ACST3006
Quantitative Asset and Liability Modelling 1
Session 1, In person-scheduled-weekday, North Ryde 2022
Department of Actuarial Studies and Business Analytics

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General Information

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Credit points
10

Prerequisites
(ACST202 or ACST2002) and (STAT272 or STAT2372)

Corequisites

Co-badged status

Unit description
This unit examines: rational expectations theory, rational choice theory, behavioural economics, properties of risk measures, risk and insurance companies, stochastic interest rate models, mean-variance portfolio theory, asset pricing models, single and multifactor returns models, binomial lattice models for option pricing and methods for calculating outstanding claims provisions in general insurance. Students gaining a credit average in both ACST3006 and ACST3007 (minimum mark of 60 on both units) will satisfy the requirements for exemption from the professional subject CM2 of the Actuaries Institute.

Important Academic Dates
Information about important academic dates including deadlines for withdrawing from units are available at https://www.mq.edu.au/study/calendar-of-dates

Learning Outcomes
On successful completion of this unit, you will be able to:

ULO1: Apply decision making via utility functions, and describe rational expectations theory, rational choice theory, behavioural economics and three different forms of market efficiency.
**ULO2:** Employ the use of Capital Asset Pricing Model (CAPM), single/multi index models and Arbitrage Pricing Theory (APT) Model in asset pricing and analyse investment risk using various risk measures.

**ULO3:** Apply the binomial option pricing models to value European and American type options.

**ULO4:** Apply a stochastic approach to the theory of interest on the mean and variance of the accumulation of a sequence of payments to solve practical problems.

**ULO5:** Use various methods of run-off triangles for valuation and reserving of liabilities.

### General Assessment Information

Assessment criteria for all assessment tasks will be provided on the unit iLearn site.

It is the responsibility of students to view their marks for each within-session-assessment on iLearn within 20 days of posting. If there are any discrepancies, students must contact the unit convenor immediately. Failure to do so will mean that queries received after the release of final results regarding assessment tasks (not including the final exam mark) will not be addressed.

**Late submissions of assessments** Unless a Special Consideration request has been submitted and approved, no extensions will be granted. There will be a deduction of 10% of the total available assessment-task marks made from the total awarded mark for each 24-hour period or part thereof that the submission is late. Late submissions will only be accepted up to 96 hours after the due date and time.

No late submissions will be accepted for timed assessments – e.g., quizzes, online tests.

**Table 1: Penalty calculation based on submission time**

<table>
<thead>
<tr>
<th>Submission time after the due date (including weekends)</th>
<th>Penalty (% of available assessment task mark)</th>
<th>Example: for a non-timed assessment task marked out of 30</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 24 hours</td>
<td>10%</td>
<td>10% x 30 marks = 3-mark deduction</td>
</tr>
<tr>
<td>24-48 hours</td>
<td>20%</td>
<td>20% x 30 marks = 6-mark deduction</td>
</tr>
<tr>
<td>48-72 hours</td>
<td>30%</td>
<td>30% x 30 marks = 9-mark deduction</td>
</tr>
<tr>
<td>72-96 hours</td>
<td>40%</td>
<td>40% x 30 marks = 12-mark deduction</td>
</tr>
<tr>
<td>&gt; 96 hours</td>
<td>100%</td>
<td>Assignment won’t be accepted</td>
</tr>
</tbody>
</table>

**Special Consideration**

To request an extension on the due date/time for a timed or non-timed assessment task, you must submit a Special Consideration application. An application for Special Consideration does not guarantee approval.
The approved extension date for a student becomes the new due date for that student. The late submission penalties above then apply as of the new due date.

### Assessment Tasks

<table>
<thead>
<tr>
<th>Name</th>
<th>Weighting</th>
<th>Hurdle</th>
<th>Due</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assignment</td>
<td>20%</td>
<td>No</td>
<td>30/3/2022</td>
</tr>
<tr>
<td>Class Test</td>
<td>20%</td>
<td>No</td>
<td>17/5/2022</td>
</tr>
<tr>
<td>Final Exam</td>
<td>60%</td>
<td>No</td>
<td>Final exam period</td>
</tr>
</tbody>
</table>

**Assignment**

Assessment Type 1: Quantitative analysis task  
Indicative Time on Task 2: 20 hours  
Due: **30/3/2022**  
Weighting: **20%**  

This is an individual assignment which focuses on problem solving using Excel spreadsheet.

On successful completion you will be able to:

- Apply decision making via utility functions, and describe rational expectations theory, rational choice theory, behavioural economics and three different forms of market efficiency.
- Employ the use of Capital Asset Pricing Model (CAPM), single/multi index models and Arbitrage Pricing Theory (APT) Model in asset pricing and analyse investment risk using various risk measures.

**Class Test**

Assessment Type 1: Quiz/Test  
Indicative Time on Task 2: 10 hours  
Due: **17/5/2022**  
Weighting: **20%**  

The test will be approximately 90 minutes, to be held during class time.
On successful completion you will be able to:

- Apply decision making via utility functions, and describe rational expectations theory, rational choice theory, behavioural economics and three different forms of market efficiency.
- Employ the use of Capital Asset Pricing Model (CAPM), single/multi index models and Arbitrage Pricing Theory (APT) Model in asset pricing and analyse investment risk using various risk measures.
- Apply the binomial option pricing models to value European and American type options.
- Apply a stochastic approach to the theory of interest on the mean and variance of the accumulation of a sequence of payments to solve practical problems.

