a *homomorphism* between two groups means that their structures are similar (in the way that

elements interact with each other). The existence of an *isomorphism* between two groups means that their structures are identical.

The main result in this topic is the *first isomorphism theorem*, which gives a decomposition of a group's structure if there is a homomorphism with another group. For example, the non-zero complex numbers under multiplication is a group, and, using the first isomorphism theorem, one part of its structure can be identified as the structure of the positive real numbers under multiplication.

Another notion related to the decomposition of group structure is a *normal subgroup*. Together with the first isomorphism theorem (in which normal subgroups make an appearance anyway), they make up the majority of the methods used to study group structure in GTLA.

One of the other important sections in this topic is the theory on free groups. A *free group* is a type of group where elements have minimal properties (this is not a rigorous description). By imposing properties on certain elements, a free group assumes more structure. Free groups are introduced to discuss *group presentations*, which, given a particular group structure, are the ways of changing the structure of a free group to arrive at that particular group structure.

Group presentations are thus bare representations of group structure. They are not used heavily in GTLA, but it is good to know that there is a universal notation for talking about group structures. Sometimes Alex may use a group presentation to denote a group [structure] instead of using its common name, mostly for dihedral groups (the group presentations have the potential to be horrendous). There is also a small section on using group presentations to study homomorphisms between groups.

At the end of this topic is a short example relating group theory to RSA cryptography.

Inner product spaces After a decent exposure to group theory is a topic on inner product spaces, beginning at around Week 10.

Inner products are no stranger: you have encountered its definition in AM1.

An inner product space is simply a vector space endowed with an inner product. With an inner product, notions like distance, length, orthogonality, and angle come into existence. This topic is (probably) the most important in preparing for future studies in topology (MAST30026 *Metric and Hilbert Spaces*).

While inner products were largely studied in the context of real numbers in AM1, the treatment in GTLA is more general. This is important if you remember a part of the definition of an inner product as symmetry — this is not true outside the real numbers.

The Gram–Schmidt process makes a reappearance with the appropriate reassurance that it is indeed an algorithm for finite-dimensional inner product spaces.

The most important concept introduced is the *adjoint* of a linear transformation on an inner product space. Its inclusion seems somewhat arbitrary at first but is necessary in discussing the intermediate results leading up to the major result of this topic. Linear transformations can be classified as certain types if conditions involving itself and its adjoint are satisfied. The different ways of characterising these types of linear transformations is the focus of a few of the results in lectures and problems in the tutorials and exams — sometimes you will be asked to prove that two different characterisations are equivalent. This can be quite difficult because of the numerous characterisations (I certainly do not recommend memorising the proofs), but luckily in exam situations hints are given.

The *spectral theorem*, the main result of this topic, states the conditions under which matrices can be represented as a diagonal matrix with respect to an orthonormal basis. You may recall in AM1 that this was always possible for real

symmetric matrices; that was no coincidence, and the spectral theorem is the more general result.

Group actions This is a short topic which begins in the middle of Week 11.

A *group action* is a set of rules dictating how a group interacts with a general set. The set may even be a group itself, which makes for slightly richer results.

There is a bit of terminology to learn, particularly when discussing the *conjugation* group action (this is a type of group action on a group).

The main result here is the *orbit–stabiliser formula*, which relates the number of elements in the group involved in a group action to other characteristics of the group action. These characteristics of the group action happen to be relatively easy to determine (at least that is the case in GTLA), so the result is useful when the group is not completely known.

Sylow theorems This topic is even shorter than the topic on group actions is and only takes one or two lectures — in fact, it is included under the group actions section in the notes, even though the results themselves do not involve group actions. They are, however, a generalisation of Cauchy's theorem, the proof of which relies on group actions.

The Sylow (pronounced *sill-low*) theorems are results that assert the existence of subgroups of certain sizes in a group. More precisely, there are four results, and you will have to memorise these results, because their proofs are not discussed in GTLA (I gather they are probably far too difficult).

These theorems are the last major tool used to study the structure of groups in GTLA, and the relevant problems in the exam are usually also the harder ones.

The subject ends on a brief note of the massive mathematical work dedicated to classifying group structure. From 1955 to 2004, mathematicians collaborated to classify all *finite simple groups* — *finite* referring to the number of elements in the group and *simple* referring to the fact that the structure is monolithic and cannot be decomposed further. It was a work that required tens of thousands of pages and is just further proof that group theory, though founded on a novel three-part definition of a group, is certainly no simple matter.

Lectures

Alex produces a ridiculously comprehensive set of lectures notes, on which the lectures are based completely. These are incrementally provided on the subject's website at http://www.ms.unimelb.edu.au/~aghitza@unimelb/teaching/gtla/ (Alex really only used the LMS for some announcement emails). The set of notes is beautifully produced in LaTeX, with numbering and labelling of basically everything (such as Theorem 4.43, Lemma 3.22, or Example 4.9). The notes are even labelled with the dates on which content was discussed in lectures and some estimates of when future content will be covered.

