ACST 816 Quantitative Asset and Liability Modelling 1

FIRST SEMESTER 2012

Unit convenor: Jiwook Jang
Prerequisites: ACST202(P) and STAT272(P). Please consult the Unit Convenor if you do not meet any of the prerequisite requirements for the unit.
Credit points: 4

Students in this unit should read this unit outline carefully at the start of semester. It contains important information about the unit. If anything in it is unclear, please consult the unit convenor.

ABOUT THIS UNIT

The unit examines utility theory, asset allocation, mean-variance portfolio theory, the Capital Asset Pricing Model (CAPM), single/multi index model and arbitrage pricing theory (APT), measures of investment risk and the efficient market hypothesis. As a stochastic approach to the theory of interest; the moments of the accumulation of a string of payments are studied. Also with the introduction of a derivative, i.e. Option, single-period to multi-period Binomial option pricing model (discrete time model), American option, Exotic options such as Lookback option, Asian option and Barrier options and their pricing via Binomial model are covered.

This unit is related to the unit ACST 817 Quantitative Asset and Liability Modelling 2, where the Black-Scholes option pricing model (continuous time model) is covered. The units ACST816 and ACST817 together correspond to the professional subject CT8.

TEACHING STAFF

The staff involved in the teaching of this unit are

<table>
<thead>
<tr>
<th>Staff Member</th>
<th>Email</th>
<th>Telephone</th>
<th>Room</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. Jiwook Jang (Unit Convenor)</td>
<td><a href="mailto:jiwook.jang@mq.edu.au">jiwook.jang@mq.edu.au</a></td>
<td>9850 8575</td>
<td>E4A 613</td>
</tr>
<tr>
<td>Celeste Chai (Unit Administrator)</td>
<td><a href="mailto:chai.celeste@gmail.com">chai.celeste@gmail.com</a></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
As consultation hours, weekly Discussion Board on the website will be used. Questions about unit content to the unit convenor should be initially posted on the Discussion Board of the website or raised during tutorials or lectures.

Consultation sessions with tutors will be held in the FBE Consultation Room E4B 104. The consultation times will be confirmed on Blackboard and in the lectures.

If face-to-face consultations for academic queries are required, students should contact to the unit convenor via the Macquarie University e-mail system to make an appointment.

There will be face-to-face consultation hours before the final exam that will be confirmed on the website and in the lectures.

Celeste Chai is a teaching administrator for this unit, who is responsible for all the administrative aspects of the unit. Administrative questions that are not covered in this unit outline should be directed to her on the Private Mail facility of the website. If the questions are of interest to everyone in the unit, the question and the reply will be post to the Discussion Board, so you should specifically request if you want your message to remain private.

## CLASSES

This unit will consist of 2 hours of lectures and 2 hours tutorials per week. Lectures are held at the following times:

<table>
<thead>
<tr>
<th>Day</th>
<th>Time</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wednesday</td>
<td>3:00 pm – 5:00 pm</td>
<td>E7B T2</td>
</tr>
</tbody>
</table>

ACST 816 Tutorials are held at the following times, commencing in week 2:

<table>
<thead>
<tr>
<th>Day</th>
<th>Time</th>
<th>Location</th>
<th>Tutor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wednesday</td>
<td>8:00 am – 10:00 am</td>
<td>X5B 143</td>
<td>Jiwook Jang</td>
</tr>
</tbody>
</table>

You must attend the tutorial class. The tutorial is an opportunity for you to attempt the section exercises given at the end of each section of work, and to discuss problems with the tutor.

There is no tutorial held during Week 1.

Any alterations to the class times or locations will be advised in lectures and via the website.

## REQUIRED AND RECOMMENDED TEXTS AND/OR MATERIALS

The recommended textbooks for this course are:

<table>
<thead>
<tr>
<th>Title</th>
<th>Author</th>
<th>Chapters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investment Science</td>
<td>David G. Luenberger</td>
<td>Chapters 4, 6, 7, 8, 9, 10, 11, 12, 13</td>
</tr>
<tr>
<td>Modern Portfolio Theory and Investment Analysis</td>
<td>Edwin J. Elton, Martin J. Gruber, Stephen J.</td>
<td>Chapter 4, 5, 6, 13, 16, 17, 21, 23, 24</td>
</tr>
</tbody>
</table>
Each copy of these books is available in the Reserve section of the Library and can be purchased from the Macquarie University Co-op Bookshop.

