  

Canadian Institute of Actuaries **Casualty Actuarial Society** **Society of Actuaries**

Fall 2009 Changes to Exams C/4 and MFE/3F

The SOA, CAS, and CIA announce that the Construction and Evaluation of Actuarial Models exam will be offered by computer-based testing beginning in November 2009. At that time, changes will be made to this exam that will also affect the Actuarial Models–Financial Economics Segment exam. Changes to each exam are summarized below followed by the revised syllabus for each exam.

❑ Changes to the Construction and Evaluation of Actuarial Models Exam

The following changes to the Construction and Evaluation of Actuarial Models examination (denoted as Exam 4 by the CAS and Exam C by the SOA) are effective with the November 2009 administration.

1. The examination will be offered via computer-based testing.

2. The examination will be 3.5 hours in length and consist of approximately 35 multiple-choice questions.

3. The financial economics topic and financial economics readings currently on the examination will move to the Actuarial Models–Financial Economics Segment examination (denoted as Exam 3F by the CAS and Exam MFE by the SOA).

4. The learning outcomes for the examination will be:

    A. Severity Models
        1. Calculate the basic distributional quantities:
            a) Moments
            b) Percentiles
            c) Generating functions
        2. Describe how changes in parameters affect the distribution.
        3. Recognize classes of distributions and their relationships.
        4. Apply the following techniques for creating new families of distributions:
            a) Multiplication by a constant
            b) Raising to a power
            c) Exponentiation
            d) Mixing
        5. Identify the applications in which each distribution is used and reasons why.
        6. Apply the distribution to an application, given the parameters.
        7. Calculate various measures of tail weight and relative tail weight, and interpret the results to compare the tail weights.

B. Frequency Models
For the Poisson, Mixed Poisson, Binomial, Negative Binomial, Geometric distribution and mixtures thereof:
1. Describe how changes in parameters affect the distribution,
2. Calculate moments,
3. Identify the applications for which each distribution is used and reasons why,
4. Apply the distribution to an application given the parameters,
5. Apply the zero-truncated or zero-modified distribution to an application given the parameters.

C. Aggregate Models
1. Compute relevant probabilities and moments for aggregate risk models.
2. Evaluate aggregate claim models.
3. Compute aggregate claims distributions.

D. Severity, Frequency and Aggregate Models
1. Evaluate the impacts of coverage modifications:
   a) Deductibles
   b) Limits
   c) Coinsurance
2. Calculate Loss Elimination Ratios.
3. Evaluate the effect of inflation on losses.

E. Risk Measures
1. Calculate VaR and TVaR and explain their use and limitations

F. Construction of Empirical Models
1. Estimate failure time and loss distributions using:
   a) Kaplan-Meier estimator, including approximations for large data sets
   b) Nelson-Åalen estimator
   c) Kernel density estimators
2. Estimate the variance of estimators and confidence intervals for failure time and loss distributions.
3. Apply the following concepts in estimating failure time and loss distribution:
   a) Unbiasedness
   b) Consistency
   c) Mean squared error

G. Construction and Selection of Parametric Models
1. Estimate the parameters of failure time and loss distributions using:
   a) Maximum likelihood
   b) Method of moments
   c) Percentile matching
   d) Bayesian procedures
2. Estimate the parameters of failure time and loss distributions with censored and/or truncated data using maximum likelihood.
3. Estimate the variance of estimators and the confidence intervals for the parameters and functions of parameters of failure time and loss distributions.
4. Apply the following concepts in estimating failure time and loss distributions:
   a) Unbiasedness
   b) Asymptotic unbiasedness
   c) Consistency
   d) Mean squared error

e) Uniform minimum variance unbiased

5. Determine the acceptability of a fitted model and/or compare models using:
   a) Graphical procedures
   b) Kolmogorov-Smirnov test
   c) Anderson-Darling test
   d) Chi-square goodness-of-fit test
   e) Likelihood ratio test
   f) Schwarz Bayesian Criterion

H. Credibility
1. Apply limited fluctuation (classical) credibility including criteria for both full and partial credibility.
2. Perform Bayesian analysis using both discrete and continuous models.
3. Apply Bühlmann and Bühlmann-Straub models and understand the relationship of these to the Bayesian model.
4. Apply conjugate priors in Bayesian analysis and in particular the Poisson-gamma model.
5. Apply empirical Bayesian methods in the nonparametric and semiparametric cases.

I. Simulation
1. Simulate both discrete and continuous random variables using the inversion method.
2. Estimate the number of simulations needed to obtain an estimate with a given error and a given degree of confidence.
3. Use simulation to determine the p-value for a hypothesis test.
4. Use the bootstrap method to estimate the mean squared error of an estimator.
5. Apply simulation methods within the context of actuarial models.

