

Exam ILALFMU

Date: Tuesday, May 7, 2024

INSTRUCTIONS TO CANDIDATES

General Instructions

1. This examination has 9 questions numbered 1 through 9 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.

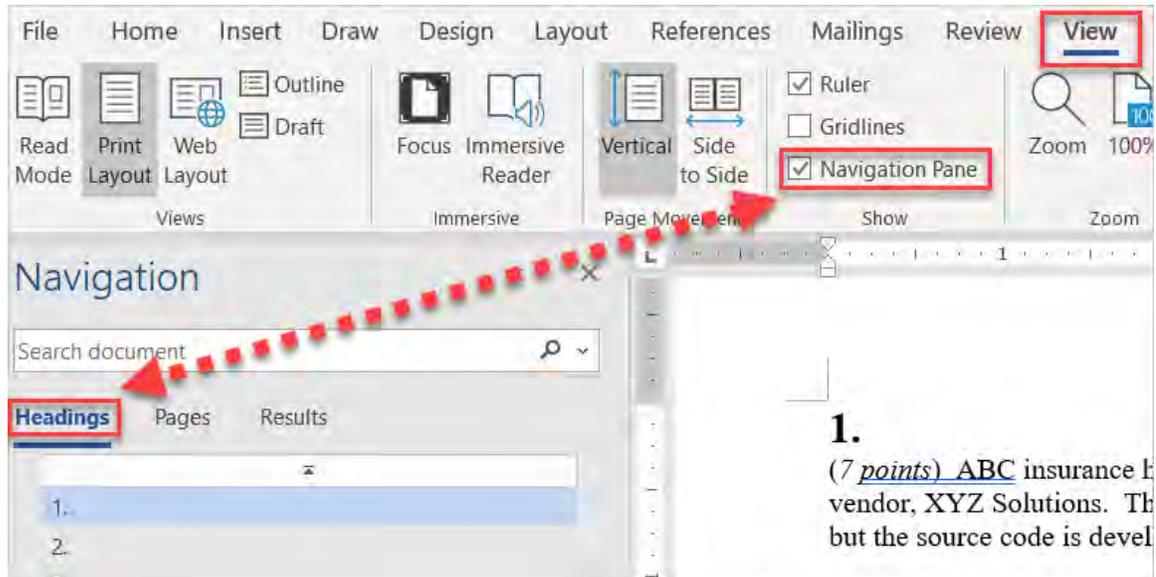
Written-Answer Instructions

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, 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.

Navigation Instructions

Open the Navigation Pane to jump to questions.

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



1.

(8 points) XYZ Life sells a variable annuity (VA) with a guaranteed minimum death benefit (GMDB) rider and uses the non-option approach to value the market risk benefit (MRB) on the GMDB rider.

You are given:

- Valuation date is the end of year 2
- Two scenarios are adequate for the calculation of the MRB
- The annuity is assumed to surrender after the 10th year
- Fees are collected at the beginning of each year
- Projected account values and minimum death benefit values are at the end of the year, and all death benefits are paid at the end of the year
- Within the year, mortality is assumed to occur before other decrements are considered
- Persistency shown includes the effect of all decrements
- Data is given in the tables in the Excel spreadsheet

- (a) (1 point) Describe the test that XYZ Life needs to perform to determine the new VA product classification under US GAAP.

ANSWER:

- (b) (5 points) Calculate the GMDB Market Risk Benefit (MRB) liability at the valuation date. Show all work.

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

- (c) (2 points) Calculate the Accumulated Other Comprehensive Income (AOCI) at the valuation date. Show all work.

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

2.

(11 points) You are a valuation actuary at QWE Life, a company that recently entered into the market for long term care (LTC) products.

(a) (4 points) For the new LTC product, you are given:

Claim projections

Incurral Year	Projection Year				
	1	2	3	4	5
1	2,500	2,250	-	-	-
2		6,063	5,456	-	-
Total	2,500	8,313	5,456	-	-

Corporate Bond Yield Curve

Moody's rating	Curve	1	2	3	4	5
Prime	Spot	5.00%	5.50%	5.25%	4.50%	4.00%
High Grade	Spot	5.25%	5.25%	5.00%	4.75%	4.50%
Upper Medium	Spot	5.50%	6.00%	5.50%	5.00%	4.75%
Prime	Forward	5.00%	6.00%	4.75%	2.25%	2.00%
High Grade	Forward	5.25%	5.25%	4.50%	4.00%	3.50%
Upper Medium	Forward	5.50%	6.50%	4.50%	3.50%	3.75%

- (i) Calculate the claim reserve under US GAAP for year 1 and 2 using the spot rate locked in at issue. Show all work.