Lecture notes can also be found from the ActEd Study Materials (subject CT8). You can purchase these notes via ASSOC at a discounted price. Information about their availability and price will be confirmed on the website and in the lectures.

**TECHNOLOGY USED AND REQUIRED**

Students need to be able to use a computer to analyse financial problems. You should be able to use a word processing package (such as WORD), a spreadsheet (such as EXCEL), a statistical package (such as MINITAB) and a programming language (such as Visual Basic or Matlab). Although the unit does not aim to teach students how to use computers, as this is covered in prerequisite units, you are encouraged to make use of spreadsheets and other software packages for the assignment.

**UNIT WEB PAGE**

Course materials are available on the learning management system (iLearn). To access the website, go to http://ilearn.mq.edu.au and login using your usual login and password. You will then have access to the websites for all the units in which you are enrolled. If you have any trouble logging in (e.g. you have forgotten your password), please contact the Student IT Helpdesk.

Before logging in, you should follow the link labelled “Technical Information” and read all the information there, including the Information Technology Security Policy and Rules and the Information Technology Usage Rules. This technical information also mentions a number of “plugins” that may be required. Of those listed, in this unit you will only need Acrobat Reader.

The web site will be used as an integral part of this unit. The website for this unit contains:

- **Course content:**
  - Unit outline. A copy of this unit outline.
  - Lecture notes.
  - Weekly exercises with solutions.
  - Tests and exams. Past class tests and exams with solutions.
  - Links. Any web links you need to use will be made available here.

- **Discussions.** A Discussions board to discuss problems with your fellow students.
**Mail.** To contact the teaching administrator and for the teaching administrator to contact you.

It is your responsibility to check the website regularly to make sure that you are up-to-date with announcements and with messages sent to your Mail address.

Remember to close your browser when you have finished using the site. If you don't, another person can use the still running browser to access the website with your account.

**LEARNING OUTCOMES**

This unit aims to introduce students to financial market theory and portfolio management, a stochastic approach to the theory of interest, options, single to multi-period Binomial option pricing model, American and Exotic option pricing via Binomial model. You should review lecture notes in advance of each lecture and after completing each section of work.

On completion of this unit, students should be able to do the following:

On completion of this unit, students should be able to do the following:

1. Decision making via utility functions.
4. Detecting three forms of market efficiency.
5. A stochastic approach to the theory of interest - the mean and variance of the accumulation of a string of payments.
6. Understanding option and single to multi-period Binomial option pricing model (discrete time model).
7. American and Exotic option pricing via Binomial model.

**GRADUATE CAPABILITIES**

In addition to the discipline-based learning objectives, all academic programs at Macquarie seek to develop the capabilities the University's graduates will need to develop to address the challenges, and to be effective, engaged participants in their world.

This unit contributes to this by developing the following graduate capabilities:

1. Discipline Specific Knowledge and Skills.
2. Critical, Analytical and Integrative Thinking.
3. Problem Solving and Research Capability.

**LEARNING AND TEACHING ACTIVITIES**

The unit material is covered in the two hours of lectures each week. The tutorial is an opportunity for you to attempt questions for each section of work, or to ask questions. In addition to the tutorial, you should use the Discussion Board to ask questions or discuss concepts covered in the unit.

