# SOCIETY OF ACTUARIES
## Life Risk Management

# Exam ILALRM

**Date:** Friday, April 28, 2017
**Time:** 2:00 p.m. – 4:15 p.m.

**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 4 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 COSO Report (2001) discussed in the *ERM Specialty Guide – May 2006* defines the components and limitations of Enterprise Risk Management.

(a) (*1 point*) Define each of the following Enterprise Risk Management Components as described in the COSO Report:

- Objective setting
- Event identification
- Risk assessment
- Information and communication

(b) (*2 points*) Assess how the DCAT exercise contributes to each of the applicable Enterprise Risk Management Components listed in part (a).

(c) (*3 points*) Your company offers the following products and is performing the annual Dynamic Capital Adequacy Testing (DCAT):

| Product | Reserve Inforce | Cash Value | Actual Deaths (5 year average) | Expected Deaths (5 year average) |
|---|---|---|---|---|
| Term | 120 million | 0 | 25 | 18 |
| UL | 100 million | 140 million | 19 | 14 |
| WL | 150 million | 100 million | 20 | 21 |
| Annuity | 80 million | 0 | 12 | 20 |

(i) The following tests have been recommended for DCAT adverse scenario testing:

- Increase mortality by 10% for all products
- Increase lapse rates by 10% for all products

Critique this plan and propose any changes.

(ii) Based on the actual mortality experience, a proposal has been made to increase premiums for Term and UL. Assess possible risks of this proposal.

**2.** (*10 points*)

(a) (*2 points*) PHX Life is considering acquiring a block of business from TUS Life, including its employees who process claims. The Chief Risk Officer (CRO) of PHX has expressed concern about several claims processing errors recently experienced at TUS.

(i) Assess the priority level (high or low) in dealing with the claims processing errors to address the CRO's concern.

(ii) List four other operational risks PHX could face by acquiring the block of business from TUS.

(b) (*2 points*) You are given the following information about the operational risk exposure of two of PHX Life's business units:

| Business unit | Cost of capital | Aggregate risk exposure | Average annual risk frequency | Average risk severity |
|---|---|---|---|---|
| C | 10% | 2,000,000 | 1 | 100,000 |
| F | 9% | 2,300,000 | 0.8 | 125,000 |

The CRO states *"the operational risk of these two units is the same because their expected losses are equal."*

Critique the CRO's statement. Justify your answer.

## 2. **Continued**

PHX Life currently sells two blocks of business with the following statistics:

| Business | Assets | Liabilities | Earnings Statistics | |
|---|---|---|---|---|
| | | | Standard Deviation | Correlation |
| A | 5000 | 1000 | 25% | 50% |
| B | 5000 | 3000 | 75% | |

PHX has decided to acquire the following block of business:

| Business | Assets | Liabilities | Earnings Statistics | | |
|---|---|---|---|---|---|
| | | | Standard Deviation | Correlation with A | Correlation with B |
| Z | 5000 | 2500 | 50% | 20% | 80% |

(c) (*4 points*) Calculate the marginal increase in risk capital by acquiring this block of business.

(d) (*2 points*) Assess how the marginal increase in risk capital would change if PHX was able to hedge the asset exposure of the acquisition.

**3.** (*10 points*)

(a) (*2 points*) You are analyzing two of SFO Life's asset portfolios. Asset returns for each portfolio were modeled over 100 scenarios. The ten worst results for each portfolio are given below:

| **Portfolio A** | **Portfolio B** |
|---|---|
| -88,000 | -95,000 |
| -80,000 | -70,000 |
| -78,000 | -68,000 |
| -75,000 | -62,000 |
| -52,000 | -55,000 |
| -45,000 | -42,000 |
| -35,000 | -38,000 |
| -20,000 | -25,000 |
| -15,000 | -18,000 |
| -5,000 | -12,000 |

(i) Calculate VaR(95) and CTE(95) for each portfolio.

(ii) Assess which portfolio is riskier. Justify your answer.

