

# Exam ILALFMC

## Life Financial Management - Canada

**Date:** Tuesday, November 7, 2023

### INSTRUCTIONS TO CANDIDATES

#### General Instructions

1. This examination has 8 questions numbered 1 through 8 with a total of 80 points.

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

2. 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 provided in this document.

#### Written-Answer Instructions

1. Each question part or subpart should be answered either in the Word document or the Excel document as directed within each question. Graders will only look at work in the indicated file.

a) In the Word document, answers should be entered in the box marked ANSWER within each question. The box will expand as lines of text are added. There is no need to use special characters or subscripts (though they may be used). For example,  $\beta_1$  can be typed as beta\_1, and  $x^2$  can be typed as x^2.

b) In the Excel document formulas should be entered. For example,  $X = \text{component1} + \text{component2}$ . Performing calculations on scratch paper or with a calculator and then entering the answer in the cell will not earn full credit. Formatting of cells or rounding is not required for credit.

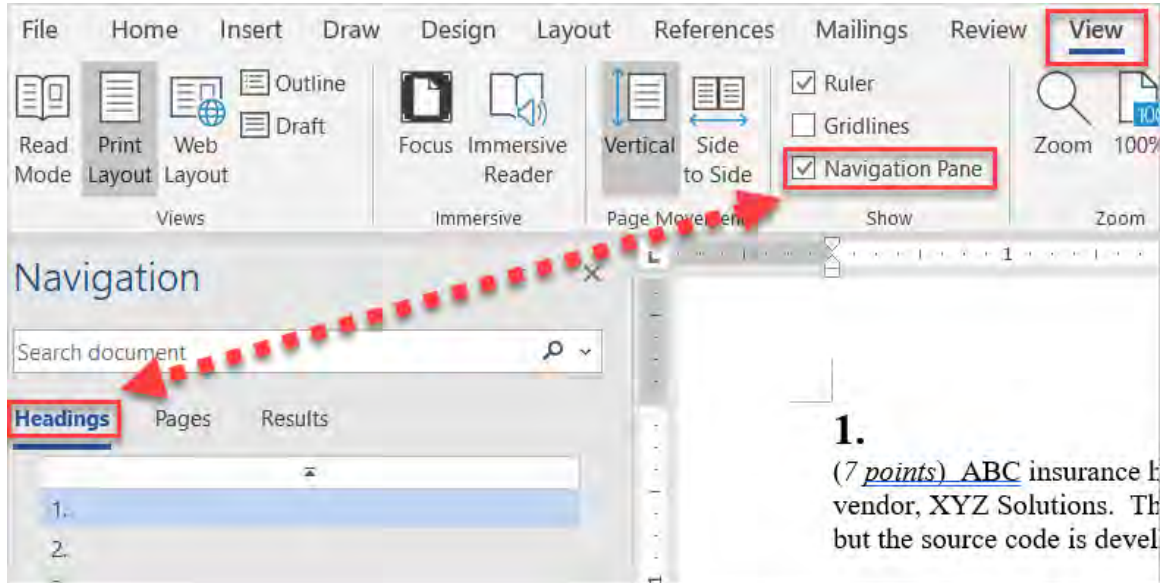
c) Individual exams may provide additional directions that apply throughout the exam or to individual items.

2. The answer should be confined to the question as set.
3. Prior to uploading your Word and Excel files, each file should be saved and renamed with your five-digit candidate number in the filename.
4. The Word and Excel documents that contain your answers must be uploaded before the five-minute upload period expires.

## Navigation Instructions

Open the Navigation Pane to jump to questions.

Press Ctrl+F, or click View > Navigation Pane:



# 1.

(9 points) MGP is a financial firm that sells term life insurance, life annuities, mutual funds, and segregated funds. They are introducing a risk capital framework to assist their corporate decision making.

(a) (1 point) Critique the following statements regarding a risk capital framework:

- A. *All else being equal, a firm that invests predominantly in equities will require more risk capital than a firm that invests predominantly in fixed income securities.*

ANSWER:

- B. *As long as there are no changes in a firm's underlying gross assets, changes in any liabilities will have no impact on the amount of risk capital required.*

ANSWER:

# 1. Continued

(b) (6 points) You are given:

- Marginal risk capital is used to allocate risk capital across business units.
- The continuously compounded risk-free rate of interest is 3%.

