

**The University of Western Ontario**

**1. Topic: Long**

**2. Topic: Survival models and their estimation (15-25%)**

**Learning Objectives**

The Candidate will understand key concepts concerning parametric and non-parametric (tabular) and multi-state models including single life, or multiple life, and multiple decrements.

**Learning Outcomes**

The Candidate will be able to:

- a) Explain and interpret survival models and transitioning between states.
- b) Calculate and interpret standard functions including survival and mortality probabilities, force of mortality, and complete and curtate expectation of life.
- c) Calculate nonparametric estimates of survival models using the Kaplan-Meier and Nelson-Aalen formulas for seriatim data and adaptations for grouped data.
- d) Calculate, using both seriatim and grouped data, maximum likelihood estimates of transition probabilities assuming constant transition intensity during fixed age intervals.
- e) Calculate the variances of and construct confidence intervals for the estimators in parts c) and d).
- f) Calculate transition intensities exactly, or estimate transition intensities using large sample approximations.
- g) Describe and apply simple longevity models.
- h) For models dealing with multiple lives and/or multiple states, explain the random variables associated with the model and calculate and interpret marginal and conditional probabilities.
- i) Construct and interpret select and ultimate survival models.
- j) Describe the behavior of Markov chain models, identify possible transitions between

**3. Topic: Present Value Random Variables (10-20%)**

**Learning Objectives**

The Candidate will be able to perform calculations on the present value random variables associated with benefits and expenses for any of the models in Learning Objective 2.

**Learning Outcomes**

The Candidate will be able to:

- a) Calculate and interpret probabilities, means, variances, and percentiles.
- b) Calculate and interpret the effect of changes in underlying assumptions such as mortality and interest.
- c) Apply appropriate approximation methods such as uniform distribution of deaths, constant force, Woolhouse, and Euler.

**4. Topic: Premium Calculation (15-30%)**

**Learning Objectives**

The Candidate will be able to use and explain premium-calculation methodologies.

**Learning Outcomes**

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5. Topic: Reserves (20-30%)

Learning Objectives

The Candidate will understand reserves for insurances and annuities for models in Learning Objectives 2 and 4.

Learning Outcomes

The Candidate will be able to:

a) ✓ Calculate and interpret the following reserve types:

- Net premium
- Modified
- Gross premium
- Expense

b) ✓ Calculate and interpret probabilities, means, variances, and percentiles of

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