5. The Study Note: *An Introduction to Risk Measures and Actuarial Applications* will no longer be listed as a reading. The risk measures topic is covered in the Third Edition of *Loss Models: from Data to Decisions.*

6. The reading selections for Learning Outcomes A through G and I will be:

Loss Models: From Data to Decisions, (Third Edition), 2008, by Klugman, S.A., Panjer, H.H. and Willmot, G.E.,

Chapter 3,

Chapter 4,

Chapter 5, Sections 5.1 – 5.4 only,

Chapter 6, Sections 6.1– 6.5 and 6.7,

Chapter 8,

Chapter 9, Sections 9.1–9.7 (excluding 9.6.1 and examples 9.9 and 9.11), Sections 9.11.1–9.11.2,

Chapter 12,

Chapter 13,

Chapter 14,

Chapter 15, Sections 15.1–15.6.4, 15.6.6 only,

Chapter 16,

Chapter 21, Sections 21.1–21.2 only.

7. Reading options for Learning Outcome H (Credibility) will be:

   Option A

   Loss Models: From Data to Decisions, (Third Edition), 2008, by Klugman, S.A., Panjer, H.H. and Willmot, G.E.,

   Chapter 20, Sections 20.2, 20.3 (excluding 20.3.8), 20.4 (excluding 20.4.3)

   Option B

   Foundations of Casualty Actuarial Science (Fourth Edition), 2001, Casualty Actuarial Society,

   "Credibility" by Mahler, H.C., and Dean, C.G., Chapter 8, Section 1 (background only), Sections 2-5. (Available as Study Note C-21-01)

   Topics in Credibility by Dean, C.G. (Study Note C-24-05)

   Option C

   Introduction to Credibility Theory (Third Edition), 1999, by Herzog, T.N.

   Chapters 1-3 (background only)
   Chapters 4-8
   Chapter 9 (background only)

8. The Second Edition of *Loss Models: from Data to Decisions* will no longer be listed as an alternate textbook.

❑ Changes to the Actuarial Models–Financial Economics Segment Exam

The following changes to the Actuarial Models–Financial Economics Segment examination (denoted as Exam 3F by the CAS and Exam MFE by the SOA) are effective with the November 2009 administration.

1. The examination will be 2.5 hours in length and consist of approximately 25 multiple-choice questions.

2. The financial economics topic and financial economics readings currently on Construction and Evaluation of Actuarial Models examination (denoted as Exam 4 by the CAS and Exam C by the SOA) will move to this examination.

3. The learning outcomes for the examination will be:

    A. Interest rate models
        1. Evaluate features of the Vasicek and Cox-Ingersoll-Ross bond price models.
        2. Explain why the time-zero yield curve in the Vasicek and Cox-Ingersoll-Ross bond price models cannot be exogenously prescribed.
        3. Construct a Black-Derman-Toy binomial model matching a given time-zero yield curve and a set of volatilities.

    B. Rational valuation of derivative securities
        1. Use put-call parity to determine the relationship between prices of European put and call options and to identify arbitrage opportunities.
        2. Calculate the value of European and American options using the binomial model.
        3. Calculate the value of European and American options using the Black-Scholes option-pricing model.
        4. Interpret the option Greeks.
        5. Explain the cash flow characteristics of the following exotic options: Asian, barrier, compound, gap, and exchange.
        6. Explain the properties of a lognormal distribution and explain the Black-Scholes formula as a limited expected value for a lognormal distribution.
        7. Explain what it means to say that stock prices follow a diffusion process.
        8. Apply Itô's lemma in the one-dimensional case.
        9. Apply option pricing concepts to actuarial problems such as equity-linked insurance.

    C. Simulation
        1. Simulate lognormal stock prices.
        2. Use variance reduction techniques to accelerate convergence.

    D. Risk management techniques
        1. Explain and demonstrate how to control risk using the method of delta-hedging.

4. The reading selections from *Derivates Markets* will be:

Derivatives Markets (Second Edition), 2006, by McDonald, R.L.,

Chapter 9,

Chapter 10, (excluding “Options on Commodities” on page 334),

Chapter 11, Sections 11.1 – 11.4, Appendices 11.A and 11.B,

Chapter 12, Sections 12.1–12.5, Appendix 12.A,

Chapter 13, including Appendix 13.B,

Chapter 14,

Chapter 18,

Chapter 19, Sections 19.1–19.5

Chapter 20, Sections 20.1–20.6 (up to but excluding “Multivariate Itô’s Lemma” on pages 665-666) and 20.7 (up to but excluding “Valuing a Claim on S^aQ^b on pages 670-672 and excluding “Finding the lease rate” on top one-half of page 669),

Chapter 21, Sections 21.1 – 21.2 (excluding “What If the Underlying Asset Is Not and Investment Asset” on pages 688-690) and 21.3 (excluding “The Backward Equation” on pages 691-692, and excluding the paragraph on page 692 that begins “If a probability…” and through the end of the section),

Chapter 22, Section 22.1 (but with only those definitions in Tables 22.1 and 22.2 that are relevant to Section 22.1),

Chapter 23, Sections 23.1 – 23.2 (up to but excluding “Exponentially Weighted Moving Average” on page 746 and through the end of the section),

Chapter 24, Sections 24.1–24.5 (up to but excluding “Forward rate agreements” on pages 806-808),

Appendix B.1, Appendix C and including relevant Errata (see below).

Unless otherwise stated chapter appendices are not included in the required readings from this text.