

MACQUARIE UNIVERSITY
Division of Economic & Financial Studies
Department of Actuarial Studies
ACST200/851 – MATHEMATICS OF FINANCE
Unit Outline – 1st Semester 2008

Unit convenor: Jim Farmer

ACST200 Prerequisites: ACST101(Cr) and {MATH133(P) or (MATH136(P) pre-2008)} and GPA of at least 2.50.

ACST851 Prerequisites: Nil.

Corequisites: Nil

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 lecturer at one of the Week 1 Lectures.

1 About this Unit

Much of the work that actuaries do involves long term financial problems. For any problem spanning more than a few months, the effects of compound interest are significant. This unit is a study of compound interest, with a few very brief diversions into alternative systems of interest. As far as possible, the examples considered are real life problems, though in some cases we deliberately simplify scenarios so that we can concentrate on the interesting maths rather than getting slowed down by fiddly details.

2 Teaching Staff

The unit convenor and lecturer, Jim Farmer, can be contacted via the unit's web site. Questions about the unit material should be placed in the Discussion Area. Administrative questions which have not already been answered in this document or the Student Guide should be sent to the "Administration Inquiries" account using the mail tool in the unit's web site. Tutors cannot be contacted other than at tutorials.

3 Classes

Class times can be found at: <http://www.timetables.mq.edu.au/>

4 Textbooks

No textbooks are prescribed for this unit. It is recommended that you purchase the "ACST200/851 Unit Notes" from the University Co-Op Bookshop.

5 Unit Web Site

The unit web site can be accessed via the logon facility at <http://learn.mq.edu.au>

6 Unit Objectives – Learning Outcomes

By the end of the unit you should be able to demonstrate competence in the range of techniques described in the unit notes and lectures. Ideally you will be able to demonstrate an understanding of the techniques rather than simply demonstrating the ability to rote learn formulae without understanding. You should also be able to demonstrate ethical behaviour by complying with examination rules and by not colluding on assessment tasks.

In addition to the discipline-based learning objectives, all academic programs at Macquarie seek to develop students' generic skills in a range of areas. In this unit students may develop their written communication skills and problem-solving skills.

7 Teaching and Learning Strategy

This unit is taught via lectures and tutorials. However, a significant amount of the lecture time will be spent on attempting problems. The emphasis is on learning by doing.

8 Assessment

Macquarie University uses the grades HD, D, Cr, P, PC and F for grading the achievements of students in units of study. The meaning of each symbol is explained in Section 10 of the Bachelor Degree Rules in the Macquarie University Handbook of Undergraduate Studies and in Section 7 of the Rules for the Degree of Master by Coursework in the Handbook of Postgraduate Studies. The handbooks are available online at <http://www.handbook.mq.edu.au>

The numerical marks resulting from assessment of your work in this unit will be used as an initial indicator of the quality of your learning and understanding. The use of these numerical marks is, however, only a starting point in determining the appropriate grade. To obtain a grade you must satisfy the qualitative definition of that grade. Once your grade has been determined, you are allocated a standardised mark in the appropriate range for that grade indicating your approximate position amongst students assigned that grade. This standardised mark is not your raw mark.

The following table gives an indication of the relative weighting of the assessment components. To pass the unit, you must pass the final exam as well as passing on the combined weighting shown below.

Quizzes	10%
Examination	90%

9 Student Support Services

Besides the general services available (see below), the Division of Economics and Financial Studies offers the following:

ERIC: EFS Resource and Information Centre. http://www.efs.mq.edu.au/student_support/eric

10 Weekly Table of Topics

Some reordering of topics has been necessary to accommodate the public holidays.

Week	Week Begins	Topics Covered
1	25 Feb	1. Compound Interest & Discount; Forces of Interest
2	3 March	2. Inflation and Capital Gains Tax 3. Level Annuities
3	10 March	4. Varying Annuities
4	17 March	7. Unit Pricing Systems (Friday public holiday)
5	24 March	5. Loans (Monday public holiday)
6	31 March	6. Bonds
7	7 April	8. Yields on funds 9. Project Appraisal
2-week study break		
8	28 April	10. Yield Curves
9	5 May	11. Forward Contracts

10	12 May	12. Bond Statistics
11	19 May	13. Immunisation
12	26 May	14. Stochastic Models
13	2 June	

11 Detailed Topic List

Compound interest; effective and nominal interest and discount rates; force of interest; accumulating and discounting at discretely changing and continuously changing interest rates; discrete and continuous cash flows; continuously removed interest.

Inflation; CPI; capital gains tax based on real and nominal gains.

Level annuities; $a_{\overline{n}|}, \ddot{a}_{\overline{n}|}, \bar{a}_{\overline{n}|}$ and corresponding perpetuities; $s_{\overline{n}|}, \ddot{s}_{\overline{n}|}, \bar{s}_{\overline{n}|}$; $a_{\overline{n}|}^{(p)}, \ddot{a}_{\overline{n}|}^{(p)}, s_{\overline{n}|}^{(p)}, \ddot{s}_{\overline{n}|}^{(p)}$; limit properties linking these to continuous annuities; dealing with changing interest rates; use of $\frac{i}{i^{(p)}}$, $\frac{i}{d^{(p)}}$ and $\frac{i}{\delta}$ factors to adjust timing of cash flows.