<table>
<thead>
<tr>
<th>Week</th>
<th>Week Beginning</th>
<th>Lecture Topics</th>
<th>Tutorial</th>
<th>Lecturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>27 February</td>
<td>Utility Theory</td>
<td></td>
<td>JJ</td>
</tr>
<tr>
<td>2</td>
<td>5 March</td>
<td>Mean-Variance portfolio theory, The CAPM</td>
<td>Tutorial</td>
<td>JJ</td>
</tr>
<tr>
<td>3</td>
<td>12 March</td>
<td>The CAPM</td>
<td></td>
<td>JJ</td>
</tr>
<tr>
<td>4</td>
<td>19 March</td>
<td>Single/multi index models. Arbitrage Pricing Theory (APT) Model</td>
<td>Tutorial</td>
<td>JJ</td>
</tr>
<tr>
<td>5</td>
<td>26 March</td>
<td>Measurements of Investment Risk, Efficient Market Hypothesis</td>
<td>Tutorial</td>
<td>JJ</td>
</tr>
<tr>
<td>6</td>
<td>2 April</td>
<td>Stochastic interest rate models</td>
<td>Tutorial</td>
<td>JJ</td>
</tr>
<tr>
<td>7</td>
<td>9 April - 16 April</td>
<td>Anzac Day Holiday on Wednesday 25 April Assignment due (Thursday 26 April 12:00noon)</td>
<td>No Tutorial</td>
<td>No Lecture</td>
</tr>
<tr>
<td>8</td>
<td>30 April</td>
<td>Options</td>
<td></td>
<td>JJ</td>
</tr>
<tr>
<td>9</td>
<td>7 May</td>
<td>Single period Binomial option pricing model</td>
<td>Tutorial</td>
<td>JJ</td>
</tr>
<tr>
<td>10</td>
<td>14 May</td>
<td>Multi period Binomial option pricing model</td>
<td>Tutorial</td>
<td>JJ</td>
</tr>
<tr>
<td>11</td>
<td>21 May</td>
<td>American and Exotic option pricing via Binomial model</td>
<td>Tutorial</td>
<td>JJ</td>
</tr>
<tr>
<td>12</td>
<td>28 May</td>
<td><strong>Test</strong></td>
<td></td>
<td>JJ</td>
</tr>
<tr>
<td>13</td>
<td>4 June</td>
<td>Revision</td>
<td></td>
<td>JJ</td>
</tr>
</tbody>
</table>

**RESEARCH AND PRACTICE**

- This unit uses research from external sources:

- This unit gives you opportunities to conduct your own research.

### Relationship Between Assessment and Learning Outcomes

<table>
<thead>
<tr>
<th></th>
<th>Quiz (2)</th>
<th>Assignment</th>
<th>Mid-semester Test</th>
<th>Final Exam</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description</strong></td>
<td></td>
<td>Individual assignment</td>
<td>In-class test</td>
<td>Formal Exam</td>
</tr>
<tr>
<td><strong>Due date</strong></td>
<td></td>
<td>Thursday 26 April 12:00noon</td>
<td>Wednesday 30 May 3:00 – 5:00pm</td>
<td>Exam period</td>
</tr>
<tr>
<td><strong>% Weighting</strong></td>
<td></td>
<td>5% in total</td>
<td>15% in total</td>
<td>10% in total</td>
</tr>
<tr>
<td><strong>Grading method</strong></td>
<td></td>
<td>Mark out of 100</td>
<td>Mark out of 100</td>
<td>Mark out of 100</td>
</tr>
<tr>
<td><strong>Submision method</strong></td>
<td></td>
<td>In-tutorial</td>
<td>ACST306/816 Assignment Box in BESS (E4B106). Late assignments will not be marked.</td>
<td>In-class</td>
</tr>
<tr>
<td><strong>Feedback</strong></td>
<td></td>
<td>Collected from tutorial class. Worked solution will be provided on the website.</td>
<td>Collected from BESS (E4B106). Worked solution will be provided on the website if required</td>
<td>Collected from BESS (E4B106). Worked solution will be provided on the website.</td>
</tr>
<tr>
<td><strong>Estimated student workload (hours)</strong></td>
<td>8</td>
<td>20</td>
<td>28</td>
<td>40</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Learning outcomes assessed</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>Graduate capabilities assessed</td>
<td>Quiz (2)</td>
<td>Assignment</td>
<td>Mid-semester Test</td>
<td>Final Exam</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------------------------------</td>
<td>---------</td>
<td>------------</td>
<td>------------------</td>
<td>-----------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Quizzes**

There will be two quizzes, each worth 2.5% of the final assessment for the unit. **No** materials will be allowed to take into the quiz.

- Quiz 1 will be held **Wednesday 28 March** at **9 am**. It will cover topics up to Week 3.
- Quiz 2 will be held **Wednesday 16 May** at **9 am**. It will cover topics up to Week 8.

