



Australian
National
University

**School of Finance, Actuarial Studies and Applied
Statistics**

**STAT4031/STAT8040
STAT4032A/STAT8041A
STAT4032B/STAT8041B**

**Actuarial Control Cycle
&
Investment and Asset Modelling**

Semester 2, 2011

**Lecturers:
David Service / Bridget Browne**

**STAT4031/STAT8040
STAT4032A/STAT8041A
STAT4032B/STAT8041B**

**ACTUARIAL CONTROL CYCLE
&
INVESTMENT and ASSET MODELLING**

Introduction

Part II of the Institute of Actuaries of Australia's Fellowship requirements comprises Part IIA - the Actuarial Control Cycle - and Part IIB - Investment and Asset Modelling.

At ANU Part IIA - the Actuarial Control Cycle - comprises STAT4031/STAT8040 - offered in first semester, and STAT4032A/STAT8041A offered in Second Semester. Part IIB - Investment and Asset Modelling - comprises STAT4032B/STAT8041B - offered in Second Semester. For the purposes of ANU degrees STAT4032A/STAT8041A and STAT4032B/STAT8041B together comprise one subject and a single grade will be given for the combination. Each unit will provide 50% of the overall grade.

For the purposes of the Institute exemptions the achievement of a satisfactory standard (see below) across the combination of all three units - STAT4031/STAT8040, STAT4032A/STAT8041A and STAT4032B/STAT8041B - will give an exemption from Part II.

Syllabii

Part IIA

1. Discuss and apply an actuarial control cycle in a variety of practical commercial situations
2. Relate the main features within the general environment to medium and long-term commercial decisions
3. Analyse the main features of the financial services marketplace including products and distribution channels
4. Examine the need for, and impact of, regulation and government policy on medium and long-term commercial decisions
5. Understand and apply an enterprise risk management framework to identify and assess the risks in a range of situations
6. Select and build an appropriate model to solve client problems
7. Discuss and apply the process of product design
8. Monitor and assess experience
9. Determine an appropriate assumption set
10. Apply the tests of professionalism
11. Recognise the importance of capital
12. Apply relevant approaches and techniques to the valuation of liabilities
13. Measure, report and manage solvency
14. Understand the methods and implications of various approaches to profit measurement
15. Apply appropriate techniques to the pricing of products and contracts
16. Manage the business and respond to the experience
17. Understand the calculation of appraisal values

Part IIB

1. Demonstrate an understanding of the characteristics, returns and risk factors of the different types of investment
2. Apply the methods used for the valuation of investments
3. Develop an understanding of the major economic, financial and practical theories relevant to investment
4. Describe the characteristics and limitations of the major actuarial stochastic investment models
5. Derive relevant assumptions for each of these models
6. Understand the impact of the liabilities on investment objectives and constraints
7. Formulate an appropriate investment strategy for a given liability portfolio
8. Discuss the practical implementation of investment strategy

The full, detailed syllabii for the whole Part II course are attached.

Assessment

The assessment for each unit is as follows

	STAT4031 STAT8040	STAT4032A STAT8041A	STAT4032B STAT8041B
Examination	75%	80%	80%
Assignment 1	10%	20%	20%
Assignment 2	15%	N/A	N/A

The examination arrangements are as follows

	STAT4031 STAT8040	STAT4032A STAT8041A	STAT4032B STAT8041B
Duration	3 hours	2 hours	2 hours
Location	PC Lab	Normal exam room	PC Lab

All examinations take place at the end of the semester. There are no mid-semester examinations.

The assignment lengths are as follows

	STAT4031 STAT8040	STAT4032A STAT8041A	STAT4032B STAT8041B
Assignment 1	2000 words	3000 words	3000 words
Assignment 2	3000 words	N/A	N/A

The topic and due date for each assignment are shown later in this document.

Assignment Submission

Assignments **MUST** have a completed cover page. An assignment submitted without a cover sheet will NOT be marked. All assignments are to be submitted electronically through Wattle.