Final Exam

Assessment Type 1: Examination
Indicative Time on Task 2: 28 hours
Due: Final exam period
Weighting: 60%

The final examination will be a three-hour written exam with ten minutes reading time, to be held during the University Examination period.

On successful completion you will be able to:

- Apply decision making via utility functions, and describe rational expectations theory, rational choice theory, behavioural economics and three different forms of market efficiency.
- Employ the use of Capital Asset Pricing Model (CAPM), single/multi index models and Arbitrage Pricing Theory (APT) Model in asset pricing and analyse investment risk using various risk measures.
- Apply the binomial option pricing models to value European and American type options.
- Apply a stochastic approach to the theory of interest on the mean and variance of the accumulation of a sequence of payments to solve practical problems.
- Use various methods of run-off triangles for valuation and reserving of liabilities.

1 If you need help with your assignment, please contact:

- the academic teaching staff in your unit for guidance in understanding or completing this type of assessment
• the Writing Centre for academic skills support.

2 Indicative time-on-task is an estimate of the time required for completion of the assessment task and is subject to individual variation

Delivery and Resources

CLASSES

It is intended that learning in this session will be a combination of face to face and pre-recorded lectures. Students can register to either face to face or online tutorials. Tutorials will commence in week 2.

REQUIRED and RECOMMENDED TEXTS and/or Materials

Required texts

Lecture materials are available for downloading from ACST3006 teaching website.

Recommended textbooks

• Investment Science; David Luenberger

• Choices, Values, and Frames; Amos Tversky and Daniel Kahneman

• Modern Portfolio Theory and Investment Analysis; Edwin J. Elton, Martin J. Gruber, Stephen J. Brown and William N. Goetzmann

• Investment Mathematics and Statistics; Andrew Adams, Della Bloomfield, Philip Booth and Peter England

• Options, Futures and Other Derivatives; John Hull

Optional ActEd material

• The ActEd CM2, that can be purchased directly from ActEd.

Unit Schedule

Week Lecture Topics
1. Utility Theory, Decision making via utility functions
2. Stochastic dominance, Behavioural finance
3. Mean-Variance portfolio theory
4. The CAPM
5. Single/Multi index models, Arbitrage pricing theory (APT)
6. Measurements of investment risk
   (Assignment due - Wednesday 30 March 12:00noon)
7. Options
Semester Break
8. Single/Multi period Binomial option pricing model
9. American option pricing via Binomial model
10. Runoff triangle
11. Class Test (Tuesday 17 May 9:00am-11:00am)
12. Stochastic interest rate models / Efficient market hypothesis
13. Revision

Policies and Procedures
Macquarie University policies and procedures are accessible from Policy Central (https://policies.mq.edu.au). Students should be aware of the following policies in particular with regard to Learning and Teaching:

- Academic Appeals Policy
- Academic Integrity Policy
- Academic Progression Policy
- Assessment Policy
- Fitness to Practice Procedure
- Assessment Procedure
- Complaints Resolution Procedure for Students and Members of the Public
- Special Consideration Policy

Students seeking more policy resources can visit Student Policies (https://students.mq.edu.au/support/study/policies). It is your one-stop-shop for the key policies you need to know about throughout your undergraduate student journey.

To find other policies relating to Teaching and Learning, visit Policy Central (https://policies.mq.edu.au) and use the search tool.

Student Code of Conduct
Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: https://students.mq.edu.au/admin/other-resources/student-conduct

Results
Results published on platform other than eStudent, (eg. iLearn, Coursera etc.) or released directly by your Unit Convenor, are not confirmed as they are subject to final approval by the University. Once approved, final results will be sent to your student email address and will be made available in eStudent. For more information visit ask.mq.edu.au or if you are a Global MBA student contact globalmba.support@mq.edu.au
Academic Integrity
At Macquarie, we believe academic integrity – honesty, respect, trust, responsibility, fairness and courage – is at the core of learning, teaching and research. We recognise that meeting the expectations required to complete your assessments can be challenging. So, we offer you a range of resources and services to help you reach your potential, including free online writing and maths support, academic skills development and wellbeing consultations.

Student Support
Macquarie University provides a range of support services for students. For details, visit http://students.mq.edu.au/support/

The Writing Centre
The Writing Centre provides resources to develop your English language proficiency, academic writing, and communication skills.

- Workshops
- Chat with a WriteWISE peer writing leader
- Access StudyWISE
- Upload an assignment to Studiosity
- Complete the Academic Integrity Module

The Library provides online and face to face support to help you find and use relevant information resources.

- Subject and Research Guides
- Ask a Librarian

Student Services and Support
Macquarie University offers a range of Student Support Services including:

- IT Support
- Accessibility and disability support with study
- Mental health support
- Safety support to respond to bullying, harassment, sexual harassment and sexual assault
- Social support including information about finances, tenancy and legal issues

Student Enquiries
Got a question? Ask us via AskMQ, or contact Service Connect.
IT Help

For help with University computer systems and technology, visit http://www.mq.edu.au/about_us/offices_and_units/information_technology/help/.

When using the University's IT, you must adhere to the Acceptable Use of IT Resources Policy. The policy applies to all who connect to the MQ network including students.