Correlation of profits by business unit

	Annuities	Mutual Funds	Seg Funds	Term Life
Annuities	1.00			
Mutual Funds	0.25	1.00		
Seg Funds	0.50	0.20	1.00	
Term Life	0.00	0.00	0.00	1.00

Business Unit Group	Annual Volatility of profits	Liabilities at time 0	Risk-free value of net assets at the end of the first year
Annuities (1)	30.0%	2,000	250
Mutual Funds (2)	40.0%	1,000	200
Seg Funds (3)	25.0%	3,000	500
Term Life (4)	20.0%	8,000	500
1 & 2 & 3	22.2%	6,000	950
1 & 2 & 4	16.2%	11,000	950
1 & 3 & 4	15.2%	13,000	1,250
2 & 3 & 4	15.3%	12,000	1,200
1 & 2 & 3 & 4	14.8%	14,000	1,450

- (i) (2 points) Calculate the variance of business profits of a portfolio consisting of mutual funds and segregated funds.

*The response for this part is to be provided in the Excel spreadsheet.*

- (ii) (4 points) Calculate the proportion of unallocated risk capital for MGP at the end of the second year.

*The response for this part is to be provided in the Excel spreadsheet.*

**1. Continued**

- (c) (2 points) MGP is considering expanding their business to include whole life insurance but is concerned about the impact on risk capital.

Recommend two criteria for MGP to use in making this decision.

ANSWER:

## 2.

(11 points) You are an actuary working for HWL Life, a US based company. You are responsible for ensuring that the company complies with the NAIC Solvency Modernization Initiative (SMI).

- (a) (2 points) Describe the key functions of an insurer's corporate governance structure within the supervisory review process.

ANSWER:

- (b) (1 point) Describe the two primary goals of the Own Risk and Solvency Assessment (ORSA).

ANSWER:

- (c) (4 points) HWL Life last updated its best estimate mortality and lapse assumptions for its term insurance block in 2019. Both assumptions are considered fully credible.

Recent experience has differed from current best estimate assumptions, primarily due to the COVID-19 pandemic:

	2020	2021	2022
Mortality	120% of expected	115% of expected	110% of expected
Lapse	80% of expected	85% of expected	90% of expected

HWL Life is currently conducting its annual ORSA exercise in which it assesses results for the normal and stressed scenario over a three-year timeframe, consistent with their business planning horizon.

Critique each of the following statements. Justify your answer.

- A. *Given experience trends, the business plan assumes that mortality and lapse experience return to pre-pandemic levels in 2023. To align with the business plan, the current best estimate assumptions are used for the ORSA normal scenario projection.*

ANSWER:

## 2. Continued

- B. *For the ORSA stress scenario, 105% of current best estimate mortality and 98% of current best estimate lapse rates are used.*

ANSWER:

- C. *To align with the business plan and the normal scenario in ORSA, the best estimate mortality and lapse assumptions are used in the deterministic reserve calculations under VM-20.*

ANSWER:

- (d) (4 points) HWL Life is considering acquiring a block of life insurance from GTX Life.

Critique each of the following statements. Justify your response:

- A. *The purchase price should be estimated using original pricing assumptions.*

ANSWER:

- B. *The valuation can rely on GTX's public financial statements combined with a base case forecast provided by their senior management.*

ANSWER:

- C. *Comparable Company Analysis is a more useful tool than Comparable Transaction Analysis.*

ANSWER:

- D. *Distributable earnings should be estimated as the pre-tax statutory earnings less the increase in economic capital.*

ANSWER:

### 3.

(7 points) With respect to the Income Tax Act of Canada:

(a) (2 points)

- (i) List the requirements for an annuity to be recognized as a prescribed annuity.

ANSWER:

- (ii) Describe the differences in the tax treatment between prescribed and non-prescribed annuities.

ANSWER:

(b) (1 point) A policyholder purchases a payout annuity for 10,000. You are given the following information as of the first anniversary:

Accumulating fund	Payment during the year	Mortality gain
9,700	1,000	200

Calculate the taxable income to the policyholder assuming the policyholder survives to the end of the first year:

*The response for this part is to be provided in the Excel spreadsheet.*

(c) (1 point) You are given the following for a 5-year prescribed annuity certain contract:

- Purchase price = 10,000
- Monthly income = 200

Calculate the policyholder's annual taxable income. Show all work.

*The response for this part is to be provided in the Excel spreadsheet.*



### 3. Continued

- (d) (3 points) You are given the following information for a block of life insurance policies issued in 2020:

Maximum Tax Actuarial Reserves (MTAR)	
31-Dec-20	31-Dec-21
30,000	25,000

- Average interest rate on long term government of Canada bonds = 4.8%
- Investment income reported to policyholders during 2021 = 100

Calculate the amount of Investment Income Tax (IIT) payable for the 2021 taxation year. Show all work.