That is not to say that lectures are unnecessary, but it is certainly a relief that basically everything discussed in lectures is written in mathematical prose.

The lectures themselves are of a high quality, and Alex consistently gives clear concise explanations for new concepts. Being an abstract subject, it was brilliant to see so many examples for everything. After introducing new concepts (or sometimes before the introduction, in order to clarify the motivation for studying them), Alex would discuss concrete examples and explain how parts of the definitions were satisfied, how the properties hold, how to apply an algorithm to this case, and so on. It was helpful to see all the theory in action in a lecture, and this made the subject far less intimidating.

Even putting aside the fantastic lecture quality, I would recommend going to lectures simply because Alex makes most of his announcements there. Unless you are stringent in regularly checking the subject website (or watching lecture recordings), it is possible you may be late in finding out important information. Sometimes tutorials also required content from the current week (more on that later), which means even lecture recordings are not timely enough.

Alex does not ask the students many questions during lectures, but keep in mind there is consistently quite a lot of material that needs to be covered, so opportunities for open brainstorming by students are few and far between.

On the note of the amount of content, I would say that in 2016 Semester 2 lectures were slightly behind, given that there was sometimes a bit of rushing at the end of lectures. All content was covered by the end, however.

Alex writes on the whiteboard during lectures, so it is ideal not to sit too far back. Technically both video (for the document camera) and audio are recorded, but the video is inherently not of much use. In 2016 Semester 2, Alex used the document camera for one of the lecturing venues because the students were seated too far from the whiteboard for it to be useful. I assume that this means the whiteboard will always be used unless it is physically infeasible during lectures.

Tutorials

Tutorials follow the traditional format for maths subjects. You are given a tutorial sheet at the start of the tutorial and form groups to solve the problems.

I would say that tutorial problems were generally hard, but this needs qualification: because of the new concepts and definitions that were consistently being introduced in lectures each week, unless you were consistently up to date with a good memory of all the definitions and results, you would not even be able to attempt the more basic problems on the tutorial sheets.

Realistically speaking, there were only ever one or two problems (out of seven or eight) that required innovative ideas or tricks; tutorial problems were by and large computational or simple applications of definitions or results. Sometimes a technique that was used in a proof in lectures would come in use, so it is important not only to know the content delivered in lectures, but also some of the methods and tricks employed in some of the delivered proofs, which Alex may not always explicitly point out. For example, if you are given that an inner product of certain elements in a vector space is always 0, then attempting to make both operands the same expression would mean that the operand has to equal 0 by the definition of an inner product. This is a technique used a few times in the inner product spaces topic.

Tutorial sheets are made available online on the subject's website, and at the end of the week solutions are also made available. The solutions contain fairly comprehensive working, so you should be able to understand solutions to all tutorial problems by the end of the semester.

I am not sure if this was intentional, but sometimes tutorial problems involved content which had only been delivered in lectures occurring in the same week as the tutorial. Older students will know that problem-based tutorials usually only have problems that need content covered up until the end of the previous week. I took this as a further sign that lectures were behind schedule, but even though my own tutorial was in the middle of the week, I never encountered problems in tutorials that needed content that was yet to be covered, so it is possible that the tutorials were deliberately scheduled to make this possible.

Assignments

There are three assignments throughout the semester, all uploaded on the subject's website (not the LMS). These are collectively worth 20% of your final grade; precise information about the breakdown was not provided.

Make sure you know when they are released, because assignment releases were not announced on the LMS; Alex points out in lectures when they are released, although this was sometimes one or two days after it was already available on the website (in case you are very keen).

Assignments are released before the required content has been fully covered, but it is still possible to complete some of it at the time of release. Students are given slightly more than two weeks to submit for each assignment.

Assignments are not very difficult and are fairly short; the difficulty is comparable to those on tutorial sheets, and most assignment problems are also direct computations or simple applications of results. In 2016, there was one question which introduced a new concept, but it was not mentioned again elsewhere.

Be careful to give full justification for everything; rigour is absolutely vital in pure maths.

End-of-semester exam

The exam is 3 hours long and is divided into Parts A and B. As with many maths subjects, it constitutes 80% of your final grade in GTLA. Historically, the exams that Alex has prepared have all been worth 100 marks each, with Parts A and B each worth 50 marks.

Part A is an act of mercy, honestly (given the difficulty of this subject): it consists purely of tutorial questions, many of which are reproduced verbatim, others of which may involve different numbers but otherwise can be dispensed with identically. This is announced by Alex to be the case, so this is not secret information or anything.

The message here is clearly that you should practise and be able to provide solutions to **every single** tutorial problem. This is not very far from knowing all the definitions and results fairly competently, but as mentioned earlier the more technique-based problems will require more attention. I am not recommending that you memorise solutions to all the tutorial problems; I am, however, advocating in favour of a good knowledge of all the definitions and results (no surprise here) and a reasonable familiarity with the techniques used in some of the harder tutorial problems.

