SOCIETY OF ACTUARIES
Exam ILALRM
Life Risk Management Exam

Exam ILALRM

Date: Wednesday, October 29, 2014
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.

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Printed in the U.S.A.

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. (*10 points*) You are an Asset-Liability Manager at JSW Financial, a life insurance company offering 10-year term and permanent life insurance. The company's asset-liability management (ALM) policy is to cash flow match as exactly as possible. Currently, each product line is backed by its own group of assets and managed by its own ALM function.

(a) (*2 points*) Define each of the following ALM methods:

(i) Exact cash flow matching

(ii) Cash flow testing

(iii) Duration matching (immunization)

(iv) Convexity matching

(v) Dynamic financial analysis

(b) (*2 points*) Define the following risks and state how they would impact each product sold by JSW:

(i) Disintermediation risk

(ii) Reinvestment risk

(c) (*2 points*) Explain how JSW could revise its cash flow matching methodology to reduce interest rate risk.

(d) (*4 points*) You have received additional information about JSW's permanent life product known as "Variable Life" which includes the following product features:

- Single premium with an initial face amount of 100,000
- Net single premium is 100% invested in an equity fund
- The death benefit payable is defined as the greater of:
  - 100,000; or
  - 100,000 × equity fund value ÷ net single premium

1. **Continued**

Your colleague has proposed the following hedging strategy:

- Project future expected claims assuming a death benefit is equal to 100,000 per policy; and
- Purchase a series of put options expiring at the end of each projection period with a strike price equal to the expected claims for that period.

Your colleague argues the put options will pay out when the fund value is below the net single premium, thereby covering the cost of guaranteeing the initial face amount.

(i) Identify the risks associated with your colleague's strategy.

(ii) Identify another hedging strategy and explain the risks it introduces.

2. (*7 points*)

(a) (*1 point*) Compare and contrast the following tail risk calculations:

(i) 95% VaR

(ii) 95% CTE

(b) (*3 points*) Given the following loss distributions:

$$X \begin{cases} 5 & \text{with a probability of } 0.800 \\ 80 & \text{with a probability of } 0.170 \\ 500 & \text{with a probability of } 0.030 \end{cases}$$

$$Y \begin{cases} 10 & \text{with a probability of } 0.850 \\ 120 & \text{with a probability of } 0.145 \\ 2000 & \text{with a probability of } 0.005 \end{cases}$$

Calculate the 95% VaR and 95% CTE for X+Y, assuming X and Y are independent. Show all work.

(c) (*3 points*) Explain the shortcomings of VaR and how stress testing can complement standard VaR models.

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3. (*8 points*) You are the Chief Risk Officer of XYZ Insurance, which sells a permanent life insurance product.

(a) (*2 points*) Describe primary sources of Demographic Risk and explain how they can be modeled.

(b) (*2 points*) You are given the following information at the time of policy issue:

l_x	10
Death Benefit	100,000 per policy
Reserve	15,000 per policy

n	$\Pr\left(l_{x+1}=n\right)$
0	0.0000
1	0.0000
2	0.0001
3	0.0001
4	0.0012
5	0.0085
6	0.0401
7	0.1298
8	0.2759
9	0.3474
10	0.1969

Calculate the 95% VaR for the Net Amount at Risk (NAR) for a 1-year horizon.

(c) (*1 point*) The company has stated publicly that it pays its death benefits within 30 days of a death claim being reported. You have gathered the following data:

Days since claim reported	Percentage of claims paid
1-15	5%
16-30	25%
31-45	25%
46-60	30%
60+	15%

Describe the risks XYZ may face from its claims paying process.

3. **Continued**

(d) (*3 points*) As part of your risk review of XYZ, you interview a few key employees of the company. Critique each of the following three statements:

(i) One of XYZ's top sales agents stated, "*Sometimes it is necessary to change the medical declaration or smoking status on an application for a life insurance product in order to get the customer a premium rate they can afford. There is really no downside risk in doing this; I get commission for selling the policy, the customer gets insurance, and the company gets new sales.*"

(ii) The Chief Financial Officer of XYZ said, "*Our operational risk management focus should be on risks that have a high likelihood and a high impact. Those are the risks that are most dangerous to the company.*"

(iii) The Manager of actuarial modeling stated, "*The best way to model operational risk is to use internal data. Since every company faces unique operational risks, external data would be irrelevant. When gathering internal data, we will exclude any outliers that could greatly distort the mean.*"

4. (*7 points*) ABC Life is a small-sized insurer specializing in Term Insurance.

(a) (*4 points*) ABC Life is hoping to create shareholder value by introducing a new universal life (UL) product.

You are given the following for three different UL product proposals (in millions):

	Annual Premium	Annual Underwriting Profit	Required Economic Capital	Present Value (PV) of Investment Income on Capital
UL #1	110	15	140	8.5
UL #2	135	12	130	10.5
UL #3	100	9.5	100	7.5

PV factor	2
Available capital	135 million
Corporate tax rate	30%
Hurdle rate	9.5%

(i) Calculate the profit margin and risk-adjusted return on capital (RAROC) for each proposed product.

(ii) Recommend which UL product(s) ABC Life should add to its portfolio, if any. Justify your answer.

4. Continued

(b) (*3 points*) You are given:

Diversification benefit	94 million
Budgeted risk appetite for equity risk	100 million
Assets	1200 million
Liabilities	900 million
Modified duration of liabilities	20

Interest rate change	Probability
1% decrease	0.025
2% decrease	0.015
3% decrease	0.005
4% decrease	0.001

Assume:

- Exposure to changes in interest rates and equity markets are the only contributors to market risk
- ABC's market risk policy is "not to lose more than 150 million of surplus in a 1-in-200 year event including the diversification benefit"

Calculate the maximum duration mismatch allowed based on duration matching.

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

5. (*8 points*) Validate each of the following statements based on Chew's paper "Theory of Risk Capital in Financial Firms" and explain how each statement applies in the context of Simple Life or its holding company, Lyon Corporation:

(i) "*Standard methods of accounting can fail to measure risk capital and its associated costs correctly in the calculation of a company's profitability, resulting in an overstatement of profitability.*"

(ii) "*The amount of risk capital depends only on the riskiness of net assets and not at all on the form of financing of net assets.*"

(iii) "*The risk capital of a multi-business firm can be less than the aggregate risk capital of the businesses on a standalone basis.*"

(iv) "*The full allocation of risk capital across individual businesses of a multi-business firm is not feasible.*"

(v) "*The true profitability of individual businesses can be significantly distorted by the attempt to fully allocate the risk capital of a multi-line business.*"

(vi) "*The economic costs of risk capital to the firm are the spreads on the price of asset insurance arising from information costs due to moral hazard or adverse selection and agency costs.*"

****END OF EXAMINATION****

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