

Course ID 026696

## Contingencies 2

Unit coordinator: Jonathan Ferns

**MATH 39522**

**Credit rating 10**

*ECTS credits 5*

**Semester 2**

**School of Mathematics**

*Undergraduate*

**Level 3**

*FHEQ level 'Last part of a Bachelors'*

### **Marketing course unit overview**

This unit is a continuation of MATH20962 (Contingencies 1) and covers the remaining part of the material required in subject CT5 of the Actuarial Profession's examinations.

In Contingencies 1 we looked at one life who may be in one of two states, alive or dead.

In Contingencies 2 we will consider assurances and annuities where payments are contingent on the lives of two people (e.g. an assurance that pays out when the second of two people dies or an annuity that only pays if two people are both alive). We will also consider models with more than two states (e.g. (i) alive and healthy or (ii) alive but ill or (iii) dead).

We will also look again at the recursive formula which links reserves but, in Contingencies 2, will use this to analyse profits. We will finally study mortality a bit more.

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### **Aims**

Provide further mathematical instruction in models using cashflows which depend upon survival, death and other uncertain factors.

### **Learning outcomes**

Appreciate how the techniques from Contingencies I can be extended to the survival of either or both of two lives.

Be familiar with the concept of competing risks (e.g. retirement and death) and how these can be the subject of a Markov Model.

Understand the techniques involved in discounting emerging costs.

Appreciate the heterogeneous factors affecting mortality.

Carry out calculations involving joint lifetime random variables and functions and last survivor lifetime random variables.

Model healthy-ill active-retired-dead or schemes.

Carry out calculations using multiple-decrement tables.

## Syllabus

This unit explores some further simple financial topics from a mathematical point of view.

1. Annuities and Assurances involving two lives. Single and joint life function. Last survivor functions. Present values of joint life and last survivor annuities, contingent assurances , reversionary annuities and annuities payable m times per year. [5 lectures]

2. Competing Risks. Multiple State modelling. Valuing benefits contingent upon competing risks. [3 lectures]

3. Multiple decrement tables and their relationship to single decrement tables. [2 lectures]

Multiple decrement service tables. Salary-related pensions benefit and contributions. Non-life contingencies [4 lectures]

Discounted emerging cost techniques. Unit-linked contracts. Expected cashflows. Profit tests and profit criteria. Product pricing [4 lectures]

Determining reserves by zeroising negative cashflows [2 lectures]

4. heterogeneity. Factors affecting mortality, selection and the need for different mortality tables. Risk-classification. Single figure indices. [2 lectures]

## Assessment methods

Other	20%
Written exam	80%

Two pieces, one coursework worth 10% and the second, a short test under examination conditions, also worth 10%.End of semester examination: two hours weighting 80%

## Feedback methods

Tutorials will provide an opportunity for students' work to be discussed and provide feedback on their understanding.

## Requisites

MATH20962	Contingencies 1 - Actuarial Science	Pre-Requisite	Compulsory
MATH39522	pre-requisites		

**Available as free choice?** N

**Recommended reading**

- Subject CT5 Contingencies Produced by the Actuarial Profession.
- D.C.M Dickson, M.R Hardy and H.R Waters, Actuarial Mathematics for Life Contingencies.
- Actuarial Mathematics N.L. Bowers, H.U. Gerber and J.C. Hickman, Society of Actuaries, 1997.

**Scheduled activity hours**

Lectures	22
Tutorials	22

**Independent study hours** 56 hours*Version Nbr 010.0.0*