Part A contributes a maximum of 40 to your final grade, so with a reasonable assignment performance, passing GTLA should not be an issue, even if you insist on rote-learning solutions to tutorial problems. Note that this is not a hurdle exam.

Part B is the more involved section of the paper, with a multi-part question dedicated to each of the topics outlined in the subject content above. Group actions and Sylow theorems are treated as one topic, so it is possible that one may not be tested in Part B.

The questions in this section are overall substantially harder than all tutorial problems (even the harder tutorial problems). The difficulty is mitigated in that marks are split between more parts, many of which are clues towards what may be useful in later parts. Sometimes hints are also explicitly included for harder questions.

There is nothing in Part B which requires the reproduction of a proof given in lectures, so there is no need to memorise those proofs. You may be required to prove a simpler version of results in lectures, however. For example, if a proof of the equivalence of statements A, B, and C was given in lectures by proving $A \Rightarrow B$, $B \Rightarrow C$, and $C \Rightarrow A$, you may be required to prove in Part B of the exam that A and C are equivalent, i.e. that $A \Rightarrow C$ and $C \Rightarrow A$, noting that $A \Rightarrow C$ is probably easier to prove than proving both $A \Rightarrow B$ and $B \Rightarrow C$.

Some of the question parts in Part B will require original arguments that you may not have encountered before. This is hit-and-miss from student to student, so do not fret about these parts. I found that the hardest question in Part B was usually a question regarding group actions or the Sylow theorems. In particular, classifying group structure with the Sylow theorems was not always very straightforward; Alex does some examples of these in lectures, but it is clear that there is no methodical approach that applies to all groups. (There is also the 50-year classification of finite simple groups in case you are not convinced.)

Occasionally you will be asked in Part B to write down a theorem statement. This is something you should do verbatim, as the wording of mathematical theorems is always very precise, so I recommend memorising all the statements of the major result from each of the topics mentioned earlier. In particular, do not forget smaller details like the requirement for a vector space to be finite-dimensional, a field to be algebraically closed, or whether the existence of something is unique. These are all vital details which taint the accuracy of your statement. Technically, of course, you are simply **wrong** if you omit anything, because this is maths. On the other hand, do not accidentally add more conditions to restrict the result, because what you state will then not be the required theorem, even though it may still be a true statement.

It helps if you are somewhat familiar with the proofs of these major theorems, because then you may be able to justify the conditions stated in the theorem even if you have not memorised the theorem statement verbatim. For example, the requirement for vector spaces to have finite dimension is because some of the theorems deal with matrices, which are by nature of finite dimension. The requirement for the field to be algebraically closed in the theorem about the Jordan normal form is because we require the minimal polynomial to be factored completely into linear factors, which is not always possible if the field is not algebraically closed.

You should expect to use the major theorem for each topic in Part B for the topics which are assessed, so try and apply the major theorem if you are ever stumped.

Concluding remarks

GTLA is a long stride away from most other undergraduate maths subjects (and an even further stride from actuarial subjects), but if you are comfortable with abstract theory, then it gives you an insight into a very beautiful area of mathematics. The hard work is there, but so is the satisfaction.

MAST90082 Mathematical Statistics

Exemption status	None.
Lecturer(s)	Professor Richard Huggins
Weekly contact hours	3 × 1-hour lectures
Assessments	2 individual assignments 2 × 10% 3-hour end-of-semester exam 80%
Textbook recommendation	Casella, G., & Berger, R. L. (1990). *Statistical Inference* (2nd ed.). Belmont, CA: Duxbury Press. Hogg, R.V., McKean, J., & Craig, A.T. (2013). *Introduction to Mathematical Statistics* (7th ed.). Upper Saddle River, US: Pearson Education. Davison, A.C. (2003). *Statistical Models*, Cambridge, United Kingdom: Cambridge University Press. Richard's notes are sufficient for the subject, but you may want access to the textbooks to explore concepts deeper.
Lecture capture	None
Year and semester reviewed	2017 Semester 1

Comments

Mathematical Statistics is a common breadth subject chosen by those who choose to do the Master of Commerce degree specialising in Actuarial Studies. It extends on topics covered in MAST20005 *Statistics*. However, it is extremely easy to become lost, even with the background knowledge from your previous studies.