*The response for this part is to be provided in the Excel spreadsheet.*

#### 4.

(11 points) XYZ Insurance sells and underwrites the product Easy-Term with the following features:

- Coverage is provided for 3 years, with a one-time option to renew the contract for an additional 3 years.
- Premium payment is in the form of a single premium purchasing the insurance coverage for 3 years.
- The contract is fully underwritten at the time it is issued.
- Contract holders wishing to renew are required to fill out a medical questionnaire. XYZ is obliged to accept the renewal but there is no contractual limit on the premium that will be charged on renewal.

You have decided to measure Easy-Term using the General Measurement model.

You are given the following at initial recognition for two groups of Easy-Term contracts:

	Group A	Group B
PV of premiums	2,500	2,500
PV of benefits	1,000	1,200
PV of directly attributable maintenance expenses	450	450
PV of non-attributable maintenance expenses	50	50
Directly attributable acquisition expenses	510	510
Non-directly attributable acquisition expenses	35	35
Risk Adjustment	400	400

- (a) (2 points) Explain in general how profit is recognized over the duration of the contract for policies that are directly issued and profitable at issue.

ANSWER:

- (b) (1 point) Recommend a contract boundary for Easy-Term. Justify your response.

ANSWER:

- (c) (2 points) Determine the impact to profit or loss at initial recognition for each group. Show all work.

*The response for this part is to be provided in the Excel spreadsheet.*

#### 4. Continued

- (d) (3 points) XYZ Insurance issues another group of life insurance contracts in 2024 with a loss of 100 on the date of issue. A reinsurance treaty covers these contracts from issue.

You are given the following information with respect to the reinsurance contract:

Proportion of loss covered	75%
PV of reinsurance premiums payable	800
PV of reinsurance claims recoverable	900
Risk Adjustment ceded	20

- (i) Discuss the setting of assumptions used for the valuation of reinsurance contracts held and the underlying direct insurance contracts.

ANSWER:

- (ii) Calculate the impact of the reinsurance contract to the company.

*The response for this part is to be provided in the Excel spreadsheet.*

- (iii) Determine the impact to profitability to the group of contracts of the reinsurance contract held. Show all work.

*The response for this part is to be provided in the Excel spreadsheet.*

- (e) (3 points) Critique the following statements with respect to XYZ Insurance's reinsurance policies.

- A. *The Assistant Vice President of Reinsurance oversees XYZ Insurance's reinsurance risk management policy. The reinsurance risk management policy specifies which XYZ Insurance products can be reinsured and the ceding limits.*

ANSWER:

- B. *Reinsurers are chosen based on the reinsurer's published capital ratio and external ratings.*

ANSWER:

**4. Continued**

- C. *All reinsurance contracts are required to be fully executed by all parties prior to the effective date of the contract.*

ANSWER:

## 5.

(10 points) MSY Life has two blocks of participating life insurance contracts with the following features:

### **Closed Par Block:**

- Closed to new business.
- Assets supporting the block are maintained in a separate account for Closed Par policies only.
- Policyholder dividends have been reduced to zero.
- MSY Life plans to add additional assets to support the product guarantees as needed.

### **Open Par Block:**

- Open to new business.
- Assets supporting the block are maintained in a separate account for Open Par policies only.
- Policyholder dividends are set annually in accordance with MSY Life's practice to credit all underlying experience to the policyholder less a nominal management fee.
- Investment experience is smoothed to avoid volatility in dividends.
- MSY Life is currently paying policyholder dividends in excess of the dividends illustrated at issue.

- (a) (1 point) State the criteria for an insurance contract to be deemed an "insurance contract with direct participation features".

ANSWER:

- (b) (3 points) Recommend a measurement model for valuing the contracts for each block at the transition date using the fair value approach. Justify your response.

ANSWER:

## 5. Continued

(c) (2 points)

- (i) Explain potential differences between market instruments and participating guarantees that MSY Life must consider.

ANSWER:

- (ii) Explain how MSY Life can reflect these differences while meeting the IFRS 17 requirement to be consistent with observable market prices.

ANSWER:

(d) (1 point) Describe how the opening contractual service margin for Open Par Block should be determined.

ANSWER:

(e) (3 points)

- (i) Describe considerations in selecting and projecting an appropriate coverage unit for individual participating life insurance.

ANSWER:

- (ii) Recommend a coverage unit for each of MSY Life's participating blocks. Justify your answer.

ANSWER:

**6.**

(12 points)

- (a) (3 points) Critique each of the following statements with respect to IFRS 17. Justify your response.