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

- (ii) Calculate the claim reserve under US GAAP for year 1 and 2 using the forward rate locked in at issue. Show all work.

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

2. Continued

- (b) (3 points) QWE would like to use reinsurance to mitigate GAAP income volatility from the risk of entering the LTC market.

Assess whether each proposal below meets the objective of QWE.

- (i) Proposal 1: Cede 80% of morbidity risk with a large ceding commission to boost surplus at inception. QWE will pay a morbidity premium set at 500% of best estimate morbidity, and will receive an experience rating refund on ceded premium paid over 0.05% of statutory reserves at the end of each year.

ANSWER:

- (ii) Proposal 2: QWE will pay a quarterly premium at 107% of the industry morbidity rate, with the first-year reinsurance premium being waived for all policies. The reinsurer will reimburse all LTC claims after the second year a policy has been on claim.

ANSWER:

2. Continued

(c) (4 points) To boost competitiveness for the LTC product, QWE's chief marketing officer has decided to increase the commission on the LTC products. The agents selling the policies have proposed the following commission schedules:

- **Schedule A:** 10% commission on first year premium only
- **Schedule B:** 1% commission on all premium collected
- **Schedule C:** fixed cost per year regardless of sales. Cost is approximately 8% of projected first year premium

The expected life of the policy is 30 years.

Identify the commission schedule that:

(i) Results in the least statutory surplus strain at issue.

ANSWER:

(ii) Results in the highest GAAP net income.

ANSWER:

(iii) Results in the least mismatch between statutory income and GAAP income.

Justify your answer.

ANSWER:

3.

(7 points) With respect to the excess spread attribution methodology under Actuarial Guideline LIII (AG53):

- (a) (3 points) Describe Projected High Net Yield assets that are the focus of AG53.

ANSWER:

- (b) (2 points) Critique the following statements about AG53:

- (i) *AG53 will help ensure spread attributions will be consistent across companies.*

ANSWER:

- (ii) *For the purpose of determining net market spreads, best estimate cashflows with margin should be used. However, investment expenses and defaults should not be considered when determining the net market spreads.*

ANSWER:

- (iii) *Guideline excess spread attribution is only required for existing asset holdings.*

ANSWER:

- (iv) *Guideline excess spread attribution should be performed for fixed rate corporate bonds with no or immaterial callability.*

ANSWER:

3. Continued

(c) (2 points) Complete Table B given the data in Table A. Show all work.

Table A: Spread Components Related to Each Risk

		<i>Spread Components Related to Each Risk</i>				
Asset Type	Net Market Spread	Factor A	Factor B	Factor C	Factor D	Other Factors/ Unallocated
Investment Grade Net Spread Benchmark	1.5%	1.0%	0.5%	0.0%	0.0%	0.0%
Asset Class 1	2.5%	0.3%	0.7%	0.5%	0.8%	0.2%
Asset Class 2	3.5%	1.8%	0.3%	1.0%	0.0%	0.4%

Table B: Excess Spread Components Related to Each Risk								
		<i>Excess Spread Components Related to Each Risk</i>						
Asset Type	Net Market Spread	Investment Grade Net Spread Benchmark	Guideline Excess Spread	Factor A	Factor B	Factor C	Factor D	Other Factors/ Unallocated
Asset Class 1								
Asset Class 2								

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

4

(8 points) ABC Life uses VM-20 for a block of newly issued universal life insurance policies.

(a) (2 points) Critique the following statements:

A. *The starting assets in the cash flow projection model should be 105% of the modeled reserve.*

ANSWER:

B. *The Deterministic Exclusion Test is not required as it is designed to identify policies that are insensitive to interest rate and asset return volatility risks.*

ANSWER:

C. *The Stochastic Reserve is calculated as the sum of the starting assets and the greatest present value of accumulated deficiency.*

ANSWER:

(b) (2 points) Calculate the Scenario Reserve given the projected scenario below. Show all work.

Projection period	0	1	2	3	4	5	6	7	8	9	10
Statement Value of Assets (000s)	20	11	2	(7)	(3)	1	5	9	13	17	21
One-Year Treasury Rate (%)		1.34	0.65	0.14	1.03	1.08	0.74	0.59	1.05	0.57	0.48

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

(c) (2 points) Describe the steps to determine the prudent estimate mortality assumption given that ABC's mortality experience is only partially credible.

ANSWER:

4. Continued

- (d) (2 points) Describe the factors that can impact ABC Life's mortality improvement assumptions under a significant pandemic, such as COVID-19.

ANSWER:

5.