Subject content

Statistics is (roughly) about using data available to us and fitting it to a probabilistic model. Doing so requires us to make inferences on any parameters in the model (for example, the λ parameter for a Poisson distribution). This subject mainly covers many different methods of estimating these parameters, as well as how effective these methods may be. The topics explored are loosely categorised as follows:

- **Bayesian Statistics** — We assume that the parameter we are estimating is itself a random variable, and make inferences about the parameter using its "posterior distribution", i.e. the distribution of the parameter given we have observed the data we have observed.
- **Data Reduction and Classical Statistics** — Various desirable characteristics for estimators are explored, such as sufficiency, minimal sufficiency, completeness, etc. The Rao–Blackwell theorem is also covered here, giving us a way of finding better estimators provided a number of conditions are met.
- **Hypothesis Testing** — If a friend flipped a coin 10 times, and 9 of those times out of 10 it came up as heads, you will probably say it is not an unbiased coin. That is a simplified example of hypothesis testing. You will cover an onslaught of definitions, the uniformly most powerful test, the Neyman-Pearson lemma and monotone likelihood

ratios. p-values are formally defined, and pivots are briefly covered as well. **Interval Estimation** is covered at the tail end of this topic, covering confidence intervals. Finally, we explore the idea that Interval Estimation and Hypothesis Testing are two sides of the same coin.

- **Large Sample Inference** — is where the subject content starts become a bit harder to grasp. For large enough sample sizes, some statistics approach a distribution that is relatively easier to work with, such as the normal or the chi-squared distribution. The delta method is covered here (which you may remember from your statistics subjects) before moving on to multivariate extensions of the above topics.
- **Maximum Likelihood Theory** — the reason why maximum likelihood estimators are used often are because they have a number of desirable properties. These properties are proved here (assuming a long list of conditions). The topic closes off with the likelihood ratio test.
- **Estimating Equations** – when finding maximum likelihood estimators, you are essentially finding the solution to an equation (more specifically, the solution when the derivative of the log-likelihood is equal to zero). A more general method of finding estimators is to have any equation that we have defined and equating it to zero. What are the desirable properties of these equations? How can we tell when one is better than another?

Before the start of Bayesian Statistics, Richard briefly gives an overview on the entire course, giving us a preview of what is to come. Topics are not strictly in the above order — some topics such as the Rao–Blackwell Theorem, Hypothesis tests and Maximum Likelihood Theory are briefly shown earlier in the course before being covered in depth later.

Lectures

Unlike most other subjects, Mathematical Statistics had no document camera or recordings (though this might be standard amongst MAST##### subjects at graduate level). Richard wrote all of his notes on the whiteboard, and provided no notes outside of class other than a few references in various textbooks, forcing students to write their own notes. This essentially meant that attendance at lectures was compulsory (or you could poach notes off your mates). On the flip side, the amount of content that could be covered in the subject was limited to the writing speed of Richard. That said, the content in the subject was still very intimidating throughout the semester.

Richard was very clear in his explanations of each topic in the course, regularly giving worked examples to see how theory was put into practice. While there were a few typos on the whiteboard, switched-on students were quick to point them out for the benefit of everyone.

Workshops

In place of the standard tutorials, Richard held workshops every week. These were essentially the same as lectures, but Richard would work on exercises rather than subject content. There was no expectation to complete exercises before the workshop, and I personally found the questions to be extremely difficult, but this was mainly because I struggled to keep up with the content. As is standard for tutorials, attempting the questions before the workshop is very valuable.

Most of the comments in the lectures section above apply to the workshops as well.

Assignments

There were two assignments due in weeks 7 and 12 of semester, each worth 10% of the overall mark. The first assignment covered all the topics up to and including data reduction and classical statistics, and the second assignment focused on the rest of the course.

These assignments were incredibly long, with roughly 10-12 questions each, and the difficulty of each was roughly the same as that of tutorial problems, with a few exceptions being a leap above the rest. Like other maths subjects you will have taken, only a subset of the questions are marked.

These assignments really tested your understanding of the definitions and application of theorems. Hence, they helped me keep up with the subject content, and were extremely useful for revising for the end-of-semester exam.

End of Semester Exam

The exam was a standard 3 hour exam that you would expect from the mathematics department. What I considered a blessing was the one double-sided hand-written A4 cheat sheet that we were allowed to take into the exam. This very obviously meant writing every definition and theorem (and proof) in as small of a font as possible, and other mathematical identities that were useful. I am obviously kidding, as many students made it through sufficiently without resorting to eye-straining measures — less confident students did put the entire course on their cheat sheet, others only put in more challenging topics such as the delta method approximations. Unlike your actuarial exams, calculators are not allowed.

Richard does not explicitly provide past exams, but he does point you in the direction of the Unimelb library, which does have them (2015 and 2016). Solutions for these exams are unavailable online, and you had to go to his office to correct your exam. Unfortunately, many of the assignment questions were taken from the past exams, but the extra practice is very helpful regardless.

Past exams had very similar structures, with three questions covering classical statistics, followed by hypothesis testing, followed by estimating equations. 2017's exam was very different, with the majority of the exam covering delta method approximations. Consequently, our exam was relatively tougher than past exams, which is yet another reason why you should not predict the difficulty of exams based on past papers.

One thing to note was that Richard suspiciously spent most of the last lecture covering uniformly most powerful tests, and how to argue that a specific hypothesis test is not uniformly most powerful. Guess what came up on the exam ;).

