

# Actuarial Mathematics II

## MTH5125

### Introduction

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Spring Term

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- ▶ Textbooks
  - ▶ Dickson, D., Hardy, M. and H. Waters: Actuarial Mathematics for Life Contingent Risks, 3rd edition, Cambridge University Press
  - ▶ Solution Manual for Actuarial Mathematics for Life Contingent Risks
- ▶ Lecture Slides, Exercises, Case Studies posted on QMPlus

# Administrative Issues

- ▶ 70%: Examination in May/June
- ▶ 30%: Two Assessments
  - ▶ set in Week 6 and Week 9
  - ▶ analytical and Excel questions

# What will we study?

- ▶ Actuarial mathematics that underlies the operation of a life assurance company.
- ▶ For a range of different types of insurance policy:
  - ▶ How premiums are calculated
  - ▶ What reserves the insurance company should hold
  - ▶ How profits can be measured
- ▶ More complicated policies that depend on the mortality/survival of two lives
- ▶ Introduction to actuarial mathematics used in pensions and in health insurance
- ▶ Policies where amount assured depends on investment returns.

- ▶ Some revision from Actuarial Maths 1
- ▶ Premiums and Reserves
- ▶ Multiple Transitions
- ▶ Multiple Decrements

- ▶ Two Lives Functions
- ▶ Projected Future Cashflow Techniques
- ▶ Unit Linked Reserves

An *insurance contract* is an agreement between two parties:

- ▶ the insurer agrees to pay for insurance benefits;
- ▶ in exchange for insurance premiums to be paid by the insured.



An insurance policy is funded by contract premiums:

- ▶ once (single premium) made usually at time of policy issue, or
- ▶ a series of payments (usually contingent on survival of policyholder) with first payment made at policy issue

*Premiums* need to to cover:

- ▶ the benefits,
- ▶ expenses associated with initiating/maintaining contract,
- ▶ profit margins, and
- ▶ deviations due to adverse experience.

*Net premiums* (called also benefit premiums)

- ▶ considers only the benefits provided
- ▶ nothing allocated to pay for expenses, profit or contingency margins

*Gross premiums* (called also expense-loaded premiums)

- ▶ cover the benefits and includes expenses, profit or contingency margins

Peter Drucker, *The Economist*, 1999

*By providing financial protection against the major 18th and 19th century risk of dying too soon, life assurance became the biggest financial industry [...] Providing financial protection against the new risk of not dying soon enough may well become the next century's major and most profitable financial industry.*

## How to set up premiums?

Principle of equivalence:

- ▶ Zero net random future loss for the insurer

*PV at time of issue, of future benefits to be paid by the insurer =  
PV at time of issue, of future premiums to be paid by the insured.*