Each assignment has a due date. Assignments which are submitted after the due date will suffer a penalty of a deduction of 10% of the maximum marks available for that assignment PLUS another 5% for each working day late. After 10 working days late the assignment will not be marked.

Applications may be made for extensions of the due date in the event of material and unforeseen events. Workload in other courses or paid employment are not acceptable reasons for an extension!

Important note regarding assessment

Your final mark for the course will be based on the above assessment formulae. However, your mark **will not** be the same number as produced by that formula, as scaling of marks will be necessary to obtain an appropriate distribution of grades relative to other Graduate subjects. The scaling applied will preserve the order of marks i.e. if your raw mark exceeds that of another student, then your scaled mark will exceed the scaled mark of that student, and may be either up or down.

Exemption Standard

The standard for exemptions from the Institute Part II is achievement of a weighted Distinction grade average over the combination of each of the three units STAT4031/8040, STAT4032A/8041A and STAT4032B/8041B. The weights will be

STAT4031/8040 50%,
STAT4032A/8041A 25%
STAT4032B/8041B 25%

If one unit is a Fail no exemption will be granted. If one unit is less than a Distinction then exemption will be granted provided the weighted average scaled mark over all units is not less than 70 (the Distinction standard) and the lowest scoring unit has a scaled mark no less than 60.

Communication with students

Email If necessary, the lecturers and tutors for this course will contact students electronically using their official ANU student email address.

Announcements Students are expected to check the Wattle site for announcements about this course, e.g. changes to timetables or notifications of cancellations. Notifications of emergency cancellations of lectures or tutorials will be posted on the door to the relevant room.

Lecturer Contact **David Service** is available on Thursdays and Fridays. It is best to email to make an appointment.

david.service@anu.edu.au

His office is Building 26C Room 3.04

Phone 02 6125 4908

Bridget Browne is available Monday, Wednesday, Thursday and Friday. It is best to email to make an appointment

bridget.browne@anu.edu.au

Her office is Building 26C Room 3.58

Phone 02 6125 7373

STAT4032A/STAT8041A
Semester Two

STAT4032A/STAT8041A Semester 2 Program

Week	Date	Type	Syllabus Item	Details
1	29 Jul	Lecture	11	Capital
2	5 Aug	Lecture	12	Liabilities
3	12 Aug	Lecture	12	Liabilities
4	19 Aug	Lecture	13	Solvency
5	26 Aug	Lecture	13	Solvency
6	1 Sep	Lecture	14	Profit Measurement
7	9 Sep	Lecture	15	Pricing
8	30 Sep	PC LAB	15	Pricing
9	7 Oct	Lecture	16	Manage the Business
10	14 Oct	PC LAB/CS	15	Pricing
11	21 Oct	CASE STUDY	16	Manage the Business
12	28 Oct	Lecture	17	Appraisal Values
13	4 Nov	Lecture	ALL	Review

STAT4032A/STAT8041A Lecture Times

The lectures and case studies take place on Friday 3pm to 5pm. (except 1 September: Thursday) in CBE LT 4. The location of the PC Lab sessions is COP G21.

Reading List

Relevant reading material will be distributed – via Wattle - during the semester.

STAT4032A/STAT8040A Assignment

Assignment 1

3000 words

Due: 13 September 2011 9:00am

APRA is currently undertaking a review of regulatory capital standards for Australian life and general insurers. You are a valuation actuary working for EITHER a life insurance company OR a general insurance company. Your manager has asked you to prepare a report that:

1. Compares and contrasts the current and proposed standards as they apply specifically to your organization.
2. Broadly estimates the impact of the changes, justifying your estimates throughout.
3. Recommends potential appropriate changes to the capital structure of your organization should the proposed standards come into force as planned and considering your estimates in 2. above.