## 3. **Continued**

(b) (*6 points*) The following metrics are calculated for SFO Life's aggregate asset portfolio for a one day time horizon:

| VaR(90) | VaR(95) | CTE(95) |
|---|---|---|
| 1.2 million | 2.5 million | 3.5 million |

(i) Explain a situation in which the company would choose to use VaR(90) instead of VaR(95).

(ii) The Chief Risk Officer states *"since the VaR(95) for a one day horizon is 2.5 million, we can say with 95% confidence that we will lose no more than 2.5 million on approximately 18 days over the next year"*. Critique this statement.

(iii) In order for SFO's assets to remain sufficient to cover its liabilities, the one day loss must never be more than 20 million. The CRO believes the given metrics provide enough confidence that the portfolio will not lose more than 20 million. Assess the appropriateness of using these metrics. Propose any changes.

(iv) To help control risk, SFO plans to implement an incentive program in which the manager of each asset portfolio will receive a quarterly bonus if the company's VaR(95) stays below 3 million. Evaluate this plan.

(c) (*2 points*) SFO's closest competitor, OAK Life, has made its VaR(90) and VaR(95) publicly available. A comparison of the two companies is as follows:

| | VaR(90) | VaR(95) |
|---|---|---|
| SFO Life | 1.2 million | 2.5 million |
| OAK Life | 2.0 million | 4.0 million |

The CEO states *"this is a clear indication that SFO is less risky than OAK"*. Critique this statement. Recommend any additional considerations.

***Question 4 pertains to the Case Study.***
***Each question should be answered independently.***

**4.** (*8 points*)

(a) (*4 points*)

(i) Define spread management.

(ii) Explain how Simple Life's UL interest crediting method complicates spread management, including potential risks.

(iii) Assess the appropriateness of Simple Life's current market risk policy for its UL line of business and the ramifications of the revised investment plan described in the case study. Justify your answer.

(b) (*2 points*) You have been asked to review the market risk profile of Simple Life's UL block. You have been provided with the following information:

| | UL assets | UL liabilities |
|---|---|---|
| Macaulay duration | 6.5 | 8.0 |
| Market value | 1.83 billion | 1.55 billion |

The discount rate is assumed to be 5%.

Calculate the cost of asset duration mismatch in excess of Simple Life's market risk policy using modified duration and a decrease in interest rates of 125 basis points.

(c) (*2 points*) As part of rebalancing the UL portfolio to match the liability duration, you analyze the historical asset return data used for Simple Life's economic capital model.

You have determined that the optimal portfolio is a mix of mortgage-backed securities, high-yield bonds, and long-term treasuries. The expected return of the optimal portfolio is 3.82%.

Calculate the optimal portfolio mix. Show all work.

**5.** (*6 points*) You are working for a U.S. based insurance company. The company is planning to enter the Canadian market by offering a variety of products, including term life, health and travel insurance.

(a) (*2 points*) Describe considerations for a risk appetite framework.

(b) (*2 points*) Assess each of the following statements as they relate to the company's entry into the Canadian market:

(i) There must be an agreement reached on event-related probabilities for both the Canadian and U.S. business.

(ii) Assessing the liquidity for the U.S. and Canadian divisions separately is more important than integrating the assessment at the total company level.

(c) (*2 points*) You are given the following data for each line of business:

| Line of Business | PV(Required Capital) | PV(Premium) | PV(Claims) | PV(Commissions) |
|---|---|---|---|---|
| Term Life | 1600 | 400 | 50 | 200 |
| Health | 800 | 200 | 100 | 50 |
| Travel | 500 | 100 | 50 | 20 |
| **Total** | **2900** | **700** | **200** | **270** |

Corporate tax rate: 30%
Return on capital: 10%
Hurdle rate: 12%

Another actuary at the company has proposed allocating more capital to the travel insurance line of business because it requires the least capital. Assess the actuary’s proposal.

****END OF EXAMINATION****

**USE THIS PAGE FOR YOUR SCRATCH WORK**