

EDUCATION AND EXAMINATION COMMITTEE OF THE SOCIETY OF ACTUARIES (SOA)

FALL 2012

ENTERPRISE RISK MANAGEMENT EXAM

INTRODUCTORY STUDY NOTE

1. The Enterprise Risk Management examination for Fall 2012 will be given on **Wednesday, October 31st, from 8:30 a.m. – 12:45 p.m.** The examination will consist of four hours of written answer questions. The first 15 minutes will be a read-through before the actual 4 hours of writing begins.
2. The following link shows a recommended FSA module/exam sequence for the Finance/ERM track:

<http://www.soa.org/Education/Exam-Req/edu-fsa-recommended.aspx>

This order is NOT mandated. Each candidate will determine the appropriate sequence based on factors including readiness to sit for an exam, exam administration schedules, or study time available.

3. Any changes in the Syllabus for this exam will be published under “Updates” on this exam’s home page of the SOA Web site.

The Syllabus material includes textbooks, online published readings, as well as the study notes listed below. A complete listing of the Syllabus and Learning Objectives is located in this exam’s home page on the SOA Web site. Study notes numbered 300 and higher apply to the reading extensions. Candidates should consult the syllabus to identify the study notes that apply to the chosen extension.

CODE	TITLE
	Case Study (Available on syllabus page of Web site)
ERM-50-12	Courseware – A Guide to the ERM Exam Core Readings
ERM-100-12	A Common Risk Classification System for the Actuarial Profession
ERM-101-12	Measurement and Modelling of Dependencies in Economic Capital
ERM-102-12	Value-at-Risk: Evolution, Deficiencies and Alternatives (same as FE-C181-11)
ERM-103-12	Developments in Modelling Risk Aggregation
ERM-104-12	Study Note on Parameter Risk
ERM-105-12	Coherent Measures of Risk: An Exposition for the Lay Actuary
ERM-106-12	Economic Capital Modeling: Practical Considerations (same as FE-C178-11)
ERM-107-12	Chapters 1 and 7 of <i>Strategic Risk Management Practice: How to Deal Effectively with Major Corporate Exposures</i>
ERM-108-12	Chapters 5 and 17 of <i>Life, Health & Annuity Reinsurance</i>
ERM-109-12	Chapter 9 of <i>Asset/Liability Management of Financial Institutions</i>
ERM-110-12	Derivatives: Practices and Principles (same as FE-C147-01)
ERM-111-12	Key Rate Durations: Measures of Interest Rate Risks (same as FE-C156-09)
ERM-112-12	Revisiting the Role of Insurance Company ALM within a Risk Management Framework (same as FE-C183-11)
ERM-113-12	A Principles-Based Reserves and Capital Standard (same as FE-C185-11)
ERM-301-12	Pension Investing and Corporate Risk Management (same as R-C112-07)

ERM-302-12	Jim Moore Discusses Liability Driven Investment Strategies and Concepts (same as R-C148-10)
ERM-303-12	Plan Sponsor Guide to Liability-Driven Investing (same as R-C149-10)
ERM-304-12	Mind the Gap: Using Derivatives Overlays to Hedge Pension Duration (same as V-C185-11 and R-C150-10)
ERM-305-12	Risk Management for Pension Funds
ERM-306-12	The Intersection of Pensions and Enterprise Risk Management
ERM-307-12	Pensions Risk in an ERM Context
ERM-308-12	<i>Integrated Risk Management</i> , Doherty - Chapter 7, Why is Risk Costly for Firms
ERM-401-12	Mapping of Life Insurance Risks (same as FE-C106-07)
ERM-402-12	Countering the Biggest Risk of All (same as FE-C159-09)
ERM-403-12	Deciphering the Liquidity and Credit Crunch 2007–2008 (same as FE-C174-10)
ERM-404-12	<i>Variable Annuities</i> , Kalberer, Section 3–Chapters 10–14
ERM-501-12	Risk Based Capital–General Overview
ERM-502-12	Healthcare Reform's Minimum Medical Loss Ratios
ERM-503-12	Hedging with Derivatives in Traditional Insurance Products (same as FE-C130-07)
ERM-504-12	Mapping of Health Company Risks (same as GH-C113-07)
ERM-505-12	Health Industry RBC Results for 2010
ERM-506-12	ERM Practice As Applied to Health Insurers, Self Insured Plans and Health Finance Professionals, Pages 4-13, 21-32
ERM-507-12	ERM for Health Insurance from an Actuarial Perspective– A Discussion Paper
ERM-601-12	Managing Your Advisor (same as V-C138-09)
ERM-602-12	<i>Investment Management for Insurers</i> , Babbel and Fabozzi, Chapter 11, The Four Faces of an Interest Model
ERM-603-12	<i>The Handbook of Fixed Income Securities</i> , Fabozzi, Seventh Edition, Chapter 47, Bond Immunization: An Asset Liability Optimization Strategy
ERM-604-12	Impact of Skewness and Fat Tails on Asset Allocation Decision
ERM-605-12	<i>Modern Investment Management</i> , Litterman, Chapter 10, Strategic Asset Allocation in the Presence of Uncertain Liabilities
ERM-606-12	<i>Fixed Income Securities</i> , Tuckman, Second Edition, Chapter 7, Key Rate and Bucket Exposures
ERM-607-12	Creating Value in Pension Plans, or Gentlemen Prefer Bonds, (same as V-C111-07)
ERM-701-12	Risk-Adjusted Performance for P&C Insurers, Pages 8–46
ERM-702-12	IAA Note on ERM for Capital and Solvency Purposes in the Insurance Industry, Pages 9–38
ERM-703-12	Overview of Enterprise Risk Management, Pages 14–32
ERM-704-12	Value of Risk Reduction
ERM-801-12	<i>Strategic Risk Management</i> , Andersen & Schroder, Chapter 3, Managing Market-Related Business Exposures
ERM-802-12	Enterprise Risk Management for Non-Financial Companies—From Risk Control and Compliance to Creating Shareholder Value