In order to do this, you will refer to the information provided for your chosen entity (EITHER the life insurance company OR the general insurance company) as well as the other information provided in the STAT4032A Assignment 1 pack on the Wattle site.

STAT4032B/STAT8041B
Semester Two

STAT4032B/STAT8041B
Semester 2 Program

Week	Date	Type	Syllabus Item	Details
1	28 Jul	Lecture	1	Investment Characteristics
2	4 Aug	Lecture	2	Valuation
3	11 Aug	Lecture	3	Investment Theories
4	18 Aug	Lecture	3	Investment Theories
5	25 Aug	Lecture	4	Stochastic Investment Models
6	2 Sep	Lecture	5	Model Assumptions
7	8 Sep	Lecture	6	Impact of Liabilities
8	29 Sep	Lecture	7	Investment Strategy
9	6 Oct	PC LAB/CS	6	Model Assumptions
10	13 Oct	PC LAB	7	Investment Strategy
11	20 Oct	PC LAB/CS	7	Investment Strategy
12	27 Oct	Lecture	8	Implementation
13	3 Nov	Lecture	ALL	Review

STAT4032B/STAT8041B Lecture Times

The lectures and case studies take place on Thursday 3pm to 5pm in CBE LT4 (except 2 September: Friday). The location of the PC Lab sessions is COP G21.

Reading List

Fitzherbert R. Investment Principles for Actuaries

This publication is available from the Institute of Actuaries of Australia.

Other relevant reading material will be distributed – via Wattle - during the semester.

STAT4032B/STAT8040B Assignment

Assignment 1

3000 words

Due: 5 October 2011 9:00am

Over the 45 years ending December 2010 Warren Buffett (Berkshire Hathaway) has achieved a compound, after-tax, rate of return in excess of 20% p.a. Such consistent, long term, outperformance might be viewed as incompatible with modern finance theory.

Discuss the Berkshire Hathaway phenomenon in the context of modern finance theory dealing with both those parts of the theory which are supported by the Berkshire Hathaway phenomenon and those which are contradicted by it.

Buffet's response to the "global financial crisis" and other market crises is a relevant consideration.

Detailed Syllabi

PART IIA - Actuarial Control Cycle - Syllabus

1. Discuss and Apply an Actuarial Control Cycle in a Variety of Practical Commercial Situations

- a) Identify the elements of the Control Cycle and how the elements interrelate in an actuarial context
- b) Recognise the various stakeholders involved in a variety of situations involving medium and long-term commercial decisions and demonstrate how the use of the Control Cycle can add value in resolving issues between the stakeholders
- c) Demonstrate how the Control Cycle can be applied in a variety of practical commercial situations

2. Relate the Main Features within the General Environment to Medium and Long-Term Commercial Decisions

- a) Interpret how the present economic conditions and the social, demographic, and economic trends within a community can affect medium and long-term commercial decisions
- b) Discuss the impact of technological changes on the economic environment

3. Analyse the Main Features and Risks of the Financial Services Marketplace Including Products and Distribution Channels

- a) Discuss the needs of consumers that are met by financial products and the major considerations which providers need to assess to meet these objectives
- b) Identify the main features and objectives of consumer protection requirements and relate these to the responsibilities of both consumers and providers
- c) Identify the main features of commonly available financial services and risk based products, and differentiate the advantages and disadvantages, including the financial, business and political risks, of each contract to the provider and the consumer
- d) Distinguish the main forms of distribution for financial services products, and interpret the impact of varying distribution channels on the development and management of products
- e) Identify the range of marketing strategies available to financial services institutions, and discuss the effect that alternative marketing strategies may have on the quality and quantity of business generated
- f) Identify and discuss how these concepts apply to products and contracts other than financial services

4. Examine the Need for, and Impact of, Regulation and Government Policy on Medium and Long-Term Commercial Decisions

- a) Identify and examine the roles and objectives of regulators and of Government policymakers
- b) Examine the implications of the main features of legislation and the regulatory taxation framework which affect medium and long-term commercial decisions
- c) Explain the statutory roles of actuaries and other independent professionals, and their interactions

