ILA – Life ALM and Modeling Exam

Fall 2019/Spring 2020

Important Exam Information:

Exam Registration	Candidates may register online or with an application.
Order Study Notes	Study notes are part of the required syllabus and are not available electronically but may be purchased through the online store.
Introductory Study Note	The Introductory Study Note has a complete listing of all study notes as well as errata and other important information.
Case Study	A case study will not be provided for this examination.
Past Exams	Past Exams from 2000-present are available on SOA website.
Updates	Candidates should be sure to check the Updates page on the exam home page periodically for additional corrections or notices.

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1. **Topic: Stochastic Models, Generalized Linear Models, Multi-State and Transition Matrix Models**

Learning Objectives

The candidate will understand, evaluate and use stochastic models, generalized linear models ("GLMs"), multi-state, and transition matrix models. The candidate will demonstrate an understanding of their underlying methodologies, strengths, limitations, applications, technical challenges, and governance.

Learning Outcomes

The Candidate will be able to:

a) With respect to stochastic models:

- Explain and apply the stochastic modeling methodology, including measurement metrics (e.g., CTE)

- Describe and apply the theory and uses of real world versus risk neutral assumptions

- Describe and apply the techniques of Monte Carlo simulation (including variance reduction and importance sampling)

- Describe and evaluate Random Number Generator models, and explain their uses, advantages, and theory

- Describe and evaluate how stochastic models may be used to understand mortality and policyholder behavior risks and inform the use of reinsurance

- Describe the technique of nested stochastic projections and explain why they are needed, and evaluate implementation issues

b) With respect to generalized linear models:

- Describe and apply the basic principles of GLMs, and evaluate where GLMs might be useful in a Life Insurance context

c) With respect to multi-state and transition matrix models:

- Describe and apply the methodologies for constructing multi-state and transition models

- Apply the modeling process (e.g., in LTC projection modeling and credit rating modeling)

Resources

- LAM-135-19: Stochastic Modeling, Theory and Reality from and Actuarial Perspective, sections I.A, I.B-I.B.3.a, I.B.4 & I.D-I.D.3

- LAM-137-19: Multi-state Transition Models with Actuarial Application, sections 1 & 2

- LAM-138-19: A Practitioner's Guide to Generalized Linear Models, 1.1-1.108, 1.118-1.130 & 3.1-3.14

- [Stochastic Modeling is on the Rise](), Product Matters, Nov 2016

- [Stochastic Analysis of Long Term Multiple-Decrement Contracts](), 2008 (excluding Attachments)

2. **Topic: Issues Common to Models (Including Model Governance and Data Issues)**

Learning Objectives

The candidate will understand and be able to assess issues and concerns common to actuarial models and their development and management.

Learning Outcomes

The Candidate will be able to:

a) Describe Model Efficiency concepts and explain and apply both the representative scenarios and replicating liabilities techniques for improving Model Efficiency

b) Explain and apply the technique for the compression of model data using the "Cluster Analysis Spatial Approach"

c) Describe and evaluate best practices for actuarial model governance over process and controls

d) Describe and evaluate key components of model risk management

e) Describe and apply model validation techniques and methods

f) Describe issues and techniques related to sound spreadsheet model management

g) Describe best practices documentation and governance over assumptions used in models

h) Describe and evaluate the guidance in the Actuarial Standards of Practice

i) Describe and evaluate issues related to open and closed coding of models, and methods for addressing those issues and concerns

j) Describe and evaluate considerations around the governance of expert judgment in actuarial modelling

Resources

- LAM-116-14: Life Insurance Forecasting and Liability Models: An Examination of the Trade-Offs Involved with Certain Modeling Decisions

- LAM-132-19: Cluster Analysis: A Spatial Approach to Actuarial Modeling

- LAM-133-19: Model Risk Mitigation and Cost Reduction Through Effective Documentation

- LAM-134-19: Supervisory Guidance on Model Risk Management, SR Letter 11-7, Board of Governors of the Federal Reserve System, 2011

- LAM-135-19: Stochastic Modeling, Theory and Reality from and Actuarial Perspective, section II.B.I

- LAM-136-19: Modeling, ASB, Third Exposure Draft, sections 3 & 4

- LAM-144-19: Framework for Use of Discount Rates in Actuarial Models

- LAM-145-19: Expert Judgment, Institute and Faculty of Actuaries, 2015, sections 1.1, 1.7-1.8, 1.10, 2.1-2.5, 3.1-3.8 & 5.1-5.4

- Model Validation for Insurance Enterprise Risk and Capital Models, 2014 (excluding Appendices)

- The Effect of Deflation or High Inflation on the Insurance Industry, 2012 (excluding pp. 11-14)

- Interesting Challenges for Insurers, Product Matters, Jun 2012

- [Model Efficiency Study Results](#), Nov 2011

- [Model Efficiency in the U.S. Life Insurance Industry](#), The Modeling Platform, Apr 2016

- [Making Spreadsheets Great Again](#), The Modeling Platform, Nov 2017

- [End-to-End Assumption Documentation Practices](#), Financial Reporter, March 2016

- [Actuarial Modeling Systems: How Open We WANT Them to be vs. How Closed We NEED Them to be](#), The Modeling Platform, Nov 2017

- [Data Visualization for Model Controls](#), Financial Reporter, Mar 2017

3. **Topic: Asset-Liability and Projection Models**

Learning Objectives

The candidate will understand the principles of Asset-liability Management ("ALM") and Projection Models, and be able to describe and evaluate various techniques for addressing the mitigation of risk.

