# SOCIETY OF ACTUARIES
## Life Finance & Valuation - Canada

# Exam ILALFVC

## MORNING SESSION

**Date:** Friday, May 2, 2014
**Time:** 8:30 a.m. – 11:45 a.m.

### INSTRUCTIONS TO CANDIDATES

**General Instructions**

1. This examination has a total of 100 points. It consists of a morning session (worth 60 points) and an afternoon session (worth 40 points).

   a) The morning session consists of 7 questions numbered 1 through 7.

   b) The afternoon session consists of 4 questions numbered 8 through 11.

   The points for each question are indicated at the beginning of the question.

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 morning or afternoon session for Exam ILALFVC.

6. Be sure your essay 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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Exam ILALFVC Front Cover

****BEGINNING OF EXAMINATION****
**Morning Session**

**1.** (*7 points*) You are given the following company risk profiles:

| | **Economic Basis** | **Statutory Basis** |
|---|---|---|
| Asset Risk | 380 | 180 |
| Insurance Risk | 2,500 | 1,800 |
| Interest Risk | 1,500 | 900 |
| Business Risk | 300 | - |
| **Simple Sum** | **4,680** | **2,880** |
| Diversification Benefit | -1,638 | ? |
| **Diversified Sum** | **3,042** | **?** |

Assume:

- The Statutory Basis is US RBC
- $C_0$ = 100 and $C_{1a}$ = 80 under asset risk
- $C_{3a}$ is all interest rate risk

(a) (*3 points*) Calculate the Authorized Control Level Risk-Based Capital under the statutory basis.

(b) (*4 points*)

(i) (*1 point*) Identify which basis produced a higher diversification.

(ii) (*3 points*) Describe three factors which might drive the basis you identified above to produce higher diversification benefits.

Show your work.

**2.** (*8 points*)

(a) (*6 points*) Blue Jay Insurance is a life insurer that has reinsured their Term 10 life insurance product on an excess YRT basis with Rock Reinsurance. The reinsurance treaty's effective date is 1 January 1995. You are given the following information on the treaty:

- Blue Jay Insurance retains the first 100,000 of face amount per life.
- Rock Reinsurance reinsures face amount in excess of 100,000 per life.
- Blue Jay Insurance may elect to increase new business retention limits with written notice to Rock Reinsurance.
- The treaty contains a recapture provision as follows: "If Blue Jay Insurance increases their per life retention limit on new business, Blue Jay Insurance may also recapture up to the new retention limit on inforce lives. Individual policies cannot be recaptured prior to their $10^{th}$ policy anniversary."
- The following recapture fee schedule applies:

| Policy Year | Recapture Fee per 1000 Face Amount Recaptured |
|---|---|
| 1-10 | Not applicable |
| 11 | 40 |
| 12 | 30 |
| 13 | 25 |
| 14 | 18 |
| 15+ | 13 |

Blue Jay Insurance is considering increasing their new business retention limit from 100,000 to 150,000 face amount per life. They are also considering increasing retention on inforce business in accordance with the reinsurance treaty terms. You are given:

| | Total Inforce Face Amount (Millions) | |
|---|---|---|
| Policy Year | Retained with Recapture | Retained without Recapture |
| 1-10 | 119.5 | 98.5 |
| 11 | 16.5 | 13.5 |
| 12 | 15.0 | 12.5 |
| 13 | 13.5 | 11.0 |
| 14 | 11.0 | 9.0 |
| 15+ | 73.5 | 60.5 |

## 2. Continued

The embedded value (EV) calculation assumes the recapture premium has already been paid for policies that have been inforce for at least 10 years. All other inforce policies will be recaptured up to the new retention limit at the earliest possible date and recapture fees will be paid at that time.

| | Embedded Value (Millions) | |
|---|---|---|
| Term 10 Block of Business | Retained with 150,000 Limit per Life | Retained with 100,000 Limit per Life |
| Inforce Business | 6.2 | 5.1 |
| Prospective New Business | 1.2 | 1.4 |
| Total | 7.6 | 5.9 |

Recommend whether Blue Jay should proceed with the proposed retention limit increase for new business only or on both new business and inforce. Justify your recommendation.

(b) (*2 points*) Rock Reinsurance is drafting a new treaty with another client, Argo Life. Argo has requested that a recapture clause be included and have asked for a structure that does not include recapture fees.

(i) Propose recapture clause conditions that Rock Reinsurance could include to limit the risks associated with Argo's recapture of their business.

(ii) Rock Reinsurance has indicated to Argo that allowing recapture will require higher YRT reinsurance premium rates. Argo's pricing actuary commented:

"*Charging higher YRT premiums so that we can recapture at a later date doesn't make sense because recapturing just moves the risk from Rock to us. There is no change to the reserves or the policy values. I would like the YRT reinsurance premiums to be restored to the pre-capture clause levels.*"

Critique the pricing actuary's comments from Rock Reinsurance's point of view.