4. ERRATA: Attached are errata for:

- **Financial Enterprise Risk Management**

5. When registering for this examination, candidates must select from six reading extensions. The Case Study for this examination also includes some extension-specific portions. Twenty-five percent of the examination points will be based on the Case Study and the selected extension. These questions may also draw on material from the core reading. Be sure to answer Case

Study related questions asked by referring to the Case Study. For example, if asked for the advantages of some action the company referenced in the Case Study is considering, limit your response to the specifics for that company. Other advantages should not be listed as they are extraneous to the question and will result in no additional credit. Further, if they conflict with the applicable advantages, no credit will be given for either answer. Candidates are advised to familiarize themselves with the Case Study. A copy will be included in the examination booklet. Candidates will not be allowed to bring their study note copy of the Case Study into the examination room.

6. EXAM OVERVIEW

The syllabus for this exam trains candidates in the financial and risk management aspects of operating and evaluating a financial institution or other entity, with particular emphasis on enterprise risk management (ERM) concepts. This includes gaining an understanding of several subjects, including risk identification, risk measurement and management, risk modelling and risk measures.

This overview section is intended to provide candidates with an approach for organizing the course of reading for studying the various sections of the syllabus. In addition, the candidates should be familiar with the Learning Objectives as described in the syllabus. These Learning Objectives were the first ingredient in developing the syllabus, and provide an indication of the level of understanding required for each major area of focus. While studying the syllabus material, candidates may want to consider both the organizational approach provided by this overview note, and to refer back to the Learning Objectives to remain focused on the goals of the Enterprise Risk Management exam. The courseware study note provides additional guidance with regard to relating the core readings to the learning objectives.

The syllabus has been organized into five major areas of focus, which align with the Learning Objectives: Risk Categories and Identification; Risk Modelling and Aggregation of Risks, Risk Measures, Risk Management Tools and Techniques and Economic Capital. Note that many syllabus sources relate to more than one topic. In the exam, candidates will be expected to integrate material across the various topics.

The candidate should focus on both the concepts and principles addressed in the exam syllabus. Candidates may be asked to apply concepts and principles in a particular context in an examination question. For example, although the candidate is not expected to remember detailed economic capital requirements the candidate is expected to understand how the concept of economic capital may apply to different business entities as specified in the examination.

The exam comprises three types of questions: Focus (covers single Learning Objective), Integrated (synthesizes multiple Learning Objectives) and Case Study.

7. Several book distributors carry some or all of the textbooks for the Society of Actuaries exams. A list appears on the SOA Web site <http://www.soa.org/education/exam-req/resources/edu-txt-manuals.aspx>.
8. The examination questions for this exam will be based on the required readings for this exam. If a conflict exists (in definitions, terminology, etc.) between the readings for this exam and the readings for other exams, the questions should be answered on the basis of the readings for this exam.

9. Candidates may ONLY use the battery or solar-powered Texas Instruments BA-35 model calculator, the BA II Plus* the BAII Plus Professional* or TI-30Xa or TI-30X II* (IIS solar or IIB battery) or TI-30X MultiView (XS solar or XB battery). Candidates may use more than one of the approved calculators during the examinations.