Varying annuities; $(Ia)_{\overline{n}|}, (I\ddot{a})_{\overline{n}|}, (I\bar{a})_{\overline{n}|}, (\bar{I}\bar{a})_{\overline{n}|}, (Is)_{\overline{n}|}, (I\ddot{s})_{\overline{n}|}, (I\bar{s})_{\overline{n}|}, (\bar{I}\bar{s})_{\overline{n}|}$; Geometrically varying annuities.

Loans; Interest only loans; Reducible Rate loans; Loan repayment schedules; Finding instalments and loan outstanding; dealing with changes in interest rates by adjusting repayments or by adjusting the term of the loan.

Bonds: Face value, coupon rate, valuing with and without allowance for tax; indexed (capital) bonds; purchasing cum and ex interest.

Unit pricing systems; income-inclusive vs income distributing; calculation of unit price for a simple income-inclusive fund.

Yields on Funds; money weighted rates of return and time weighted rates of return; calculation from accounts and from unit-pricing system data; Hardy's formula; linked rates of return.

Project Appraisal; IRR; NPV; discounted payback period; problems involving different interest rates on loans and deposits; unique or multiple solutions for IRR; deficiencies of IRR for project assessment.

Yield Curves; spot rates and forward rates; calculations using the no-arbitrage assumption; valuation of bonds using spot rates; spot rate yield curve; yield to maturity yield curve; par bond yield curve;

Forward contracts; derivation of formula for the forward price & the value of an existing contract under the no-arbitrage assumption; allowance for fixed dollar income on the security prior to delivery date; assumptions and limitations of the no-arbitrage model.

Bond statistics; discounted mean term; duration; volatility; modified duration and formulae linking them. Convexity and Spread. Theoretical definitions and practical approximations.

Immunisation: Absolute immunisation and Redington immunisation; derivation of formula and worked examples with fixed and certain liabilities and government bonds.

Stochastic Models; derivation of mean and variance of accumulation of a single cash flow and of a level annuity; application of the lognormal distribution; simulation.

12 EXAMINATIONS:

The University Examination periods are from 11/6/08 to 27/6/08, and from 19/11/08 to 5/12/08. 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>

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. Information about unavoidable disruption and the special consideration process is available at: <http://www.reg.mq.edu.au/Forms/APSCon.pdf>

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.

You are advised that it is Macquarie University policy not to set early examinations for individuals or groups of students. All students are expected to ensure that they are available until the end of the teaching semester, that is, the final day of the official examination period.

No aids, other than a pen and pencil, may be brought into an exam *unless specifically permitted by the Convenor*. The following are expressly forbidden: mobile phones, calculators, computers, I-pods, PDAs, MP3s and any other electronic aid, and books.

13 PLAGIARISM AND CHEATING:

The University defines plagiarism in its rules: "Plagiarism involves using the work of another person and presenting it as one's own." Plagiarism is a serious breach of the University's rules and carries significant penalties. You must read the University's practices and procedures on plagiarism. These can be found in the *Handbook of Undergraduate Studies* or on the web at: <http://www.student.mq.edu.au/plagiarism/>

The policies and procedures explain what plagiarism is, how to avoid it, the procedures that will be taken in cases of suspected plagiarism, and the penalties if you are found guilty. Penalties may include a deduction of marks, failure in the unit, and/or referral to the University Disciplinary Committee.

Plagiarism is simply a type of cheating. Any confirmed cheating may result in serious penalties, including deduction of marks, failure in the unit, and/or referral to the University Disciplinary Committee.

14 UNIVERSITY POLICY ON GRADING:

Academic Senate has a set of guidelines on the distribution of grades across the range from fail to high distinction. Your final result will include one of these grades plus a standardized numerical grade (SNG).

On occasion your raw mark for a unit (i.e., the total of your marks for each assessment item) may not be the same as the SNG which you receive. Under the senate guidelines, results may be scaled to ensure that there is a degree of comparability across the university, so that units with the same past performance of their students should achieve similar results.

It is important that you realise that the policy does not require that a minimum number of students are to be failed in any unit. In fact it does something like the opposite, in requiring examiners to explain their actions if more than 20% of students fail in a unit.

The process of scaling does not change the order of marks among students. A student who receives a higher raw mark will also receive a higher final scaled mark.

For an explanation of the policy see:

<http://www.mq.edu.au/senate/MQUonly/Issues/Guidelines2003.doc> or

<http://www.mq.edu.au/senate/MQUonly/Issues/detailedguidelines.doc>

The standard grading scheme is:

0 – 45	Fail
46 – 49	Pass Conceding*
50 – 64	Pass
65 – 74	Credit
75 – 84	Distinction
85 – 100	High Distinction

* when this subject is not a prerequisite for later units.

15 STUDENT SUPPORT SERVICES:

Macquarie University provides a range of Academic Student Support Services. Details of these services can be accessed at <http://www.student.mq.edu.au>

16 CLASSROOM ETIQUETTE

Students are expected to arrive on time, certainly before five minutes past the hour, and not to leave until the class ends. If you have a recurring problem that makes you late, or forces you to leave early, have the courtesy to discuss this with your lecturer/tutor.

Students are expected to be quiet during lectures unless, of course, class participation is required.

Mobiles should be turned off during classes; not simply set to “silent”.