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**SOCIETY OF ACTUARIES**  
**Life Risk Management**

# Exam ILALRM

**Date:** Tuesday, October 31, 2017

**Time:** 2:00 p.m. – 4:15 p.m.

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## INSTRUCTIONS TO CANDIDATES

### General Instructions

1. This examination has a total of 40 points.  
  
This exam consists of 5 questions, numbered 1 through 5.  
  
The points for each question are indicated at the beginning of the question. Question 2 pertains to the Case Study, which is enclosed inside the front cover of this exam booklet.
2. Failure to stop writing after time is called will result in the disqualification of your answers or further disciplinary action.
3. While every attempt is made to avoid defective questions, sometimes they do occur. If you believe a question is defective, the supervisor or proctor cannot give you any guidance beyond the instructions on the exam booklet.

### Written-Answer Instructions

1. Write your candidate number at the top of each sheet. Your name must not appear.
2. Write on only one side of a sheet. Start each question on a fresh sheet. On each sheet, write the number of the question that you are answering. Do not answer more than one question on a single sheet.
3. The answer should be confined to the question as set.
4. When you are asked to calculate, show all your work including any applicable formulas.
5. When you finish, insert all your written-answer sheets into the Essay Answer Envelope. Be sure to hand in all your answer sheets because they cannot be accepted later. Seal the envelope and write your candidate number in the space provided on the outside of the envelope. Check the appropriate box to indicate Exam ILALRM.
6. Be sure your written-answer envelope is signed because if it is not, your examination will not be graded.

Tournez le cahier d'examen pour la version française.



## **CASE STUDY INSTRUCTIONS**

**The case study will be used as a basis for some examination questions. Be sure to answer the question asked by referring to the case study. For example, when asked for advantages of a particular plan design to a company referenced in the case study, your response should be limited to 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.**



**\*\*BEGINNING OF EXAMINATION\*\***

- 1.** (6 points) The Board of Directors for YHM Life is requesting management perform a thorough review of its insurance operations, including its processes and procedures regarding its Enterprise Risk Management (ERM) program.

The Chairman of the Board believes each of the following statements to be true:

- A. *The cost of maintaining a properly functioning Enterprise Risk Management program destroys shareholder value.*
- B. *The total risk exposure of the enterprise is simply the sum of all risks.*
- C. *Given the limitations of ERM, the enterprise should spend its time and money building better stress testing models which will undergo robust validation and vetting.*
- D. *The enterprise would be better served to implement a transparent incentive compensation program for senior management that encourages the achievement of both short-term and long-term goals, which if designed properly and communicated to staff and shareholders, would reduce its agency costs.*
- E. *Provided all risks are understood and have been appropriately modeled, the insurer can use its Required Capital as a proxy to its Economic Capital.*
- F. *ERM will allow the enterprise to avoid losses provided appropriate hedges are utilized.*

Critique the validity of each statement. Justify your answers.

*Question 2 pertains to the case study.  
Each question should be answered independently.*

**2.** (7 points)

- (a) (2 points) Explain the sources of liquidity risk for the following two products of Simple Life:
- (i) Level premium term insurance, and
  - (ii) Adjustable premium universal life.
- (b) (5 points) Assess the impact on the liquidity risk for each of the Variable Annuity product improvements proposed by Simple Life. Justify your answer.

3. (8 points) BOS Life has the option of investing in two types of assets with the following cash flows:

Year	Asset A	Asset B
1	0	1,050
10	1,994	0
30	0	1,127

Assume a force of interest  $\delta = 3\%$

- (a) (1 point) Explain how two major milestones which occurred in the 1980s highlighted the importance of Asset Liability Management (ALM).
- (b) (1 point) Explain which asset has greater interest rate risk. Justify your answer.
- (c) (5 points) Calculate the following measures of interest rate sensitivity for each of the two assets:
- Macaulay logarithmic convexity  $M^2_M$
  - Measure of dispersion or logarithmic convexity  $M^2$
- (d) (1 point) Describe how to protect each of the following under the full classical immunization model:
- Absolute surplus level
  - Surplus ratio level

**4.** (10 points)

- (a) (1 point) Define the top-down and bottom-up approaches for risk aggregation.
- (b) (2 points) Describe the advantages and disadvantages of using the top-down approach.
- (c) (3 points) You have been given the following information for ORD Life:

Risk	Risk Capital Requirement
Mortality	100 million
Morbidity	30 million
Equity	80 million
Interest Rate	50 million

Risk Variance-Covariance Matrix	Mortality	Morbidity	Equity	Interest Rate
<b>Mortality</b>	1.00	0.75	0.25	0.25
<b>Morbidity</b>	0.75	1.00	0.25	0.25
<b>Equity</b>	0.25	0.25	1.00	-0.25
<b>Interest Rate</b>	0.25	0.25	-0.25	1.00

Risk Variance-Covariance Matrix	Insurance	Market
<b>Insurance</b>	1.00	0.25
<b>Market</b>	0.25	1.00

Calculate ORD Life's risk capital requirement using the top-down approach, assuming all risks follow the normal distribution.

- (d) (4 points) IND Financial is the parent holding company of subsidiaries ORD Life and MDW Re. The latest quarter-end financial reporting for ORD Life shows an excess economic capital of 2 million, while MDW Re shows an economic capital shortage of 0.5 million.

Propose a suitable transaction with ORD Life to resolve MDW Re's economic capital shortage. Justify your answer.



**5.** (9 points)

- (a) (2 points) Define three top-level event risk categories and how they can impact an insurance company.
- (b) (3 points) Compare and contrast Traditional and Modern Operational Risk Management.
- (c) (4 points) Your company's current practice is to determine the operational risk capital based only on internal data. Your company's risk tolerance is 99.5% and the expected operational loss is 1.

You are given the following 10 worst operational risk events out of 1,000 whose probabilities are uniformly distributed:

Loss (in millions)	10	11	11	13	15	17	22	23	25	35
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- (i) (1 point) Propose a suitable metric to calculate the operational risk capital. Justify your answer.
- (ii) (1 point) Calculate the operational risk capital.
- (iii) (2 points) Evaluate your company's current practice for determining operational risk capital.

**\*\*END OF EXAMINATION\*\***

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