Many students did not do as well as they expected, considering the relatively easy exam (compared to ACTL##### exams). This was likely due to silly mistakes or having insufficiently rigorous arguments to justify certain results.

Tips for Success

A lot of the lectures are taken up by examples and proofs, and the subject content is very intimidating due to the sheer volume of what Richard goes through in each lecture. However, once you strip away all the examples and proofs, the content becomes infinitely more manageable, and it becomes clear what all the core concepts covered are. Take some time to differentiate between worked examples, proofs, definitions and theorems — in order from most important to least important, you should understand the theorems and definitions, use the examples to help you apply the definitions and theorems, and study the proofs for an in-depth understanding of how the theorems work. If you are feeling extra daring, you can recreate Richard's notes in LaTeX (though this may take more effort than it is worth).

MGMT30017 Global Managment Consulting — Seoul

Exemption status	None.	
Supervisor(s)	Dr Daejeong Choi	
Weekly contact hours	All week for 2 weeks	
Assessments	1-hour presentation to client company (Including 20 minutes Q & A)	30%
	Written report to client company	40%
	Individual reflective essay	20%
	Peer Assessment	10%
Textbook recommendation	No textbooks are required or prescribed	
Lecture capture	N/A	
Year and semester reviewed	2016 Winter Term	

Comments

MGMT30017 Global Management Consulting is a very different subject to normal university subjects. There are no lectures, no tutorials, no exams, and the subject is completed in two weeks at an international destination (Sounds great already!). For the July intake of the subject, destinations were: Berlin, Seoul, Shanghai, and Singapore. This subject is also a capstone subject with an application process (see **Application Process** section).

The subject gives students the opportunity to complete a management consulting style project for a client in an overseas country. Students are accompanied by an academic staff member to the country, and are required to work under fairly tight deadlines whereby the project must be completed, and a presentation delivered to the client, all within two weeks.

Many students walk into the subject thinking it will be a good chance for a holiday, and are often proved wrong. Those seeking a holiday can enjoy it after the subject is completed by staying back. You get some time to explore the city during the actual subject, but it ultimately depends on how efficiently the group works. Working through the weekend (especially the second weekend) is quite a common phenomenon (think 'SWOTVAC cramming for exam' style work patterns).

The Project and Learning Experience

Since there are no lectures, and no tutorials, most of the learning comes from working on the job whilst you are overseas. Twenty students visit each of the four cities, and for Seoul, the clients were: ANZ, Tourism Australia, IBM, Covestro (a pharmaceutical company), and Eukor (a shipping company).

For actuarial students, the projects are not often directly related to our studies, but this provides us with the opportunity to think about how we can apply our thinking and numeric ability to other areas. Every now and then, the client may be an insurance company. However, the projects are not designed to target one particular commerce discipline.

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

The subject gives actuarial students the opportunity to experience working in teams, with other students from different commerce disciplines. Students are also (inevitably) presented with the challenge of overcoming language barriers. The clients are often able to speak English, but to various degrees of proficiency. The resources they give you may also be in a foreign language!

Lectures

There are no formal lectures for this subject. However, there is a **two day pre departure seminar** that all students **MUST** attend. The two day pre departure seminar usually takes place the weekend before students are recommended to fly out. During the two day seminar, various sessions are held regarding what to expect for the projects, how to identify resources, meeting your team, project briefing, and tips for successfully breaking down management consulting style projects. You also meet your academic staff during the two day seminar, and they provide information about how to safely get yourself from the airport to the hotel (This might sound trivial, but no one will be waiting at the airport ready to escort you to the hotel — the subject also gives students the opportunity to develop themselves in a personal sense!).

Assessments

Final Presentation to the Client

This presentation is made to the client on the second last day of the two week program. A few days before the final presentation, you have a practice run through with your academic in the hotel, and they provide you feedback. The presentation is 40 minutes long, and there is an additional 20 minutes for Q&A.

Written Report to the Client

This written report is due approximately a month after the final presentation. This meant most teams completed it within the first two weeks of semester 2 so they could enjoy the rest of their semester break.

Individual Written Reflection & Peer review

These are due a week after the written report deadline.

Overall speaking, the way the subject is graded seems slightly subjective with justification of scores given not as transparent as what actuarial students may be used to. However, the coordinators are evidently trying their best with the newly introduced marking criteria. Students should not walk into this subject assuming a guaranteed H1 — this may have been the case in previous years, but not under the new marking system.

Application Process

This subject is a capstone subject, so entry can be competitive. The application process consists of two main steps: an online application (including resume and cover letter) and a group interview. Shortlisting for a group interview is based purely on WAM.

(From the writer's experience) in the group interview, you are given a question to brainstorm as a group, and report back on after twenty minutes of discussion. Each person is then asked a single (somewhat) behavioural style question. Good luck!

