SOCIETY OF ACTUARIES
Life Risk Management

Exam ILALRM

Date: Friday, May 1, 2015
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 5 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*) ABC Insurance is a Canadian Life Insurance Company and offers the following products:

- T-100 life insurance with no cash value
- A Segregated Fund product offering a 100% Guaranteed Minimum Death Benefit (GMDB)

ABC has the following operational structure and strategies in place:

- Underwriting, claims and asset management are outsourced to large external firms
- Experience monitoring team tracks lapse experience, providing yearly revisions to pricing and valuation assumptions
- Given their strong relationship with their third-party asset manager, ABC feels no need to hedge their segregated fund guarantee risks
- Capital management team indicates the company is in a good financial position and should begin aggressively pricing their products to generate additional new business sales volume

(a) (*2 points*) Evaluate ABC's Risk Control Process.

(b) (*4 points*) You have been asked to investigate ABC's Enterprise Risk Management (ERM) Quality Classification:

(i) (*2 points*) Propose which of the ERM Quality Classifications is currently appropriate for ABC. Justify your answer.

(ii) (*2 points*) Explain how ABC could improve its ERM Quality Classification, if possible.

2. (*7 points*) You are responsible for managing interest rate exposure for XYZ Life's fixed-income securities using an internally-developed model.

(a) (*3 points*) One of your analysts proposes that matching effective duration of XYZ Life's assets and liabilities is sufficient to manage interest rate risk exposure. XYZ Life's liability portfolio behaves like an option-embedded bond. State whether you agree or disagree with your analyst's proposal. Justify your answer.

(b) (*4 points*) One of XYZ Life's insurance products behaves similarly to a bond. The product's liability value is 100 million and the liability duration is 20 years.

You decide to replicate it with the following zero-coupon bond index:

Bond	Term (Years)	Key rate duration
1	0.25	0.05
2	1	0.2
3	2	0.7
4	5	1.0
5	10	0.7
6	30	0.6

(i) (*1 point*) Calculate the key rate duration of the bond index.

(ii) (*3 points*) Construct a portfolio of zero-coupon bonds from the above bond index to replicate this product's liabilities.

3. (*10 points*) LFW Life is an insurance company which sells universal life with secondary guarantees (UL-SG) and variable annuities (VA). You have been asked to assess the company's enterprise risk management framework.

(a) (*2 points*) Describe the role of the central risk function (CRF) in each of the following models of risk management:

(i) Three Lines of Defence

(ii) Offence and Defence

(iii) Policy and Policing

(iv) Partnership

(b) (*3 points*) You have been given the following financial results for new business sold in 2014:

Product	2014 Premium	Present Value (PV) of Premium	PV of Required Capital	Profit Margin
UL-SG	90 million	250 million	125 million	8%
VA	40 million	100 million	80 million	12%

Assume:

- Profit margin is level over the lifetime of each product
- Interest earned on required capital is 4%
- There is no diversification benefit for LFW's overall business
- Tax rate is 0%

Calculate the risk-adjusted return on capital (RAROC) for 2014 new business for each of the following:

(i) UL-SG product

(ii) VA product

(iii) LFW's combined insurance portfolio

3. **Continued**

(c) (*5 points*) LFW's leaders are preparing a business plan for 2016 and the Chief Risk Officer received the following new business projections:

Product	Expected Sales	Minimum Required Capital	PV of Minimum Required Capital	RAROC
UL-SG	100 million	28 million	60 million	25%
VA	50 million	25 million	60 million	15%

LFW has 135 million of available capital for 2016 new business.

Due to competitors exiting the UL-SG and VA lines of business, LFW's sales executives are recommending an aggressive campaign to attract new clients, while maintaining existing relationships.

Propose a revised new business plan which maximizes RAROC while satisfying the following requirements:

- Hold 225% of minimum required capital for each product
- Increase 2016 expected sales by at least 5% for each product

4. (*8 points*) You are an actuary working for Luck Life Insurance Company. You are evaluating the company's risk profile based on Value-at-Risk (VaR).

(a) (*2 points*) Luck Life has two asset portfolios which have been modeled over several scenarios as summarized below:

Ending Value of Portfolio

Scenario	**1**	**2**	**3**	**4**	**95% VaR**
Portfolio A	15	10	-20	8	9
Portfolio B	10	-12	4	-7	15

The Chief Actuary has reviewed these results and made the following statements:

(i) "Portfolio B is our riskiest portfolio since it has a higher VaR."

(ii) "The 95% VaR of the combined portfolios is 24; this is the number on which we should base our risk analysis."

Critique these statements.

(b) (*2 points*) Luck Life wants to compare its VaR to Chance Mutual, a company with similar risks as Luck Life as per the following:

	Luck Life	**Chance Mutual**
Size (in assets)	500 million	500 million
Type of company	Public	Private
VaR method used	100 day historical simulation	100 day historical simulation
90% VaR	20 million	50 million

The CEO of Luck Life is concerned that Luck Life isn't holding enough risk capital. He believes that because Luck Life is so similar to Chance Mutual they should have virtually the same VaR.

Explain why Luck Life's VaR might be different than Chance Mutual's.

4. Continued

(c) (*4 points*) The senior management at Luck Life has been debating the time horizon that should be used for their VaR calculation.

You run a model to calculate VaR under two different time horizons. The results are as follows:

Method	**Time Horizon**	**99% VaR**
100 day historical simulation	1 day	60 million
100 day historical simulation	1 month	40 million

(i) (*1 point*) List the motivating factors that may influence the choice of time horizon.

(ii) (*3 points*) The Chief Actuary states *"For all future VaR calculations, we should use the historical simulation method because historical data is the best data available. We should also use a 1 day time horizon because it will always result in a bigger VaR."*

Critique this statement.

Question 5 pertains to the Case Study.
Each question should be answered independently.

5. (*9 points*) Simple Life has been presented with a strategic opportunity to grow life insurance quickly in a broker focused market as follows:

- A new exclusive UL product from Simple Life targeting high net worth non-smoking females aged 40 to 50
- Face Amount: 20 million per policy
- Premiums: 50 per thousand

The broker has been in this market for 7 years and has never had a customer lapse their coverage. They would like to use the proposed Simple Life UL product with the following financial terms:

- First year commissions: 50% of paid premiums
- Renewal commissions: 2% of paid premiums
- Minimum credited rate on the accumulation fund: 3.5%

The broker guarantees 50 sales per year growing to 100 sales per year after 3 years. Most sales will be new clients for the broker and others will be replacements of their in-force customers.

(a) (*3 points*) Explain new product, investment and business risks that would be introduced to Simple Life if they agree to the broker's proposal.

(b) (*4 points*) Identify changes Simple Life should make to their risk management processes if the broker meets their sales objective.

(c) (*2 points*) Recommend changes to the broker's proposal to reduce the risk for Simple Life.

****END OF EXAMINATION****

USE THIS PAGE FOR YOUR SCRATCH WORK

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