(11 points) PGY Group is a reinsurance company headquartered in the US, with legal entities in other jurisdictions. PGY reinsures business written in North America, Europe, Australia, and Japan. Depending on the location, PGY's entities follow US Statutory Accounting, US GAAP (LDTI), or IFRS 17.

- (a) (4 points) Due to the impact of COVID-19, PGY Group has been reviewing and revising some of its best estimate assumptions for a block of term business. You are given:

Assumption	Before	After
Mortality	100% of past experience	10% increase
Maintenance expense	2,000 per policy	2,000 per policy with 3% inflation
Claim expense	1,000 per claim	1,000 per claim, decreasing by 5% each year, floored at 500
PGY's experience is considered fully credible		

Assess the current year directional impact of the assumption update (while holding all other assumptions constant) for each of the above assumptions with regard to each of the following:

- (i) Deterministic US Statutory Reserve under VM-20

ANSWER:

- (ii) US GAAP Reserve

Justify your answers.

ANSWER:

5. Continued

(b) (2 points) Critique the following statements for ULSG under VM-20:

- A. *The VM-20 Minimum Reserves for a group of individual life insurance policies that pass both the deterministic and stochastic exclusion tests is $NPR + \text{Max}[0, DR - NPR]$.*

ANSWER:

- B. *The process for calculating the NPR assumes that at issue, all policies are level premium permanent plans that will expire on the maturity date with a minimum guaranteed benefit.*

ANSWER:

- C. *When calculating the NPR floor, the COI would be determined to the next paid-to-date using credibility weighted company experience.*

ANSWER:

(c) (5 points) PGY Group's management will strategically assign a legal entity for each block of business to be reported through, with the goal of optimizing profit and capital.

You are given the following information on a block of whole life business at issue:

Plan	PV premium (millions)	PV claims (millions)	IFRS 17 Risk Adjustment (millions)	PV expenses (millions)
A	10	5	0.5	0
B	12	13	1	0

(i) Calculate the GAAP liability for each plan. Show all work.

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

(ii) Calculate the IFRS 17 fulfillment cashflow for each plan. Show all work.

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

5. Continued

- (iii) Calculate the IFRS 17 contractual service margin for each plan. Show all work.

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

- (iv) Recommend which entity below should be used for this block:

- Entity 1: follows IFRS 17 reporting
- Entity 2: follows U.S GAAP reporting

Justify your response.

ANSWER:

6.

(9 points)

- (a) (3 points) You are given the following information on an individual whole life policy as of 12/31/2023.

Issue date	April 10, 2016
Mean reserve (includes deficiency reserves)	5,000
Valuation premium	1,000
Deficiency reserve	1,000
Supplemental benefit reserve	100
Cash surrender value	3,500
Policy Mean Reserve	Semi Continuous Reserve Method assuming an Annual Valuation Mode
Policy premium mode	monthly

Calculate the tax reserve for the policy as of 12/31/2023. Show all work.

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

- (b) (3 points) You are given the following information for a universal life policy:

Face amount	234,000
Minimum guarantee rate	2.0%
Issue age	46
Premium expense load	3.0%

	2%	4%	6%
Present value of death benefits	86,073.58	48,556.15	29,244.58
Present value of expenses	131.98	95.02	72.35
\ddot{a}_{46}	27.40	20.00	15.47
$\ddot{a}_{46:7}$	6.57	6.22	5.89

6. Continued

Calculate the following:

- (i) Initial Cash Value Accumulation Test Net Single Premium

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

- (ii) Guideline Level Premium

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

- (iii) Guideline Single Premium

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

- (iv) 7-Pay Premium

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

Show all work.

- (c) (3 points) Using information from (b), you are given additional information about actual premium payments:

Policy Year	Premium Paid
1	10,000
2	5,000
3	25,000
4	3,000
5	2,500
6	2,000
7	0

- (i) Determine whether the policy qualifies as life insurance using the guideline premium test. Show all work.

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

- (ii) Determine whether the policy is a modified endowment contract. Show all work.

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

6. Continued

- (iii) Describe how policyholder taxes change when the policy is a modified endowment contract.

ANSWER:

7.

(7 points)

(a) (2 points) The following is an excerpt from SPW Life's ORSA report:

- *SPW Life has identified its key risk to be disintermediation risk in the rising interest rate environment, where SPW Life will incur a large loss when selling assets to fund its high amount of lapses.*
- *SPW Life's experience in mortality underwriting has been more favorable than the industry, and it does not view mortality as a key risk.*

You have been provided the following information about SPW Life's RBC components:

RBC Component	Capital Amount (before diversification)
C0	0
C1	4,000,000
C2	100,000,000
C3	5,000,000
C4	0

Explain why the biggest risk identified from the RBC above may be different from the ORSA excerpt.