MUSI20168 Glee Singing [SM1]

Exemption status	None.
Lecturer(s)	Geoffrey Williams
Weekly contact hours	1 × 1-hour lecture 1 × 1.5-hour tutorial/rehearsal (less than 80% attendance will result in fail)
Assessments	3 × blog entries (400 words each) 30% 30-minute test in class 10% 2000-word essay due during SWOTVAC 50% Continuous participation in tutorials 10% Final performance (week 12) Hurdle Requirement
Textbook recommendation	No textbook is required although you will need copies of sheet music available for purchase online.
Lecture capture	Full (both audio and video) — not useable though, see lectures section for more details
Year and semester reviewed	2017 Semester 1

Comments

MUSI20168 Glee Singing is best described as a fun and reasonably relaxing subject. I have never been that keen on music but I must say that I thoroughly enjoyed it. I mainly attribute this to the high level of participation and interaction between staff and students.

I think that it's fair to say that if you're unwilling make a fool of yourself and step out of your comfort zone, you will not like this subject anywhere near as much as someone who would. For this reason, Glee Singing is best done by yourself rather than with a large group of friends. However, due to the highly unique nature of this subject, everyone will have a very different experience. Ultimately you should do whatever makes you feel the most comfortable.

Glee Singing begins by taking a brief look at vocal health and some of the physiology behind singing. There is then a 5-week period during which you walk through the decades and look at songs, artists and events which have made an impression on music between the 1950s and today. Finally, the latter half of the semester looks at various topics ranging from Australian music, manufactured music and general artistic influence.

Administration Issues

Firstly, be aware that the lectures and tutorials for this subject are held at the Victorian College of the Arts, not on the main campus. If you take a tram down Swanston street, it is the second stop after Flinders Street Station. Be aware that it will take you a good 20 minutes to travel between the two campuses (I would even allow as long as 30 minutes, given that the waiting time for trams is exponentially distributed and we don't know the parameter). Especially for Glee's compulsory tutorials, make sure you don't schedule any important classes immediately before or after.

You will definitely need sheet music to participate in the performance aspect of this subject. As someone who knows little about singing, I was surprised to find out how important this was. You will quickly find out that merely having the lyrics is not enough to be able to perform a song. Additionally, there are many versions of the sheet music for a song and it is important that you use the same version that the tutor is using. Although you will be supplied with the URL at the start

of the semester, sheet music purchase is a pain in the neck. You cannot purchase individual copies, only sets of at least five (which then come in PDF form). This means you will need to make new friends (lol, good luck) to share the costs. Alternatively, if they don't change the songs, find a friend who has already done it.

Unlike most other subjects, Glee Singing has a 400-student quota. Selection is automated and based on the order in which students enrol (not register). Once the subject is full, spaces will only become available if a student withdraws. There are no waiting lists for this subject. However, this did not pose a problem for our cohort. Originally there were five scheduled tutorials for the subject but only four ended up running, so there were plenty of leftover spaces.

Secondly, Geoffrey (the lecturer) is highly unresponsive with emails. If you wish to contact someone you should use the LMS's blog function or email the subject coordinator.

Lectures

Geoffrey is an excellent and knowledgeable lecturer. He is highly engaging and promotes (voluntary) audience interaction. Part of what makes this subject so interesting is the flexibility that comes with the content. There are no lecture slides and most lectures seem like a relaxed discussion. This allows Geoffrey to go off on interesting tangents about history and other relevant issues. You will get to listen to plenty of music and be exposed to a wide range of artist during lectures.

Glee only has one lecture stream each week. However, overflow students are allocated in a second 'online lecture stream'. That's to say that you are registered but you don't go to lecture, instead you watch the lecture capture. Despite this, Geoffrey actively did not wear a microphone for any lectures. This means that if you're watching at home (or on the tram on the way to the tutorial), you miss out on 80% of the commentary. Frankly, if you are not attending in person, there is no point watching the lectures at all.

Thankfully lecture content is not highly correlated with assessment tasks so it won't impact your score. Given the location, if it is not convenient for you (i.e. timetabled next to your tutorial), I honestly wouldn't bother with lectures.

Tutorials

Tutorial attendance is compulsory. You need to attend at least 80% of tutorial to pass the subject. Believe me, you don't want to have to tell your friends that you failed Glee Singing.

Tutorials are not what you are used to. There are up to 80 students in each tutorial and it is held in a lecture theatre. It will be a bit of a shock at first, but Glee works well in this manner.

Tutorials are divided into two components

- **Theory** — Up until the middle of the semester when you complete your written test, the first half of tutorials will effectively be study for this test. You will listen to a variety of artists and analyse their singing styles and the techniques they use. Unless you have choral experience this will be a struggle (not as much as some of your core actuarial subjects).
- **Performance** — All other time in tutorials is spent preparing for the end of semester performance. We learned 5 songs:
  - Jailhouse Rock (1957) – Elvis Presley
  - All You Need Is Love (1967) – The Beatles

- Heroes (1977) – David Bowie
- Black Or White (1991) – Michael Jackson
- Born This Way (2011) – Lady Gaga

As someone who knows next to nothing about music, I though the song choices were fantastic as I actually knew half of them (the titles, not the lyrics).