5. Understand and Apply an Enterprise Risk Management Framework to Identify and Assess the Risks in a Range of Situations

- a) Define Enterprise Risk Management (ERM) and describe how an organisation's culture impacts its approach to ERM
- b) Discuss the importance of having a risk management framework that is understood by all within the organisation
- c) Explain how ERM is managed at all levels within an organisation
- d) Outline how to determine the level of risk that is acceptable/optimal for a business
- e) Demonstrate an understanding of the tradeoff between risk and reward
- f) Use various analyses to identify the risks that count to an organisation
- g) Apply the actuarial control cycle to enterprise risk
- h) Relate the concept of financial risk evaluation to a range of financial products, with particular reference to assets in isolation (eg derivatives), liabilities in isolation (eg reinsurance) and asset-liability management, from the point of view of the provider and the consumer
- i) Demonstrate an understanding of the considerations which need to be taken into account in the decision of accepting, transferring or rejecting risk, including the availability of capital
- j) Examine the importance of quality data in the assessment of risks, and identify checks that could be used
- k) Explain the major risks faced by the long-term insurer, identify factors that are likely to affect their future experience and how they may be handled
- l) Examine the effect of variations in the major areas of risk and uncertainty faced by general insurers, and how they may be handled
- m) Describe the operation of the main types of reinsurance
- n) Explain the major risks faced by employers and members of defined benefit and defined contribution superannuation plans, and how they may be handled
- o) Demonstrate an understanding of the impact of guarantees and options on the risks faced by providers, and how they may be handled
- p) Identify the principles of project management, including verification of client needs and ongoing communication

6. Select and Build an Appropriate Model to Solve Client Problems

- a) Identify the objectives of building a model for the management of risk based and other financial products, from the perspective of users and other stakeholders
- b) Describe the basic features of commonly used models, and discuss their limitations in terms of achieving the objectives of the modelling exercise
- c) Critically examine the data available for constructing a model, and identify shortcomings
- d) Identify the parameters required for a model, and the assumptions inherent in the model
- e) Examine the interrelationships between the parameters and assumptions within the model, and the way in which the model objectives affect the choice of these parameters and assumptions
- f) Explain the need for assessing the sensitivity of the results to changes in the major assumptions, and demonstrate an understanding of how the results from models are influenced by its assumptions
- g) Discuss the strengths and weaknesses of stochastic and deterministic models, and identify situations to which each may be well-suited
- h) Analyse the choice of a model for use in solving particular problems in a range of areas

- i) Demonstrate an ability to build a model appropriate for a typical financial services business problem

7. Discuss and Apply the Process of Product Design

- a) Outline and relate the factors to consider in determining a suitable design for a range of financial products, including new contracts for life insurance, general insurance and the design of superannuation plans, from perspectives of the major stakeholders
- b) Examine the interaction between the different disciplines in a product development process, including finance, sales and marketing, and compliance
- c) Outline the protections available to consumers of financial products, including insurance and wealth creation products
- d) Describe the purpose and process of risk assessment (underwriting), the impact of adverse selection, and examine its role in financial product design
- e) Explain the concept of Policyholder Reasonable Expectations and how these can be managed
- f) Examine particular issues which need to be taken into consideration in the design of group financial products, in contrast to individual financial products
- g) Demonstrate an understanding of the interests of various stakeholders, and the ability to communicate and verify this understanding