Calculator instructions may not be brought into the exam room. During the exam, the calculator must be removed from its carrying case so the supervisor can confirm that it is an approved model. Candidates using a calculator other than the approved models will have their exams disqualified.

Candidates can purchase calculators directly from: Texas Instruments, Attn: Order Entry, PO Box 650311, Mail Station 3962, Dallas, TX 75265, phone 800/842-2737 or <http://epsstore.ti.com>.

The memory of **TI-30X II, TI-30X MultiView, BA II Plus and BAII Plus Professional will need to be cleared by the examination supervisor upon the candidate's entrance to the examination room.*

10. A list of various seminars/workshops and study manuals appears on the SOA Web site <http://www.soa.org/education/exam-req/resources/edu-sem-workshops.aspx> and <http://www.soa.org/education/exam-req/resources/edu-txt-manuals.aspx>.

These seminars/workshops and study manuals do not reflect any official interpretation, opinion, or endorsement of the Society of Actuaries or its Education Committee.

Please note that the Education Committee expects candidates to read the material cited in the *Syllabus* and to use other material as a complement to the primary sources rather than a substitution for them.

11. The Society of Actuaries provides study notes to persons preparing for this examination. They are intended to acquaint candidates with some of the theoretical and practical considerations involved in the various subjects. While varying opinions are presented where appropriate, limits on the length of the material and other considerations sometimes prevent the inclusion of all possible opinions. These study notes do not, however, represent any official opinion, interpretation or endorsement of the Society of Actuaries. The Society is grateful to the authors for their contributions in preparing study notes.

The American Academy of Actuaries, the Canadian Institute of Actuaries, the Conference of Consulting Actuaries, and the Society of Actuaries jointly sponsor the examinations administered by the Society of Actuaries.

Financial Enterprise Risk Management – Paul Sweeting

ERRATA

3 October 2011

<u>Page</u>	<u>Words/ref</u>	<u>Line</u>	<u>Comments</u>
12	6+7	6	Delete “by”
29	3.2.10	3	“lie” should be “like”
34		7	Second “as” should be “of” (“...as a result of...”)
44		1	Insert “the” (“One of the main...”)
47	Para 2	3	Replace “cannot” with “might not”
52	3.6.2	7	“presence” should be “present”
55	4.3	14	Delete “is” (“however, it should...”)
57		5	“determine” should be “determines”
71		16	“lose” should be “lost”
73	Para 3	6	“where” should be “were”
80	Para 2	1	“is” should be “are”
86	Para 2	2	“The” should be “They” (“They also...”)
91	Para 6	2	“of” should be “as” (“as well as the question...”)
95	Para 8	2	Second “in” should be “is” (“...in that there is both incidence...”)
110	7.11	10	“in” should be “is” (“...is unable...”)
112	8.2	1	“are” should be “is” (“...is discussed...”)
114	8.2.3	5	“where” should be “are”
115	8.3	1	“Each have their...” should be “Each has its...”
118	8.3.5	7	Missing “on” after “based” (“...are based on the responses...”)
124	9.3	8	Capital N for “negative”
148		7	Superfluous “the” (“...to test whether...”)

149	Ex. 10.6	17	Superfluous "be" ("...than 0.05 is needed")
166	10.2.18	2	"distributions" is mis-spelled
171	Para 3	1	Missing "be" ("...can also be defined)
177	Para 2	4	First "in" is superfluous "...shown for...")
246	11.5.1	Last line	Delete "and" after "logit;"
256	11.5.5	4	Replace "networks" with "machines"
257	Para 3	4	Insert "it" between "if" and "is" ("...whilst if it is...")
286	Para1(13.4.2)	9	Replace "as" with "a" ("Such a process is...")
300	Para 2	Last line	Delete "a" ("vertical axis is defined...")
307	Para 1	5	Replace "on" with "or" ("...undertaken or not...")
312	Para 4	3	Replace "are" with "area" ("the first area of interest is...")
338	14.5.1	1	Insert "a" between "in" and "large" ("...itself in a large...")
341	Para2(14.5.3)	2	Delete "for" ("...profile is...")
359	14.5.5	3	Replace "lost" with "loss" ("...proportion of loss...")
361	Para 1	5	Replace "used" with "use" (...of little use...")
385	Para 5	2	Replace "reflect" with "reflects" ("...that it reflects how...")
		5	Delete "when developing strategies" ("...mental anchors so that...")
401	Convex risk measures	4	Delete "the" ("...words, a convex...")
421		Last line	Delete "a" before "differential rates"
428	16.2.5 Para 3	2	Replace "limits" with "limit" ("...be used to limit the...")
430	16.3 Para 2	(16.17)	Replace theta with "v" in the equation ("v = dC_0/d sigma_X)
430	16.3 Para2	2	Insert "is" between "This" and "partly"