Please note that coverage may be subject to change and that any alterations will be advised in lectures/on Blackboard.

The format of the quiz will be a written paper consisting of 1 or 2 questions. You will answer in the spaces provided on the quiz paper. All answers must be written in black or blue pen or a pencil (do NOT use a red pen).

Marked quizzes will be returned in tutorial class. Worked solution will be provided on the website. It is hoped that marked quizzes will be returned within 12 working days of the quiz date.

You should contact the unit convenor immediately (e.g. prior to the quiz) if unexpected ill-health or other disruption affects your preparation for or performance in each quiz. Applications for special consideration due to documented illness or unavoidable disruption must then be made on the “Special Consideration” form, available at [http://www.registrar.mq.edu.au/Forms/APScons.pdf](http://www.registrar.mq.edu.au/Forms/APScons.pdf).

All requests for special consideration should be made in writing through **BESS** (E4B106) and include full supporting documentation.

Requests for special consideration for a quiz should be made within 5 days of the quiz date. Students excused from a quiz will not be asked to sit for a supplementary quiz. Instead 5% quiz weight will be added to the final exam.

**Assignment**

There will be one assignment, worth **15%** of the final assessment for the unit.

- Assignment due is **Thursday 26 April 12:00noon** and has to be submitted to ACST306/816 Assignment Box in **BESS** (E4B106). It will cover topics up to Week 6.
• Late assignments will not be marked.

Please note that coverage may be subject to change and that any alterations will be advised in lectures/on Blackboard.

When the assignment is marked, you will be notified to collect them from BESS (E4B106). Worked solution will be provided on the website if required. It is hoped that marked assignments will be returned within 12 working days of the Assignment due date.

You should contact the unit convenor immediately (e.g. prior to the assignment due) if unexpected ill–health or other disruption affects your preparation/submission for an assignment. Applications for special consideration due to documented illness or unavoidable disruption must then be made on the “Special Consideration” form, available at http://www.registrar.mq.edu.au/Forms/APScons.pdf.

All requests for special consideration should be made in writing through BESS (E4B106) and include full supporting documentation.

Requests for special consideration for assignment should be made within 5 days of assignment due. Students excused from assignment will not be asked to submit for a supplementary assignment. Instead 15% assignment weight will be added to the final exam.

**Mid-Semester Test**

There will be one class test, worth 10% of the final assessment for the unit. You will be allowed to take one A4 page into the exam (handwritten or typed and filled in on one or two sides).

• Test will be held Wednesday 30 May at 3 pm. It will cover topics up to Week 10.

Please note that coverage may be subject to change and that any alterations will be advised in lectures/on Blackboard.

The format of the mid-semester test will be a written paper consisting of 3 or 4 questions. You will answer in the spaces provided on the test paper or answer booklet. All answers must be written in black or blue pen or a pencil (do NOT use a red pen).

When the test is marked, you will be notified to collect them from BESS (E4B106). Worked solution will be provided on the website. It is hoped that marked papers will be returned within 12 working days of the class test date.

You should contact the unit convenor immediately (e.g. prior to the test) if unexpected ill–health or other disruption affects your preparation for or performance in the class test. Applications for special consideration due to documented illness or unavoidable disruption must then be made on the “Special Consideration” form, available at http://www.registrar.mq.edu.au/Forms/APScons.pdf.
All requests for special consideration should be made in writing through BESS (E4B106) and include full supporting documentation.

Requests for special consideration for mid-semester test should be made within 5 days of the test. Students excused from mid-semester test will not be asked to sit for a supplementary test. Instead 10% mid-semester test weight will be added to the final exam.

Exam

The final examination (3 hours with 10 minutes reading time) is worth **70%** of the final assessment for the unit. The examination will cover the entire course. You will be allowed to take **one** A4 page into the exam (handwritten or typed and filled in on one or two sides).

The University Examination period in First Half Year 2012 is from 12 June to 29 June.