Glee doesn't require you to sing solos, all performance is choral (although there might be one or two opportunities to volunteer for a more individual role). However, as I alluded to earlier, the subject will be much more enjoyable if you ignore the fact that you suck and just try to participate and have fun. Try a solo if you're keen.

Also, a quick side note, my tutor was Jackie Sannia (yep, the one from The Voice). She was an amazing tutor and she made every lesson heaps of fun. If she's still tutoring, I would highly recommend you try and get into one of her classes.

Assessments

In the past, Glee Singing has been treated as a gigantic joke. It was an easy H1, hence its popularity. To our detriment, the music department caught onto this and ramped up the difficulty of assessments.

Firstly, to pass this subject you must attempt all assessments. This means that if you skip an assessment, you will still need to complete and submit it to pass, even if it means getting zero for late submission. There is no point putting assignments off because you can't skip them, just suck it up and do them on time.

Generally, the assessments are not a straight forward as what you are used to in mathematics. One thing I found is that they had nothing to do with lecture content. Furthermore, written assessment topics were quite vague and sometimes confusing. Finally, marking is reasonably slow. Whilst you will get some brief feedback, you may need to wait as long as 5 or 6 weeks.

Assessments include:

- **3 x 400-word blog posts due in week 3, 6 and 9** — These weren't too challenging but were sometimes confusing. Whilst they were quite open ended and informal, you still need to do proper referencing.
- **30-minute in class test** — This took place in the middle of the semester and dealt with the content learned in tutorials. It involved listening to and analysing short snippets of popular music. You will get given a list of singing techniques, and with a little bit of work outside class you can do reasonably well. Also, make sure you turn up on time to the class on the day of the test, if you're late you will not get to hear the first tracks again.
- **2000-word essay** — Due during SWOTVAC, you will be given a topic to be addressed in relation to a given song.

  When it came to writing this essay, I procrastinated heaps. Since it was during SWOTVAC, it took me about a week to do two days of work. If you are like me, make sure you focus on your core subjects during SWOTVAC, don't just try to get the essay out the way first. Going into the first week of exams, this put me behind in all my other subjects and made study much more stressful over the next few weeks. Instead, focus on your core subjects and plan to write most of the essay in the last 3 days before it is due.
- **Tutorial participation** — Just answer a few questions from time to time and you'll be fine. Make sure the tutor learns your name, it will be a big help if you want these marks. This is more complex in Glee Singing because your class may have up to 80 students.

- **Final performance** — This happens in place of the Week 12 tutorial and participation is a hurdle requirement. You will perform as a group in public. You will need to memorise the lyrics of all the songs you are singing. The whole semester builds up to this, and if you have taken the time to learn the songs, you will probably enjoy this end of semester celebration.

Personally, I enjoyed the performance aspect of Glee Singing. I think that my general lack of shame helped me get more out of the subject. As for the assessments (especially the written ones), I didn't find them particularly engaging and they caused me to procrastinate more than usual.

If you think you are an introvert, Glee Singing is most likely not the subject for you. However, if you are knowledgeable and passionate about music and singing, you will most likely enjoy this class.

Despite it being low-stress, under the new assessment model, don't expect to get a H1 with little to no work. Marking is quite tough and getting a great score is challenging.

Overall, it's a good subject and a welcome change from the content you study in other classes. Although if you're not an artsy person (music, history, essays and such), I'd recommend perhaps a computer programming subject or another mathematics breadth.

Subject Review Index

This section serves as an index for each subject review across all the different editions of the *Actuarial Students' Society Subject Review*.

Table 1: Core Subjects

Subject Code	2015 Start	2016 Start	Mid	End	2017 Mid
ACCT10001		1	1	1	1
ACCT10002	2	2	2	2	2
ACTL10001	2	2	2	2	2
ECON10003		2	2	2	2
ECON10004	1	1	1	1	1
FNCE10002					1
MAST10006		1	1		
MAST10007			S	S	
MAST10008	1	1	1	1	1
MAST10009	2	2	2	2	2
ACTL20001	1	1	1	1	1
ACTL20002	2	2	2	2	2
ECON20001	2	2	2	2	2
FNCE20001	2	2	2	1	
MAST20004	1	1	1	1	1
MAST20005	2	2	2	2	2
MGMT20001		2	2S	2S	1
ACTL30001	1	1	1	1	1
ACTL30002	1	1	1	1	1
ACTL30003	2	2	2	2	2
ACTL30004	2	2	2	2	2
ACTL30005	2	2	2	2	2
ACTL30006	1	1	1	1	1
ACTL40002		1	1	1	1
ACTL40003				2	2
ACTL40004		1	1	1	1
ACTL40005				A	A
ACTL40006		1	1	1	1
ACTL40008		2	2	2	2
ACTL40009				2	1