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

(a) (*4 points*)

(i) (*2 points*) Describe the three components of an IFRS insurance contract liability.

(ii) (*1 point*) You are given the following for a whole life portfolio:

| | |
|---|---|
| Acquisition Costs (successful efforts) | 150 |
| Acquisition Costs (unsuccessful efforts) | 200 |
| Expected Present Value of Premiums | 5,500 |
| Expected Present Value of Claims | 5,000 |
| Assumed Value of Indifferent Fixed Cash Flows (excluding Acquisition Costs) | 600 |

Calculate the components described in (i). Show all work.

(iii) (*1 point*) Describe how these components are treated differently under FASB.

(b) (*3 points*)

(i) (*1 point*) Compare the two approaches to determine the discount rate under IFRS.

(ii) (*2 points*) You are given:

| | |
|---|---|
| Risk free rate of return | 2.00% |
| Actual reference portfolio rate | 5.50% |
| Expected reference portfolio rate with asset duration exactly matching liability duration | 5.90% |
| Liquidity premium | 1.50% |
| Market risk premium for expected credit losses | 1.20% |
| Market risk premium for unexpected credit losses | 0.70% |

Calculate the IFRS discount rate based on each of the two approaches. Show your work.

## 3. Continued

(c) (*3 points*) For contracts that require the mirroring approach under IFRS:

(i) (*1 point*) Describe the criteria that would qualify contracts for this approach.

(ii) (*2 points*) Explain the measurement and decomposition of cash flows that is required.

**4.** (*10 points*) Ford Accounting LLP has been hired by Burch Life Insurance Company to perform annual reviews of their year-end financial statements. Tom, senior accountant at Ford, has been assigned to lead the review for year-end 2013. Ben, senior actuary at Ford, has been assigned to assist Tom with the review.

(a) (*3 points*) Burch is a large public company subject to the financial reporting requirements of Section 404 of the Sarbanes-Oxley Act (SOX 404). Burch uses the COSO framework to comply with those requirements.

(i) Describe Burch's management responsibilities under SOX 404.

(ii) Describe the key steps to implementing an effective financial reporting evaluation process within the COSO framework.

(b) (*2 points*) While planning for the review, Ben provides the following advice:

- Tom should reference the review from the prior fiscal year.
- Since Burch is a large company, Tom should reach out directly to individuals from different departments to obtain information needed.
- During the course of the review, Tom should make sure that all material issues are documented and resolved, but he does not need to concern himself with immaterial issues.

Critique Ben's advice.

(c) (*5 points*) Burch's term life block can be subdivided into three major plan groups. The table below shows statistical characteristics of each group:

| Plan Group | Number of policies | Face Amount (000's) | |
|---|---|---|---|
| | | Mean | Standard Deviation |
| A | 10,000 | 80 | 20 |
| B | 15,000 | 175 | 37 |
| C | 25,000 | 96 | 24 |

## 4. Continued

One of the tests Ford will perform requires a random sample of 100 policies where the sample mean of the face amounts will be used to estimate the mean face amount of the entire block. Tom plans to take a simple random sample, but Ben suggests that the accuracy of the estimate can be improved if the random sample is stratified as follows:

| Plan Group | Policies chosen |
|---|---|
| A | 20 |
| B | 30 |
| C | 50 |
| Total | 100 |

(i) (*1 point*) Compare and contrast simple random sampling with stratified random sampling.

(ii) (*4 points*) Determine whether or not you agree with Ben's suggestion by calculating and comparing the standard deviation of the sample mean under both approaches. Show all work.

**5.** (*8 points*) You are the Valuation Actuary of KJO Life, a Canadian life insurance company.

(a) (*2 points*) List the principles that should be considered when setting best estimate assumptions and margins for adverse deviations (MfAD) for the purpose of valuation.

(b) (*6 points*) KJO Life sells 5-year term life insurance renewable to age 65 with guaranteed premiums at renewal. There are preferred non-smoker rates available with medical underwriting for face amounts over 500,000. You have been provided with the following list of best estimate valuation assumptions for this product:

