Actuarial Models, Financial Economics Segment—Fall 2010

The Financial Economics Segment is a two and a half hour multiple-choice examination and is referred to as Exam MFE by the SOA and Exam 3F by the CAS. The examination is jointly sponsored and administered by the SOA, CAS and the Canadian Institute of Actuaries (CIA). The examination is also jointly sponsored by the American Academy of Actuaries (AAA) and the Conference of Consulting Actuaries (CCA).

The purpose of each segment's syllabus is to develop the candidate's knowledge of the theoretical basis of certain actuarial models and the application of those models to insurance and other financial risks. A thorough knowledge of calculus, probability, and interest theory is assumed. Knowledge of risk management at the level of Exam P/1 is also assumed. In addition, for Exam MFE/3F, candidates are assumed to be familiar with the earlier chapters of the McDonald textbook, which are in the syllabus of Exam FM/2.

Tables are provided below for the candidate and will be provided to the candidate at the examination. These include a table of values from the standard normal distribution and the density and distribution functions for the standard normal and lognormal random variables. Since the tables will be provided to the candidate at the examination, candidates will not be allowed to bring copies of the tables into the examination room.

Note: It is anticipated that candidates will have done the relevant exercises in the textbooks.

Check the Updates section of the SOA Web site for any changes to the exam or syllabus.

LEARNING OUTCOMES – FINANCIAL ECONOMICS SEGMENT

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. Identify the situations where the values of European and American options are the same.
   5. Interpret the option Greeks.
   6. Explain the cash flow characteristics of the following exotic options: Asian, barrier, compound, gap, and exchange.
   7. Explain the properties of a lognormal distribution and explain the Black-Scholes formula as a limited expected value for a lognormal distribution.
   8. Explain what it means to say that stock prices follow a diffusion process.

9. Apply Itô's lemma in the one-dimensional case.

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.

Note: Concepts, principles and techniques needed for Exam MFE/3F are covered in the reference listed below. Candidates and professional educators may use other references, but candidates should be very familiar with the notation and terminology used in the listed references.

Texts – Financial Economics Segment *

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 an 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 (pp.744 thru the middle of p.746 only),

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.

***Any textbook errata are included below.**

Other Resources - Financial Economics Segment

Exam MFE/Exam 3F Tables

Some Remarks on *Derivatives Markets*

Derivatives Markets, Errata 2006 Second Edition, by R. McDonald,
http://www.kellogg.northwestern.edu/faculty/mcdonald/htm/typos2e.html

All released exam papers, since 2000 can be found here.

Exam MFE/3F Sample Questions and Solutions (1-76)