Table 2: Breadths and Electives

Subject Code	2016 Start	Mid	End	2017 Mid
AGRI20030			J	
BLAW10001	1	1		
BLAW20001	1	1		
CHIN20026				2
COMP10001		1	1	
COMP20005	2	2		1
ECON20002	1	1	S	S
ECON20005			2	2
FNCE10001		1		
FNCE30007	2	2		1
GERM10008	1	1		
JAPN10001		1	1	
MAST20022			2	2
MAST30020		1	1	
MGMT30006			2	
MAST90082				1
MGMT30017			W	W
MUSI20168			1	1
D-MATHSC		O		

Legend	
1	Semester 1
2	Semester 2
S	Summer Term
W	Winter Term
J	July Intensive
A	All Year
O	Other

List of Exemptions

Table 3: Actuaries Institute exemption subjects and corresponding university subjects

Exemption subject	University subject
Part I	
CT1 Financial Mathematics	ACTL20001 Financial Mathematics I ACTL20002 Financial Mathematics II
CT2 Finance and Financial Reporting	ACCT10002 Introductory Financial Accounting FNCE10002 Principles of Finance[1]
CT3 Probability and Mathematical Statistics	MAST20004 Probability MAST20005 Statistics
CT4 Models	ACTL30001 Actuarial Modelling I ACTL30002 Actuarial Modelling II
CT5 Contingencies	ACTL30003 Contingencies
CT6 Statistical Methods	ACTL30004 Actuarial Statistics ACTL40002 Risk Theory I
CT7 Business Economics	ECON10004 Introductory Microeconomics ECON20001 Intermediate Macroeconomics
CT8 Financial Economics	ACTL30006 Financial Mathematics III ACTL40004 Advanced Financial Mathematics I
Part II	
Part IIA The Actuarial Control Cycle	ACTL40006 Actuarial Practice and Control I ACTL40007 Actuarial Practice and Control II
Part IIB Investment and Asset Modelling	ACTL40009 Actuarial Practice and Control III

Source: Centre for Actuarial Studies
Current as of 19th January 2017.

[0]Students are also eligible for the exemption if they complete FNCE20001 Business Finance

Equivalent Graduate Subjects

Subjects offered as part of the 2-year MC-ACTSCI *Master of Actuarial Science* or 1.5-year MC-COMACSC *Master of Commerce (Actuarial Science)* degrees allow graduate students to gain professional actuarial exemptions from the Actuaries Institute. Due to the overlap in content between these subjects and actuarial subjects offered as part of the B-COM *Bachelor of Commerce* and the BH-COM Honours program, we have listed graduate actuarial subjects with their undergraduate counterparts below. The reviews for undergraduate subjects included in the *Actuarial Students' Society Subject Review* will serve as an accurate reference of the content in the corresponding graduate subjects.

Some of these graduate actuarial subjects will share the same lectures as their undergraduate counterparts, as in Table 4. Others will just contribute to the same exemption subject as their undergraduate counterparts (and hence have common content), as in Table 5.

Table 4: Graduate and undergraduate actuarial subjects with common lectures

Graduate subject	Undergraduate subject
ACTL90003 Mathematics of Finance III	ACTL40004 Advanced Financial Mathematics I
ACTL90004 Insurance Risk Models	ACTL40002 Risk Theory I
ACTL90009 Actuarial Practice and Control III	ACTL40009 Actuarial Practice and Control III
ACTL90010 Actuarial Practice And Control I	ACTL40006 Actuarial Practice and Control I
ACTL90011 Actuarial Practice and Control II	ACTL40007 Actuarial Practice and Control II
ACTL90014 Insurance Risk Models II	ACTL40003 Risk Theory II
ACTL90015 Mathematics of Finance IV	ACTL40008 Advanced Financial Mathematics II

Table 5: Graduate and undergraduate actuarial subjects with common exemption subjects

	Graduate subject	Undergraduate subject
CT1	ACTL90001 Mathematics of Finance I	ACTL20001 Financial Mathematics I ACTL20002 Financial Mathematics II
CT4	ACTL90006 Life Insurance Models I ACTL90007 Life Insurance Models 2	ACTL30001 Actuarial Modelling I ACTL30002 Actuarial Modelling II
CT5	ACTL90005 Life Contingencies	ACTL30003 Contingencies
CT6	ACTL90008 Statistical Techniques in Insurance ACTL90004 Insurance Risk Models	ACTL30004 Actuarial Statistics ACTL40002 Risk Theory I
CT8	ACTL90002 Mathematics of Finance II ACTL90003 Mathematics of Finance III	ACTL30006 Financial Mathematics III ACTL40004 Advanced Financial Mathematics I
Part IIA	ACTL90010 Actuarial Practice And Control I ACTL90011 Actuarial Practice and Control II	ACTL40006 Actuarial Practice and Control I ACTL40007 Actuarial Practice and Control II
Part IIB	ACTL90009 Actuarial Practice and Control III	ACTL40009 Actuarial Practice and Control III