

Exam ILALFMU

Date: Tuesday, May 11, 2021

INSTRUCTIONS TO CANDIDATES

General Instructions

1. This examination has 10 questions numbered 1 through 10 with a total of 100 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, β_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.

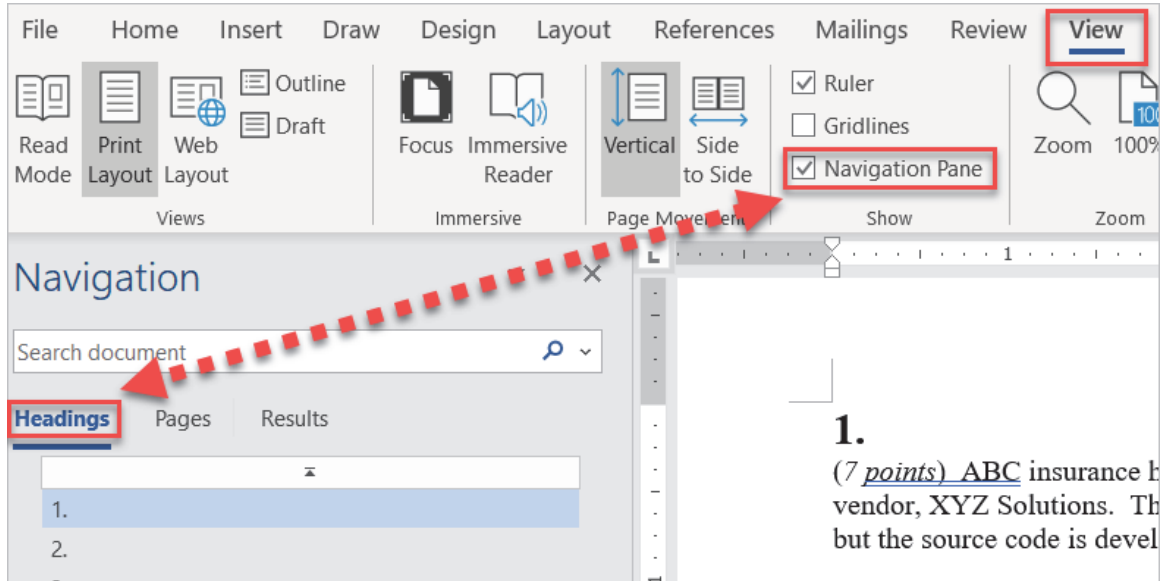
2. The answer should be confined to the question as set.
3. Prior to uploading your Word and Excel files, each file should be saved and renamed with your five-digit candidate number in the filename.
4. The Word and Excel documents that contain your answers must be uploaded before time expires.

Canadian version of this exam is recognized by the Canadian Institute of Actuaries.

Navigation Instructions

Open the Navigation Pane to jump to questions.

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



1.

(11 points) Company A and Company B are U.S. life insurance companies. Company A is interested in acquiring Company B. To help determine a selling price, Company B has performed an actuarial appraisal and has also hired an investment bank.

- (a) (1 point) Describe one of the three basic techniques used by investment banks to value life insurance companies.

ANSWER:

- (b) (3 points) Critique the following statements regarding actuarial appraisals:

A. *In essence, an actuarial appraisal is an analysis of cash flows, where the cash flow is based on GAAP earnings and changes in economic capital.*

ANSWER:

B. *Assumptions should include a reasonable but not excessive provision for adverse deviation.*

ANSWER:

C. *Mortality anti-selection is reflected to the extent that it is expected on lines of business with high lapse rates.*

ANSWER:

D. *It is common to use a single yield curve which does not change over time, where the curve reflects actual market yields at the time the actuarial appraisal is performed. However, if these yields are abnormally low or high, they will typically be adjusted towards a long term expectation over time.*

ANSWER:

1. Continued

E. *Effective tax rates on future business are often well below the tax rate applied to taxable income (currently 21% for U. S. companies) due to the DAC proxy tax and differences between GAAP and tax reserves.*