| Item | Best Estimate Assumption |
|---|---|
| Term of Liabilities | 10 years from issue |
| Mortality | Based on most recent CIA Mortality Tables. Non-smoker tables have been adjusted to reflect medical underwriting and standard versus preferred rates. |
| Future Mortality Improvements | Varies by attained age as follows: 2% from age 0 to 60, decreasing linearly from 2% to 0% from age 60 to 100 for non-smokers regardless of preferred underwriting status or gender.<br>No mortality improvement assumed for smokers. |
| Lapse | Years 1 – 3: 6%<br>Year 4: 2%<br>Years 5 – 6: 15%<br>Years 7 – 8: 6%<br>Year 9: 2%<br>Subsequent 5 year periods follow the same pattern as years 5 – 9. |
| Interest | Equal to the current forward interest rates at the balance sheet date. |
| Expense per policy | Based on expense study completed annually: 63 per policy, inflated at 2.7% per year |
| Commissions | 25% for year 1, 5% for years 2-7, 0% thereafter |
| Acquisition Expenses | 2.3% of Face Amount per year |
| Income Tax | 33% year 1, decreasing linearly to 29% over 5 years |
| Premium Tax | 2.25% of premium |

Assess the appropriateness of each assumption giving consideration to the CIA Standards of Practice. Recommend changes where applicable.

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**6.** (*10 points*)

(a) (*4 points*) ABC Life uses the following methodology to calculate the capital for all of its "qualifying participating" products:

- Asset Default (C-1) Risk:
  - Uses credit ratings from Moody's and from Standard and Poor's for assets
  - Multiplies the asset market value by 50% of the factor corresponding to the rating of the asset
- Mortality Risk:
  Factor for "qualifying participating" product times the net amount at risk
- Lapse Risk:
  Determined as difference between:
  - Policy liabilities calculated assuming 50% higher lapse MfAD
  - Policy liabilities
- The minimum capital requirement is the sum of these capital requirements for the above components times 120% to cover operational risks

Evaluate the above approach to the determination of capital.

(b) (*2 points*) You are reviewing the MCCSR calculated by ABC for one of its participating whole life insurance products. The product is backed by an asset segment containing Government of Canada bonds and investment grade corporate bonds. There is no reinsurance on this product.

The company pays dividends reflecting the following:

- Actual mortality and lapse experience.
- A minimum interest rate of 5%.
- Per policy expense assumptions of 100 per year, inflated at 2% each year
- The company dividend policy is made available to advisors and policyholders on request. ABC reviews the policyholder dividend scale once every three years.

Determine whether this product is a "qualifying participating product" based on the criteria outlined in the MCCSR guidelines. Justify your answer.

## 6. Continued

(c) (*2 points*) With respect to the following capital levels:

- Minimum Capital
- Supervisory Target Capital
- Internal Target Capital

Identify which of the following statements pertain to each level:

(i) The level of capital, based on a company's own risk and capital adequacy assessment process, is necessary to cover the risks in the capital tests as well as all other risks of the insurer.

(ii) If the insurer's capital ratio were to approach or fall below this level, OSFI would be concerned about the ongoing viability of the insurer.

(iii) Target capital ratio is 150% of the calculated capital.

(iv) Level of capital which would provide adequate time for management to resolve financial concerns that arise while minimizing the need for OSFI intervention.

(v) Level of capital necessary to cover the risks specified in the capital test.

(vi) Insurers are expected to operate above this level of capital.

(d) (*2 points*) You are given the following plan for reviewing and revising ABC's Internal Target Capital Ratio:

- Review the capital plan and associated stress testing.
- Verify that scenarios include extreme events that could adversely affect the company.
- Determine the probability of falling below the internal target capital.
- The internal target should be set so that the company has the ability to access capital (through capital markets) to address financial requirements as they emerge.
- Write a report to the board describing the determination and review of the internal target.
- Notify OSFI if there is a change in the Internal Target Capital Ratio.

Critique the above plan.

**7.** (*7 points*) Gamma is a Canadian Life Insurance Company. As the Valuation Actuary, you are leading the IFRS4 transition under OSFI "Guideline B3" for all your related reinsurance agreements and you are also assessing Gamma's existing reinsurance framework.

(a) (*1 points*) Gamma is evaluating a prospective reinsurance contract to cede the entire segregated fund block to Delta Re. Your broker has already performed a detailed analysis on the financial strength of Delta Re. To evaluate this reinsurance contract the Valuation Actuary relies entirely on the Broker's report as well as an external rating agency's assessment. Critique this approach.

(b) (*3 points*)

(i) Describe the mirror reserving approach.

(ii) In the US, a few states require mirror reserving for statutory reserves. Explain why mirror reserving is not appropriate for life insurance in Canada.

(c) (*3 points*) You are given the following information for the segregated fund block:

- General Account Assets = 1000
- Net insurance liabilities = 800
- Coinsurance quota share 70%
- Margin for prudence in all liability calculations (gross, ceded, and hence net) is assumed to be 10% of best-estimate values.

Calculate the impact of prudence in financial statements under IFRS4. Show your work.

****END OF EXAMINATION****
**Morning Session**

**USE THIS PAGE FOR YOUR SCRATCH WORK**

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