

## Models for Financial Economics—March 2015

The Models for Financial Economics is a three-hour exam that consists of 30 multiple-choice questions. Also, a [normal distribution calculator](#) will be available during the test by clicking a link on the item screen. Details are available on the [Prometric Web Site](#).

The purpose of the 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, interest theory and the earlier chapters of the McDonald textbook (which are in the syllabus of Exam FM) is assumed.

Formulas are provided for the density and distribution functions for the standard normal and lognormal random variables. For paper and pencil examinations, tables of the standard normal distribution function are provided. 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. For CBT candidates, a normal distribution calculator is provided. See the link below for more information.

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

Check the [Updates](#) section of the web site for any changes to the exam or syllabus.

The ranges of weights shown are intended to apply to the large majority of exams administered. On occasion, the weights of topics on an individual exam may fall outside the published range. Candidates should also recognize that some questions may cover multiple learning outcomes.

Each multiple-choice problem includes five answer choices identified by the letters A, B, C, D, and E, only one of which is correct. Candidates must indicate responses to each question on the computer.

As part of the computer-based testing process, a few pilot questions will be randomly placed in the exam (paper and pencil and computer-based forms). These pilot questions are included to judge their effectiveness for future exams, but they will NOT be used in the scoring of this exam. All other questions will be considered in the scoring. All unanswered questions are scored incorrect. Therefore, candidates should answer every question on the exam. There is no set requirement for the distribution of correct answers for the SOA/CAS/CIA multiple-choice preliminary examinations. It is possible that a particular answer choice could appear many times on an examination or not at all. Candidates are advised to answer each question to the best of their ability, independently from how they have answered other questions on the examination.

Since the CBT exam will be offered over a period of a few days, each candidate will receive a test form composed of questions selected from a pool of questions. Statistical scaling methods are used to ensure within reasonable and practical limits that, during the same testing period of a few days, all forms of the test are comparable in content and passing criteria. The methodology that has been adopted is used by many credentialing programs that give multiple forms of an exam.

## LEARNING OUTCOMES – MODELS FOR FINANCIAL ECONOMICS

- A. Interest rate models (10-15%)
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 (65-75%)
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 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 an 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 (10-15%)
1. Simulate lognormal stock prices.
  2. Use variance reduction techniques to accelerate convergence.
- D. Risk management techniques (5-10%)
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 – Models for Financial Economics\*

*Derivatives Markets* (Third Edition), 2013, by McDonald, R.L.,

Chapter 9,

Chapter 10, (excluding "Options on Commodities" on pages 315 and 316),

Chapter 11, Sections 11.1–11.3, 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 20.1–20.3 (up to but excluding “Modeling Correlated Asset Prices” on pages 612-613), 20.4 (excluding “Multivariate Itô’s Lemma” on pages 616-617), 20.5–20.6 (up to but excluding “Valuing a Claim on  $S^aQ^b$ ” on pages 621-622)

Chapter 21, Sections 21.1–21.2 (excluding “What If the Underlying Asset Is Not an Investment Asset” on pages 635–637) and 21.3 (excluding “The Backward Equation” on pages 637–638, and excluding the last two paragraphs of the section on page 639),

Chapter 23, Section 23.1 (but with only those definitions in Tables 23.1 and 23.2 that are relevant to Section 23.1),

Chapter 24, Sections 24.1 – 24.2 (up to the second paragraph on page 721, but including footnote 4 on page 721 and the top panel in Figure 24.3 on page 723),

Chapter 25, Sections 25.1 – 25.4 (up to the first paragraph on page 773), 25.5 (excluding “LIBOR Market Model” on pages 781-783), Appendix 25.A (this appendix contains only a reference to the following site for download, <http://wps.aw.com/wps/media/objects/14728/15081864/appendices/McDonald-web-25-A.pdf> ),

Appendix B.1, Appendix C.

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

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

### **Other Resources – Models for Financial Economics**

[Exam MFE Formulas and Tables for paper/pencil](#)

Formulas and Tables for CBT:

- A [normal distribution calculator](#) will be available during the test by clicking buttons on the item screen.
- [Formula document](#)

[Some Remarks on Derivatives Markets](#)

[All released exam papers](#), since 2000 can be found here.

[Exam MFE Sample Questions and Solutions \(1-76\)](#)