472	19.1	1	Replace “to” with “with” (“...be complied with...”)
477	Criticisms of Basel II. Para 3	2	Replace “or” with “of” (...the list of risks...”)
483	Comp of Basel II. Para 2	1	Replace “difference” with “differences” (“...major differences between...”)
485	COSO ERM	3 rd from end	Replace “cover” with “covers” (“...framework covers eight...”)
493	Framework for Management etc	Final bullet	Replace “organizations” with “organisations”
499	19.3.1 Para 1	1,2	Replace “was” with “were” and “it” with “they”
507	Last Para	1	Replace “are” with “is” (“...of earnings is paid...”)
511	20.3.1 Para 1	4	Replace “manger” with “manager”
515	Para 4	2	Insert “were” (“...interest rates were high.”)
	Para 5	1	Insert “were” (“...personal pensions were introduced...”)
	Para 6	4	Insert “the” (“...when the role existed...”)
525	20.10 Para 4	1	Replace “important” with “crucial” (...of incentives is crucial.”)

The legend for high and low variance in figure 9.1 is wrong (dotted should be high, continuous should be low).

Also, on page 212/213 – final paragraph onwards should read “From the formulae for Kendall’s tau in Table 10.2, it can be seen that the generalised Clayton copula is indeed a generalisation of the Clayton copula. In particular, it becomes the standard Clayton copula if $\beta = 1$. This formulation...” etc. In other words, there should be no reference to the Gumbel copula, and it should be $\beta = 1$ rather than $\beta = 0$.

Finally, in table 10.2, the first formula in that column is wrong – it should read:

$$\frac{(\alpha + 2)\beta - 2}{\alpha + 2}$$

rather than

$$\frac{(2 + \alpha)}{\alpha + 2}$$

Financial Enterprise Risk Management – Paul Sweeting

ERRATA

17 October 2011

P127 – para 3 line 4 should be “...correlation coefficients do not...” (“do” rather than “to”)

P327 – the first formula both denominators should have 0.0525 and not 0.0520 in them; the last term in the second formula should be $105e^{-2s_2}$ rather than $105e^{-s_2}$

P339 – para 2 first line should be “...credit risk is that it...” (“it” rather than second “is”)

Sweetening further errata, updated August 16, 2012

Page 119 – Section 8.5, line 3 “in” should be “is”

Page 127 – In the third full paragraph, the reference should be to Chapter 10

Page 138 – Equation 10.7 is missing a beta (β) in the denominator

Page 146 – The excess kurtosis of the t-distribution is $6/(\text{gamma} - 4)$

Page 153 – Equation 10.31 is missing a beta (β) in the denominator

Page 167 – Figure 10.21; Page 169, Figure 10.23 – the horizontal axis labels are too large (the area under these density functions is not one)

Page 199 – 5 lines from the bottom of the page, “was” should be “way”

Page 201 – In the last paragraph, in the phrase “say that the coefficient of upper” the word “upper” should be “lower”

Page 204 – in the last line, the independence copula requires $p = q = 0$

Page 212 – The last formula on the page, 10.175, should be

$${}_{GC}C_{\alpha,\beta}(F(x_1), F(x_2), \dots, F(x_N)) = \left(\left\{ \sum_{n=1}^N [(F(x_n))^{-\alpha} - 1]^{\beta} \right\}^{1/\beta} + 1 \right)^{-1/\alpha}$$

Page 215 – In Example 10.9, lines 2 and 5 on this page, the expressions for the probability of surviving x and y years should have the x and y in the exponent

Page 216 – Formula 10.185, the last term of the formula should have a subscript of lower case “ n ” rather than “ N ”

Page 273 – The references to alpha being greater than, equal to, and less than zero should be to gamma

Page 305 – In line 1, the second formula should have a square on sigma_t; equations 13.62 and 13.63 each have a right parenthesis that should be removed

Page 352 – Example 14.5, in the second bullet, the first 0.00% should be 0.02%; with rounding, the answer is unchanged

Page 358 – Equation 14.34, all the numerals should be subscripts

Page 366 – Table 14.13, in the first column, x should go from 0 to 4, not 1 to 5