ANSWER:

F. *If a fundamental change in business operations is expected after the transaction, operating expense assumptions are typically determined based on the “target unit expenses without an unallocated expense” approach.*

ANSWER:

G. *Mortality improvement is not reflected on life insurance.*

ANSWER:

(c) (4 points) You are given the following information from Company B’s actuarial appraisal:

	Year 1	Year 2	Year 3	Year 4	Year 5
After tax earnings (inforce and future business)	6	3	8	10	15
Required capital	15	20	22	25	33

Adjusted book value	40
Discount rate	10%
Before tax investment earnings rate on capital	5%
Tax rate	21%
Terminal valuations at end of Year 5	
Net present value of after tax earnings for Years 6 and later (inforce and future business)	155
Net present value of required capital charges for Years 6 and later	28

Calculate the actuarial appraisal value of Company B. Show all work.

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

1. Continued

(d) (3 points) You are given:

- Company A and Company B use the same administration system.
- Company A has a larger distribution channel than Company B.
- Company A and Company B have a similar capital structure, but Company A has a lower CAPM beta.

(i) Recommend three adjustments Company A should make to the actuarial appraisal developed by Company B.

ANSWER:

(ii) Describe the directional impact of each recommended adjustment on the actuarial appraisal value.

ANSWER:

2.

(9 points)

- (a) (7 points) A life insurance company is currently developing an Economic Capital model for its life in-force block, which includes UL, term and whole life products, using the Liability Runoff Approach. The intended applications of the model are for establishing the risk management and risk appetite.

Critique each of the following proposed approaches. Recommend improvements where applicable.

- A. *The liability runoff approach is being performed using a stochastic simulation with 3,000 real world economic scenarios. The scenarios being used were originally developed in the context of Variable Annuity Pricing.*

ANSWER:

- B. *The current valuation assumptions consist of best estimate assumptions plus margins for adverse deviations. Risk driver categories are aligned with these margins, covering a variety of economic and non-economic assumption sub-categories.*

ANSWER:

- C. *Current inforce data is used to generate projected liability cash flows. Lapse assumptions vary by scenario for UL products. Mortality and expense assumptions for all products and lapse assumptions for non-UL products are on a best estimate basis and do not vary by scenario, with the exception of expense inflation, which is scenario-dependent.*

ANSWER:

2. Continued

D. Projected asset cash flows are generated for each scenario, such that the level of assets required at the beginning of a given scenario satisfies key obligations including paying policyholder cash flows, debt payments, and dividends.

ANSWER:

E. The required assets at the valuation date are ranked to form a distribution. The plan is to use a CTE99 metric applied to the distribution, based upon the segregated fund pricing methodology which uses CTE.

ANSWER:

F. The economic capital is defined by applying the CTE99 metric to the total assets required and deducting the current statutory liabilities.

ANSWER:

G. It has been suggested that the development team use a correlation matrix approach to calculate the between-risk diversification benefits.

ANSWER:

(b) (2 points) Describe ways that Economic Capital can be applied in the following areas:

(i) Capital Adequacy

ANSWER:

(ii) Performance Measurement

ANSWER:

3.

(9 points) With respect to Principle Based Reserve (PBR) calculations:

(a) (7 points) You are given the following model output for a block of life insurance as of the valuation date:

Scenario	NPR	COI	Due & Deferred Premium Asset	PV With Margins				Reinsurance Reserve Credit (with Margins)	PV With No Margins				Reinsurance Reserve Credit (without Margins)
				Benefits	Premiums	Taxes	Expenses		Benefits	Premiums	Taxes	Expenses	
1	310	70	45	800	200	-57	150	480	760	202	-51	143	456
2	310	70	45	828	200	-59	151	497	787	202	-54	144	472
3	310	70	45	882	204	-63	151	529	838	206	-57	144	503
4	310	70	45	824	202	-59	152	494	782	204	-53	144	469
5	310	70	45	843	203	-60	153	506	801	205	-55	145	480
6	310	70	45	802	200	-57	152	481	762	202	-52	144	457
7	310	70	45	854	202	-61	150	513	812	204	-55	143	487
8	310	70	45	869	200	-63	151	521	825	202	-57	144	495
9	310	70	45	836	204	-59	152	502	794	206	-54	145	477
10	310	70	45	854	200	-61	151	512	811	202	-56	143	487
11	310	70	45	840	200	-60	152	504	798	202	-55	145	479
12	310	70	45	847	202	-61	152	508	804	204	-55	145	483
13	310	70	45	870	201	-63	151	522	826	203	-57	143	496
14	310	70	45	854	203	-61	152	512	811	205	-55	144	487
15	310	70	45	802	202	-57	153	481	761	204	-52	145	457
16	310	70	45	861	200	-62	152	517	818	202	-57	144	491
Baseline	310	70	45	836	204	-59	152	502	794	206	-54	145	477
Deterministic	310	70	45	847	202	-61	152	508	804	204	-55	145	483
CTE70				861	203	-62	152	517	818	205	-56	145	491
CTE90				873	204	-63	153	524	829	206	-57	145	498
CTE95				880	204	-63	153	528	836	206	-58	145	502

(i) (5 points) Assess whether a Stochastic Reserve component is necessary for this block using the Stochastic Exclusion Ratio Test. Show all work.

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

(ii) (2 points) Calculate the minimum reserves required. Show all work.

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

(b) (2 points) Describe how VM-20 and VM-31 have impacted mortality assumption considerations and disclosures.

ANSWER:

4.

(9 points)

(a) (3 points) Critique the following statements regarding the accounting for investments in debt securities, as defined by SFAS 115:

A. *To avoid tainting the classification of other HTM securities, an HTM security should be reclassified before it is sold.*

ANSWER:

B. *Securities that are held to maturity (HTM securities) are carried at fair value.*

ANSWER:

C. *Securities that are held for trading purposes (Trading securities) are carried at amortized cost.*

ANSWER:

D. *Securities that are available for sale (AFS securities) are carried at amortized cost.*

ANSWER:

E. *Changes in the fair value of Trading securities are recognized in earnings.*

ANSWER:

4. Continued

F. Changes in the fair value of AFS securities are recognized in other comprehensive income.

ANSWER:

G. If an HTM or AFS security is impaired, then the security must be written down.

ANSWER:

- (b) (6 points) As of the date of purchase, you are given the following information about a collateralized mortgage obligation (CMO) accounted for under U.S. GAAP:

Principal Amount	500,000
Purchase Price	550,000
Stated Interest Rate	4%
Principal Pay Down Schedule	50,000 annually in years 5 to 14
Timing of principal and interest payments	End of year
Asset Classification	Held to maturity

- (i) Calculate the expected amount of premium amortization in year 5. Show all work.

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

- (ii) Assume:

- No principal payments occur in the first 3 years.
- A principal payment of 100,000 occurs in year 4.
- Future principal payments at the end of year 4 are forecasted to be 50,000 annually in years 5 to 12.

Calculate the true-up to interest income in year 4. Show all work.

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

5.

(13 points) You are given the following for a single premium fixed deferred annuity that has a guaranteed living withdrawal benefit (GLWB) rider:

- The death benefit is the current account value.
- No partial withdrawals are allowed outside of GLWB election.
- The GLWB amount is equal to the GLWB % times the account value at the beginning of the year of election.
- All GLWB payments are made at the end of the policy year.
- There are no policy fees for the rider.