8. Monitor and Assess Experience

- a) Identify the need for experience to be monitored, and the critical elements of experience relevant to particular products or entities
- b) Identify appropriate measures of experience
- c) Undertake an experience analysis
- d) Examine the practical issues involved, including data difficulties
- e) Explain the need for analysis of the financial impact of experience and its place in the Control Cycle
- f) Identify the items of such analysis relevant to particular products or entities
- g) Undertake an analysis of the financial impact of experience in a simplified situation
- h) Examine the practical issues involved, including the use of approximations
- i) Explain how returns on asset portfolios should be monitored and assessed, including the appropriate usage of the different methods of calculating returns, performance attribution to asset classes and security selection, and analysis of risk
- j) Demonstrate how to monitor the ongoing validity of the strategic asset allocation adopted in light of experience
- k) Discuss and apply criteria by which the success of the investment decision can be assessed over time, and identify how the asset liability monitoring process can be used to benefit the investment decision process

9. Determine an Appropriate Assumption Set

- a) For each assumption used in the modelling process, specify the information required, explain its relevance, examine problems that may arise in obtaining the required information, including difficulties with data, and explain how these issues may be addressed in determining the appropriate assumption
- b) Recognise the issues arising when assumptions are determined on a regular cycle rather than at a single point
- c) Demonstrate an understanding of the need for internal consistency between the individual assumptions in an assumption set
- d) Determine an appropriate assumption set in a variety of practical situations

10. Apply the Tests of Professionalism

- a) Identify the principles of professionalism and relate them to the actuarial profession
- b) Outline the main features and functions of the professional association, its code of conduct, professional standards and major guidance notes
- c) Discuss the responsibilities of actuaries individually and in statutory roles
- d) Demonstrate an understanding of the need for, and application of, materiality and peer review
- e) Identify situations where actuarial expertise may be insufficient, and analyse what consequent actions might then be appropriate

11. Recognise the Importance of Capital

- a) Discuss the importance of capital for different types of entities
- b) Recognise the ongoing need for capital, and how to project future levels of capital
- c) Identify risks to the level of capital and apply risk based capital methodologies
- d) Demonstrate an understanding of the interaction between the management of risk and capital requirements

12. Apply Relevant Approaches and Techniques to the Valuation of Liabilities

- a) Compare and contrast the different purposes for which a valuation of liabilities may be needed
- b) Relate data requirements, specification, verification, correction and materiality to the purpose of the valuation of liabilities
- c) Discuss and apply the major criteria in the selection of discount factors
- d) Explain the need for assessing sensitivities and reasonableness of the valuations, identifying the major drivers of change, both at a point in time and over time, and how these may be communicated
- e) Examine the issues in spreading the cost for commitments, such as defined benefit superannuation, where costs are being met over a period, and describe, in broad terms, the techniques used
- f) Explain how guarantees and other options for long-term products can be incorporated in the valuation of liabilities
- g) Apply the valuation of liabilities in a variety of practical situations

13. Measure, Report and Manage Solvency

- a) Compare and contrast the different purposes for which a comprehensive valuation of liabilities and assets may be needed, including the various purposes for which these values might be reported
- b) Recognise alternative measures of solvency with reference to assets and liabilities
- c) Describe the different approaches to dealing with uncertainty in measuring liabilities and assets, including the difficulties of placing a value on risk
- d) Understand the approaches adopted by APRA in respect to solvency of the institutions whom they regulate
- e) Discuss the interaction between solvency, best estimates of liabilities, prudential margins and release of profit
- f) Discuss how consumers can be protected from the effects of insolvency, including the role of regulators, professions and guarantee schemes
- g) Identify the issues involved in dealing with insolvency/“winding-up”
- h) Communicate valuation methodology and results to stakeholders

14. Understand the Methods and Implications of Various Approaches to Profit Measurement

- a) Discuss the different approaches which are used to measure profit
- b) Relate the interaction between the valuation process and the timing of release of profit
- c) Describe, in broad terms, techniques used to manage the release of profit on ongoing contracts
- d) Communicate the results to stakeholders

15. Apply Appropriate Techniques to the Pricing of Products and Contracts

- a) Discuss the general objectives of pricing for each stakeholder, and examine the interrelationship of their particular needs and requirements
- b) Describe and apply processes for setting margins (either implicit or explicit) which may be used in the pricing process
- c) Describe the role of profit testing and its relationship with the desired return on capital invested
- d) Apply the pricing process in a variety of practical situations