Learning Outcomes

The Candidate will be able to:

a) With respect to Asset-Liability Models:

- Describe and apply the fundamental elements of the theory and practice of ALM in an insurance company, including assessing the dangers of mismatched assets and liabilities

- Describe and demonstrate how ALM can be used to identify and manage product and asset risks, including:

  o   Major product risks for which ALM can be a useful tool for their management

  o   Using ALM as a means to manage interest rate risk, equity risk, and risks from optionality

- Describe how common insurance contracts and variations generate embedded options in an insurer's balance sheet, and assess basic strategies for managing exposures created by such embedded options

- Describe and apply the basic concepts of cash flow matching, immunization, duration/convexity matching, segmentation

- Describe and apply Key Rate Durations (KRD) and their use in evaluating interest rate sensitivities of portfolios, including understanding the derivation of KDRs, the profiles of KDRs for selected major asset types, and assessing KRDs in a portfolio context

- Describe and evaluate the Goldman Sachs' ALM/Strategic Asset Allocation approach for integrating ALM into an enterprise's risk and financial management framework

- Describe and evaluate ALM modeling considerations in the context of modeling risk aggregation, dependency, correlation of risk drivers and diversification

b) With respect to asset adequacy analysis and cash flow testing, describe and evaluate actuarial practice with respect to:

- Modeling and selecting assets and related assumptions (incl. modeling assets with contingent cash flow risks)

- Handling liability cash flow contingencies and risks

- Setting up projection model parameters and assumptions

- Describe how Interest Rate Forwards and Futures and Swaps can be used in ALM, and apply the mathematics in given situations

c) With respect to Projection Models:

- Describe and evaluate the differences in model structure, features and assumptions for models used for various actuarial purposes

- Describe and evaluate the requirements for creating an LTC projection model from first principles

Resources
- LAM-117-14: Key Rate Durations: Measures of Interest Rate Risk   - LAM-118-14: Revisiting the Role of Insurance Company ALM w/in a RM Framework   - LAM-130-15: Diversification: Consideration on Modelling Aspects & Related Fungibility and Transferability, CRO, Oct 2013, pp. 1-18   - LAM-131-19: Ch. 22 of *Life Insurance Accounting, Asset/Liability Management*   - LAM-140-19: Asset Adequacy Analysis Practice Note, 2017, questions: 3, 5, 10-16, 18-20, 27, 29-31, 39, 42-60, 65-68, 71-82, 85 & 89   - LAM-141-19: Case Study: LTC Insurance First Principles Modeling, Modeling   - LAM-142-19: Case Study: LTC Insurance First Principles Modeling: Mortality Assumptions   - LAM-143-19: Case Study: LTC Insurance First Principles Modeling: Lapse Assumptions   - LAM-146-19: Ch. 16 of *ALM Management of Financial Institutions*, Tilman, 2003   - LAM-147-19: Ch 2 of *ALM Management of Financial Institutions*, Tilman, 2003

4. **Topic: Economic Scenario Generator and Equity-Linked Models**

Learning Objectives

The candidate will understand the basic design and function of Economic Scenario Generators and Equity-Linked Insurance Models.

Learning Outcomes

The Candidate will be able to:

a) With respect to Economic Scenario Generators:

- Describe the need for ESGs and explain the structure of ESG models and components

- Describe and apply basic default free interest rate models, including one-factor continuous time models

- Assess the propriety of a particular ESG model and related assumptions for particular applications

b) With respect to Equity-Linked models:

- Describe and apply methods for modeling long-term stock returns and certain guarantee liabilities (GMMB, GMDB, GMAB)

- Describe and evaluate the Actuarial and Hedging risk metrics for GMAB and GMDB models

- Describe and apply methods for modeling Guaranteed annuity options and Guaranteed Minimum Income Benefits (GMIB), and EIA guarantees

Resources

- Investment Guarantees, Hardy, Mary, 2003

    o Ch. 1

    o Ch. 2

    o Ch. 6

    o Ch. 7 (pp. 115-125)

    o Ch. 8 (pp. 133-143)

    o Ch. 12

    o Ch. 13

- LAM-139-19: Simulation of a Guaranteed Minimum Annuity Benefit, Freedman, 2019; Excel Model - Stochastic Simulation of a GMAB Option (Accompanies Simulation of a GMAB)

- LAM-148-19: Introduction to Economic Scenario Generators - Selecting and Specifying ESGs

- Economic Scenario Generators: A Practical Guide, 2016, Ch. 1, 2, 4.1, 5, 6, 9, 10, 11.1 & 11.3