You are expected to present yourself for examination at the time and place designated in the University Examination Timetable. The timetable will be available in Draft form approximately eight weeks before the commencement of the examinations and in Final form approximately four weeks before the commencement of the examinations. [http://www.timetables.mq.edu.au/exam](http://www.timetables.mq.edu.au/exam)

The only exception to not sitting an examination at the designated time is because of documented illness or unavoidable disruption. In these circumstances you may wish to consider applying for **Special Consideration**. The University’s policy on special consideration process is available at [http://www.mq.edu.au/policy/docs/special_consideration/policy.html](http://www.mq.edu.au/policy/docs/special_consideration/policy.html)

If a Supplementary Examination is granted as a result of the Special Consideration process the examination will be scheduled after the conclusion of the official examination period. (Individual Faculties may wish to signal when the Faculties’ Supplementary Exams are normally scheduled.)

The Macquarie university examination policy details the principles and conduct of examinations at the University. The policy is available at: [http://www.mq.edu.au/policy/docs/examination/policy.htm](http://www.mq.edu.au/policy/docs/examination/policy.htm)

**ACADEMIC HONESTY**

The nature of scholarly endeavour, dependent as it is on the work of others, binds all members of the University community to abide by the principles of academic honesty. Its fundamental principle is that all staff and students act with integrity in the creation, development, application and use of ideas and information. This means that:

- all academic work claimed as original is the work of the author making the claim
- all academic collaborations are acknowledged
- academic work is not falsified in any way
• when the ideas of others are used, these ideas are acknowledged appropriately.

Further information on the academic honesty can be found in the Macquarie University Academic Honesty Policy at [http://www.mq.edu.au/policy/docs/academic_honesty/policy.html](http://www.mq.edu.au/policy/docs/academic_honesty/policy.html)

**GRADES**

Macquarie University uses the following grades in coursework units of study:

- HD - High Distinction
- D - Distinction
- CR - Credit
- P - Pass
- F - Fail

Grade descriptors and other information concerning grading are contained in the Macquarie University Grading Policy which is available at: [http://www.mq.edu.au/policy/docs/grading/policy.html](http://www.mq.edu.au/policy/docs/grading/policy.html)

**GRADING APPEALS AND FINAL EXAMINATION SCRIPT VIEWING**

If, at the conclusion of the unit, you have performed below expectations, and are considering lodging an appeal of grade and/or viewing your final exam script please refer to the following website which provides information about these processes and the cut off dates in the first instance. Please read the instructions provided concerning what constitutes a valid grounds for appeal before appealing your grade.


**SPECIAL CONSIDERATION**

The University is committed to equity and fairness in all aspects of its learning and teaching. In stating this commitment, the University recognises that there may be circumstances where a student is prevented by unavoidable disruption from performing in accordance with their ability. A special consideration policy exists to support students who experience serious and unavoidable disruption such that they do not reach their usual demonstrated performance level. The policy is available at: [http://www.mq.edu.au/policy/docs/special_consideration/policy.html](http://www.mq.edu.au/policy/docs/special_consideration/policy.html)

**STUDENT SUPPORT SERVICES**

Macquarie University provides a range of Academic Support Services. Details of these and other services for students can be accessed at [http://www.student.mq.edu.au](http://www.student.mq.edu.au).

**BESS.** Business and Economics Student Services (BESS) is located in room E4B106. In this unit, assignment and class test will be returned via BESS.
**Consultation room.** Consultation sessions with tutors will be held in the FBE Consultation Room E4B 104. The consultation times will be confirmed on the website and in the lectures.

**IT CONDITIONS OF USE**

Access to all student computing facilities within the Faculty of Business and Economics is restricted to authorised coursework for approved units. Student ID cards must be displayed in the locations provided at all times.

Students are expected to act responsibly when utilising University IT facilities. The following regulations apply to the use of computing facilities and online services:

- Accessing inappropriate web sites or downloading inappropriate material is not permitted. Material that is not related to coursework for approved unit is deemed inappropriate.
- Downloading copyright material without permission from the copyright owner is illegal, and strictly prohibited. Students detected undertaking such activities will face disciplinary action, which may result in criminal proceedings.

Non-compliance with these conditions may result in disciplinary action without further notice.

Students must use their Macquarie University email addresses to communicate with staff as it is University policy that the University issued email account is used for official University communication.