You are also given:

Premium	100,000
Interest Guarantee Period	5 years
Initial Interest Rate	2.00%
GLWB %	4%
Annual contract charge	50
Valuation Rate – Elective Benefits	3.00%
Valuation Rate – Non-Elective Benefits	3.50%
Surrender Charges (as a percent of account value)	First year: 6% Second year: 4% Third year: 3% Fourth year: 2% Fifth year: 1%

(a) (3 points) You are given:

- 5-year CMT rate is 2.00%
- No premium taxes
- The GLWB is elected in the first policy year

Calculate the NAIC nonforfeiture value for the first 5 years. Show all work.

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

5. Continued

(b) (2 points) You have been asked to consider the implications of the Standard Nonforfeiture Law interest rate floor changing to 0.15%.

(i) Justify why this could be an appropriate measure for insurers.

ANSWER:

(ii) Evaluate the change in the interest rate floor from the policyholder perspective.

ANSWER:

(c) (2 points) Describe how the Commissioners Annuity Reserve Valuation Method (CARVM) would be performed on this type of GLWB policy.

ANSWER:

(d) (4 points) Calculate the maximum present value of each of the following 4 CARVM benefit streams individually over the first 5 years of the policy assuming no mortality:

(i) Surrender benefits assuming GLWB election in the first policy year

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

(ii) Surrender benefits assuming GLWB election in the fifth policy year

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

(iii) GLWB payment stream assuming election in the first policy year

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

(iv) GLWB payment stream assuming election in the fifth policy year

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

5. Continued

- (e) (2 points) Combine the 4 individual benefit streams in part (d) into 2 appropriately integrated benefit streams.

Identify the election timing option which should be used to set the CARVM reserve. Justify your answer.

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

6.

(10 points) GHI Company is analyzing the impacts of the 2017 Tax Cuts and Jobs Act on their block of term life insurance business.

- (a) (4 points) You are given the following information on a 5-year term policy that automatically expires after 5 years without a maturity benefit:

Issue date	1/1/2016
Face amount	100,000
Valuation interest rate	4.50%
EA under FPT for a 20-pay limited-payment life contract	50

	2016	2017	2018	2019	2020
Premium rate	0.011	0.011	0.011	0.011	0.011
Valuation mortality rate	0.009	0.0099	0.0109	0.012	0.0132

Calculate the statutory reserve for this policy at 12/31/2017 assuming that premiums are paid at the beginning of the year and death benefits are paid at the end of the year. Show all work.

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

- (b) (2 points) You are given the following balances (in millions) as of 12/31/2018 on GHI's entire block of term life policies:

Total Statutory Reserve	250
Statutory Basic Reserve	200
Statutory Deficiency Reserve	40
Asset Adequacy Reserve	10
Impact of Contract-Level Net Surrender Value Floor	5

Calculate the tax reserve. Show all work.

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

6. Continued

(c) (4 points) With respect to GHI's term insurance products:

- (i) Describe the impact of the four major changes in the 2017 Tax Cuts and Jobs Act on profitability.

ANSWER:

- (ii) Propose a strategy that GHI could use to offset some of the tax burden from the 2017 Tax Cuts and Jobs Act. Justify your response.

ANSWER:

7.

(9 points) YUL Life, a US life insurance company, has existing in-force and actively writes new business in the market.

- (a) (1 point) List four responsibilities or requirements of the Appointed Actuary role.

ANSWER:

- (b) (4 points) Describe the type of statutory reserve standards and components that may be applicable to the following cohorts of YUL's business:

- (i) Universal Life with Secondary Guarantee issued in 2015

ANSWER:

- (ii) 10YR Level Term issued in 2018

ANSWER:

- (iii) Whole Life issued in 2019

ANSWER:

- (iv) Indexed UL with Clearly Defined Hedging Strategy (CDHS) issued in 2020

ANSWER:

7. Continued

(c) (4 points) Critique the following statements:

A. *YUL's statutory reserves on business issued in 2015 continues to increase each year since the valuation interest rate is a function of the rolling average of corporate bond yields published by Moody's which has been decreasing each year.*

ANSWER:

B. *The main difference between a CRVM and NLP reserve for Whole Life under Standard Valuation Law (SVL) is the additional conservatism built into the CRVM method.*

ANSWER:

C. *The standard non-forfeiture calculation under SNFL uses the same mortality, interest, and expense allowance as SVL for policies issued before 1/1/2017.*

ANSWER:

D. *YUL uses mean reserves because they are higher and thus a more conservative basis for setting up a liability.*

ANSWER:

8.