16. Manage the Business and Respond to the Experience

- a) Discuss how changes in experience impact on the management of businesses
- b) Outline ways of responding to the experience, other than distribution of surplus
- c) Explain the issues of distribution of surplus, including equity, solvency and practicality
- d) Apply methodologies for allocating investment return to individual accounts, for both unitised and non-unitised products, and discuss the issues which arise in practice
- e) Discuss appropriate ways of allocating profit for an insurer and achieving equity between different groups of policyholders and shareholders
- f) Examine the methods available to handle surpluses or deficits within superannuation plans and achieving equity between groups of members
- g) Discuss management processes such as claims control, expenses control, financial control systems and audit controls

17. Appraisal Values

- a) Calculate embedded value and appraisal values
- b) Discuss the uses of these measures of profitability and value

PART IIB - Actuarial Control Cycle - Syllabus

- 1. Demonstrate an Understanding of the Characteristics, Returns and Risk Factors of the Different Types of Investment**
 - a) Explain the characteristics of each of the different types of investment
 - b) Explain the returns expected of different investment types under different economic conditions
 - c) Demonstrate an understanding of the risk factors, including issuer default, counterparty failure, systemic liquidity, the collapse of speculative bubbles, shocks to the system and cyclical/structural changes for each type of investment

- 2. Apply the Methods Used for the Valuation of Investments**
 - a) Describe the principles, implicit assumptions and limitations of the main methods used to value the common forms of debt, equity, property and derivative securities
 - b) Determine the data required to perform a valuation of each type of investment

- 3. Develop an Understanding of the Major Economic, Financial and Practical Theories Relevant to Investment**
 - a) Develop an understanding of the application and limitations of the major economic, financial and practical theories relevant to investment
 - a. modern portfolio theory,
 - b. the efficient market hypothesis
 - c. the capital asset pricing model,
 - d. multi-factor pricing models,
 - e. theories from behavioural finance
 - f. fundamental analysis
 - g. technical analysis - “charting”
 - h. fractal finance
 - b) Critically evaluate each of these theories and discuss the evidence for and against the validity of each one

- 4. Describe the Characteristics and Limitations of the Major Actuarial Stochastic Investment Models**
 - a) Describe the characteristics of each of the major actuarial stochastic investment models
 - a. random walk
 - b. Wilkie
 - c. ERCH
 - d. regime switching
 - b) Understand the differences in structure and implicit assumptions between each of the models
 - c) Critically evaluate the suitability of each model for a given context
 - d) Understand the “success” of each model’s past predictions against the actual outcomes

- 5. Derive Relevant Parameters for each of these Models**
 - a) Demonstrate the ability to select the appropriate data
 - b) Derive parameters from this data which is consistent with the structure, characteristics and implicit assumptions of each model

6. Understand the Impact of the Liabilities on Investment Objectives and Constraints

- a) Describe the needs of different investors in terms of the role of liabilities, the attitude to risk, liquidity requirements and any gearing restrictions, taxation and regulatory constraints that should be taken into account in establishing an investment strategy
- b) Determine investment objectives and material constraints based on the nature of the liabilities

7. Formulate an Appropriate Investment Strategy for a Given Liability Portfolio

- a) Demonstrate the ability to optimise asset/liability matching to achieve the best match of durations, investment returns and volatility constraints
- b) Manage the relationship between this optimisation and the availability of capital and other constraints
- c) Formulate a strategic asset allocation, including using an asset liability model where appropriate
- d) Examine the imperfections and compromises of the model and the process

8. Discuss the Practical Implementation of Investment Strategy

- a) Discuss the practical implementation of investment strategy, including manager selection, the roles of major stakeholders (fund managers, custodians, etc), performance measurement, manager replacement in the process.
- b) Determine the relevant constraints on manager freedom