ANSWER:

(b) (2 points) Evaluate whether each of the following statements from SPW Life's ORSA report is consistent with the ORSA guidance.

- A. *SPW Life has performed all its quantitative risk assessments, using stochastic analysis and actuarial judgement. All assessments were done on a quantitative basis.*

ANSWER:

- B. *The stress tests used in ORSA calculations were based on historic worst cases experienced by SPW Life in the last 5 years.*

ANSWER:

7. Continued

- C. *SPW Life defines solvency as having enough liquid assets, limited to cash and US Treasury bonds, to ensure all obligations will be able to be met within the next 3 years.*

ANSWER:

- (c) (3 points) Determine the C-3 Risk Category appropriate for each product below using the NAIC RBC rules at the inception of the product. Justify your reasoning.
- (i) Fixed deferred annuity with a 3-year surrender charge period and no Market Value Adjustment (MVA). The first-year surrender charge is 6%.

ANSWER:

- (ii) Single premium deferred payout annuity. The single premium cannot be withdrawn for 5 years. Starting in year 6, payments are guaranteed for life.

ANSWER:

- (iii) Fixed indexed annuity with a 2% surrender charge for only the first 5 years.

ANSWER:

8.

(9 points) CWY Asset Management is acquiring ELF Insurance Company.

- (a) (2 points) CWY hired an investment bank to use the Comparable Company Analysis technique to generate a range of appraisal values for ELF.

You are given:

- price-to-book value multiples ranging from 1.1 to 1.8
- a change of control premium of 15%
- ELF's current book value is 1000

- (i) Describe the general guidelines that are useful for peer group selection in the Comparable Company Analysis.

ANSWER:

- (ii) Calculate the range of appraisal value of ELF Insurance. Show all work.

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

- (b) (5 points) You are given the following statutory projection:

	12/2023	12/2024	12/2025	12/2026	12/2027	12/2028
Premium		500	450	400	350	300
Investment Income (all assets)		138	131	125	118	112
Benefits		200	210	220	230	240
Commissions		10	9	8	7	6
Expenses		100	90	80	70	60
Statutory Reserves	2000	1900	1800	1700	1600	0
Total Required Capital	300	290	280	270	260	0

8. Continued

Assuming:

Pre-tax earned rate	6%
Tax rate	21%
Free surplus	0
Risk discount rate	10%

Taxable incomes equal to pre-tax earnings.

Calculate the following information for all projection years:

- (i) Book profit
- (ii) Cost of Capital
- (iii) Inforce Business Value
- (iv) Embedded Value

Show all work.

The response for this (all 4 parts) is to be provided in the Excel document.

- (c) (2 points) Critique the following statements. Justify your answers.

A. *A going concern valuation captures only the value of all the tangible assets that are reflected on the seller's balance sheet.*

ANSWER:

B. *For public companies, the actuarial appraisals developed by the seller are usually done on a US GAAP accounting basis.*

ANSWER:

8. Continued

- C. *The assumptions underlying the seller's actuarial appraisal analysis are intended to be moderately adverse to be conservative.*

ANSWER:

- D. *If embedded value assumptions are the same as actuarial appraisal assumptions and the same discount rates are used for both, then the actuarial appraisal value is the sum of embedded value and the value of future business.*

ANSWER:

9

(10 points)

- (a) (3 points) You are given the following information on a block of 5-year term life insurance policies:

Annual premium	5
Interest rates	0%
Decrements	0
Policies sold	10
Total maintenance expenses per year	25
Total claims per year	10
Total risk adjustment per year	5

Calculate the IFRS 17 liability components on initial recognition. Show all work.

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

- (b) (4 points) Compare and contrast IFRS 17 and LDTI in each of the following areas:

- (i) level of aggregation

ANSWER:

- (ii) financial statements presentation

ANSWER:

- (iii) earnings emergence for profitable and unprofitable business

ANSWER:

- (c) (3 points) Critique the following statements under IFRS 17:

- A. *A contract is considered as an insurance contract only if it exposes the insurers to both insurance and financial risks.*

ANSWER:

9. Continued

- B. *An insurance risk is not considered significant if the insured event is extremely unlikely to occur and if there is minimal probability of significant losses for a group of contracts.*

ANSWER:

- C. *Insurance risks are risks that are related to an insurance contract, such as death, illness, or lapsation.*

ANSWER:

- D. *Contractual service margin (CSM) from a profitable direct contract can be used to offset the losses from another contract that is determined to be onerous at initial recognition and in subsequent measurements.*

ANSWER:

****END OF EXAMINATION****