(11 points)

- (a) (1 point) Describe two reasons why the NAIC might be interested in international perspectives regarding insurance regulation.

ANSWER:

- (b) (2 points) With respect to the NAIC's approach to determining RBC requirements as described in *The Modernization of Insurance Company Solvency Regulation in the US*:

- (i) (1 point) Describe two criticisms of the approach.

ANSWER:

- (ii) (1 point) Describe the NAIC's response to each criticism above.

ANSWER:

- (c) (2 points) Describe two positive outcomes and two negative outcomes that could potentially occur if the NAIC decided to increase RBC requirements.

ANSWER:

8. Continued

- (d) (6 points) MSP Life is a U.S. life insurance company. MSP's inforce block consists of ordinary whole life insurance and individual fixed deferred annuities. Some of the annuities allow the contract holder to withdraw funds at book value with no surrender charge, whereas the rest of the annuities apply a market value adjustment to withdrawals.

You are given the following RBC information for MSP (in millions):

Asset Risk Affiliated	2
Asset Risk Unaffiliated	10
Asset Risk Other	5
Amount of insurance inforce for ordinary life	7,500
Reserves for ordinary life	500
Reserves for annuity contracts with a market value adjustment	200
Reserves for annuity contracts with a book value withdrawal and no surrender charge	100
Business Risk	10
Total Adjusted Capital (TAC)	40
Policy loans	0

Authorized Control Level (ACL) RBC formula:

$$0.50 \cdot \left[C_0 + C_{4a} + \sqrt{(C_{1o} + C_{3a})^2 + (C_{1cs} + C_{3c})^2} + C_2^2 + C_{3b}^2 + C_{4b}^2 \right]$$

Insurance Risk	
Net Amount at Risk	RBC Factor
First 500 million	0.0023
Next 4,500 million	0.0015
Next 20,000 million	0.0012
Over 25,000 million	0.0009

Interest Rate Risk	
Risk Category	RBC Factor
Low	0.0077
Medium	0.0154
High	0.0308

8. Continued

- (i) (5 points) Calculate the ACL RBC for MSP. Show all work.

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

- (ii) (1 point) Describe the regulatory action triggered by MSP's RBC ratio. Show all work.

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

9.

(10 points) EWR and LGA are U.S. life insurance companies. EWR has just acquired LGA. All of the acquired business consists of traditional non-participating life insurance products (term and whole life).

- (a) (2 points) Critique the following statements regarding how EWR should account for the acquired business under U.S. GAAP:

A. *EWR should establish a DAC asset based on SFAS 60 deferability criteria.*

ANSWER:

B. *EWR should amortize the DAC asset as a level percentage of premium using assumptions consistent with benefit reserves.*

ANSWER:

C. *With respect to acquired identifiable intangible assets, EWR should initially record each asset at estimated fair value and then amortize it over the lesser of the asset's useful life and 30 years.*

ANSWER:

D. *EWR should establish a deferred tax liability based on temporary timing differences between acquisition basis accounting and tax basis accounting.*

ANSWER:

9. Continued

- (b) (4 points) You are given the following information for the acquired business at the time of acquisition:

	(in millions)
Actuarial appraisal	
Adjusted book value (ABV)	400
Value of Future Business Capacity (VFBC)	100
Total Actuarial Appraisal Value (TAAV)	990
GAAP benefit reserve based on best estimate assumptions at issue plus PAD (GBRI)	4,800
GAAP benefit reserve based on best estimate assumptions at acquisition plus PAD (GBRA)	4,700
Statutory reserve (SR)	5,000
GAAP deferred tax liability excluding the impact of income tax on the VOBA asset (DTLX)	5

Tax rate (TR) is 21%

- (i) (2 points) Calculate the initial VOBA asset. Show all work.