A. *The estimate of future cash flows must incorporate the full range of possible outcomes. Therefore, we need to develop stochastic models to estimate the value of each non-financial assumption.*

ANSWER:

B. *Identifying onerous contracts will require individual testing of each contract.*

ANSWER:

C. *All taxes paid by the company, such as premium taxes, Investment Income Taxes (IIT), and incomes taxes, should be included in the future cashflows.*

ANSWER:

- (b) (4 points) Assess how each of the following expenses would be treated under IFRS 17, including any areas of judgement. Justify your response.

(i) Business expenses for developing a new universal life product that was never launched.

ANSWER:

(ii) Acquisition costs incurred by a company from engaging external auditors and lawyers for acquiring a block of in-force segregated fund policies from another company.

ANSWER:

## 6. Continued

(iii) Costs from a risk and control peer review of ALM processes.

ANSWER:

(iv) An advertising campaign aimed at increasing brand awareness.

ANSWER:

(c) (5 points) You are given insurance cash flow projections in the Excel spreadsheet.

Assume the following:

- The contractual service margin and acquisition expenses are amortized linearly over the 5-year duration of the contract
- The risk adjustment is 10% of expected future claims
- The locked-in discount rate is 5%
- All expenses in the table are attributable.
- Claims and maintenance expenses occur at the end of the year. Premiums and acquisition expenses occur at the beginning of the year.
- Actual claims are 110% of expected in year 1; no change to expected claim cash flows after year 1.
- Actual maintenance expenses are 95% of expected in year 1; no change to expected maintenance expense cash flows after year 1.
- Actual investment yields in year 1 are 6%
- Income tax rate is 0%

Calculate the profit or loss in year 1 under IFRS 17. Show your work

*The response for this part is to be provided in the Excel spreadsheet.*



## 7.

(10 points)

- (a) (1 point) List four factors to be considered when determining the selective lapse rate assumption.

ANSWER:

- (b) (3 points) You are given the following assumptions for a renewable 10-year term life insurance product:

- Total lapse rate at duration 10 is 20%
- Base lapse rate at duration 10 is 5.5%
- Selective proportion is 75%
- Attained age mortality at duration 11 is 0.9 per thousand
- Residual mortality at duration 11 is 2 per thousand

Calculate the select mortality at duration 11 based on the VTP2 revised method. Show all work.

*The response for this part is to be provided in the Excel spreadsheet.*

- (c) (2 points) Your company is administering a block of life insurance contracts and a block of payout annuities.

- (i) Describe the steps that you would perform to determine the minimum mortality improvement assumption.

ANSWER:

- (ii) Identify any additional considerations in assessing the level of diversification between the two blocks.

ANSWER:

## 7. Continued

(d) (4 points) You are provided with the following information for a 3-year payout annuity contract:

- Issue date: December 31, 2020:
- Issue age: 60
- Mortality margin = 5%
- Mortality improvement margin = 1%
- Diversification factor = 0%

Best estimate mortality rates	
Attained Age	$q_x$
60	0.0010
61	0.0011
62	0.0012

Best estimate mortality improvement rates			
Attained age	Calendar Year		
	2020	2021	2022
60	0.025	0.020	0.015
61	0.024	0.019	0.014
62	0.023	0.018	0.013

Calculate projected mortality rates by duration including mortality improvement rates and margins.

*The response for this part is to be provided in the Excel spreadsheet.*

## 8.

(10 points) You are an actuary supporting risk and capital management for ABC Life, which is a federally regulated Canadian life insurance company.

(a) (4 points) Critique each of the following approaches for setting an internal capital target:

A. *Set the target at a fixed percentage of the OSFI core ratio supervisory target capital requirement*

ANSWER:

B. *Set the target to the average of its three biggest competitors' ratios*

ANSWER:

C. *Set the target considering expected new business*

ANSWER:

D. *Set the target to 140% of the LICAT total ratio.*

ANSWER:

(b) (3 points) You are provided with the following mortality capital components:

	Life	Annuity
Level	100	50
Trend	75	40
Volatility	25	10
Catastrophe	10	5

Assume that the life block is life supported and the annuity block is death supported.

Calculate the LICAT total mortality buffer for the combined blocks.  
Show all work.

*The response for this part is to be provided in the Excel spreadsheet.*

**8. Continued**

- (c) (3 points) ABC Life is considering reinsuring a block of business with an unregistered reinsurer. Assume that the ceded liabilities are positive.
- (i) Describe the impact of using an unregistered reinsurer on ABC Life's total LICAT capital ratio as compared to using a registered reinsurer.

ANSWER:

- (ii) Identify the available options to limit any adverse capital impacts from using unregistered reinsurance.

ANSWER:

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