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

- (ii) (1 point) Calculate the initial GAAP deferred tax liability. Show all work.

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

- (iii) (1 point) Describe the procedure for amortizing the VOBA asset.

ANSWER:

9. Continued

- (c) (4 points) As part of the acquisition, EWR obtained the following items from LGA:
- (i) A significant term life reinsurance contract with rates higher than current market rates
 - (ii) A captive agency sales force that has expressed enthusiasm over the acquisition
 - (iii) An independent agency sales force that has expressed reservations over the acquisition
 - (iv) A home office building, including land and office supplies
 - (v) All employees (1,000 in total) working at the home office
 - (vi) A lease agreement for home office computer equipment at rates lower than current market rates
 - (vii) Negative goodwill
 - (viii) Licenses to operate in all 50 states

Explain whether each of the above items should be recognized on EWR's balance sheet as an identifiable intangible asset (IIA).

ANSWER:

10.

(9 points) XYZ Insurance Group is a US-based corporation that sells Variable Deferred Annuity policies with GMDB, GMAB, and GMWB riders. XYZ is now preparing for implementation of Long Duration Targeted Improvements in FASB's ASU 2018-12 (LDTI).

(a) (5 points) Critique the following statements regarding LDTI:

A. *Because XYZ's GMDB protects the value of a death benefit, it will not be considered a Market Risk Benefit*

ANSWER:

B. *The requirement to adjust DAC for unrealized gains and losses on available for sale assets (shadow DAC adjustment) is eliminated. Therefore, changes in asset values will only affect the DAC balance when gains or losses are realized.*

ANSWER:

C. *If the calculated market risk benefit amount is negative, it needs to be floored at zero to avoid being reported shown in an asset position.*

ANSWER:

D. *Assumptions for mortality and lapses will no longer be needed for DAC calculations since it will be based on a straight-line basis.*

ANSWER:

E. *An own credit adjustment is used to account for when a company cannot fulfill its obligations, which will increase the fair value liability due to this non-performance risk.*

ANSWER:

F. *All changes in fair value related to market risk benefits shall be recognized in net income.*

ANSWER:

10. Continued

- (b) (4 points) For a single premium variable deferred annuity with a Guaranteed Minimum Withdrawal Benefit (GMWB), the only fees charged are the M&E fees. XYZ decided to use the non-option method to value the Market Risk Benefit (MRB) for the GMWB.

You are given the following risk-neutral scenario projections for a single policy:

Projection date: At-issue			Projection date: 1 year after issue,			Projection date: 1 year after issue,		
Discount rates: risk-neutral interest rates plus the instrument specific credit risk			Discount rates: updated risk-neutral interest rates plus the at-issue instrument specific credit risk			Discount rates: updated risk-neutral interest rates plus updated instrument specific credit risk		
Scenario	PV of M&E Fees	PV Of GMWB Excess Benefits	Scenario	PV of M&E Fees	PV Of GMWB Excess Benefits	Scenario	PV of M&E Fees	PV Of GMWB Excess Benefits
1	100	20	1	94	17	1	93	16
2	93	26	2	87	25	2	86	25
3	95	29	3	91	30	3	90	29
4	107	10	4	102	11	4	101	10
5	102	15	5	98	15	5	97	15
6	97	30	6	91	29	6	90	29
7	92	40	7	87	41	7	86	41
8	108	20	8	104	21	8	103	21
9	106	18	9	102	16	9	101	16
10	100	22	10	94	25	10	93	24

- (i) Calculate the MRB fair value 1 year after issue. Show all work.

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

- (ii) Calculate the amount recognized in Other Comprehensive Income (OCI) in the first year of the policy. Show all work.

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

****END OF EXAMINATION****