Life Product Management

Exam ILALPM

Date: Thursday, May 13, 2021

INSTRUCTIONS TO CANDIDATES

General Instructions

1. This examination has 11 questions numbered 1 through 11 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 = component1 + 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.

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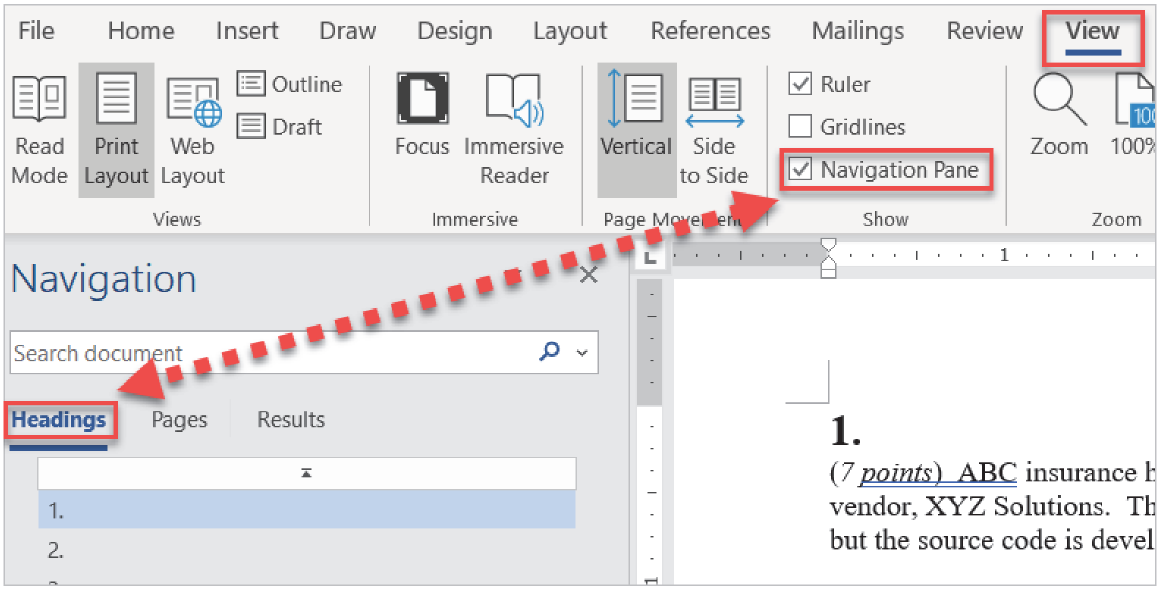
Navigation Instructions

Open the Navigation Pane to jump to questions.

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



1.

(*8 points*) You are given the following for BXP Life:

- Sells fixed deferred annuities in the U.S with a one-year surrender charge period and no market value adjustment
- There has been an extended period of low interest rates.
- To support competitive pricing in the market during this period, management has invested in 30-year fixed income securities to maximize yield as part of the crediting strategy.

(a) (*4 points*)

(i) Describe two risks to BXP due to a significant rise in future interest rates.

ANSWER:

(ii) Recommend strategies to address these risks.

ANSWER:

(b) (*4 points*) You are given the following components of Distributable Earnings:

(i) Commissions

(ii) Overhead expenses

(iii) Surrender benefits

(iv) Investment income

Describe the impact of a spike in interest rates to each of the above components. Justify your answer.

ANSWER:

2.

(*8 points*) AAJ Life Insurance Company is developing "New Term", a 5-year level premium with increasing renewable rates to age 95, term insurance product for sale in addition to the 10-year and 20-year term products they already sell. AAJ uses profit margin and IRR as profitability metrics for this product.

You are given the following illustration for the new product:

Year	**1**	**2**	**3**	**4**	**5**
Premiums	2,000	2,000	2,000	2,000	2,000
Benefits	1,200	1,400	1,700	2,000	2,400
Expenses	100	100	100	100	100
Statutory Reserve	1,000	2,000	4,000	1,500	0
Investment Income	20	50	80	140	40
Tax Reserve	920	1,840	3,680	1,380	0
Tax Rate	21%	21%	21%	21%	21%
Discount Rate	3%	3%	3%	3%	3%

Assume:

- There are no permanent differences between the statutory reserve and tax reserve.
- There is immediate deductibility of losses.
- All cashflows are in the middle of the year.
- 100% Shock lapse at year 5

(a) (*3 points*) Calculate the after-tax profit margin. Show all work.

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

2. Continued

New Term is AAJ's first new term product since the inception of VM-20. Their existing term products use Regulation 830 (XXX) for reserves, and they have AG48 financing structures in place.

(b) (*3 points*) Evaluate term insurance pricing considerations under VM-20 with respect to:

(i) Product design changes.

ANSWER:

(ii) Profitability impacts from moving from Regulation XXX.

ANSWER:

(iii) Profitability impacts of assuming no mortality improvement to future reserve nodes in the deterministic reserve.

ANSWER:

(c) (*2 points*) Describe the impacts the Tax Cuts and Jobs Act will have on the profit margin for the term insurance products.

ANSWER:

3.

(*10 points*) You are given the following pricing model review report of a variable annuity (VA) pricing model for company DXF that has previously only sold fixed annuities (FA):

VA Pricing Model Review

Policyholder	Issue age	Fund allocation (fixed income funds/equity funds)	Additional death benefit option elected
1	40	0%/100%	Greater of step-up & 5% roll-up
2	50	5%/95%	Greater of step-up & 5% roll-up
3	60	15%/85%	None
4	70	30%/70%	None

<u>Product Features and Pricing Assumptions</u>:

- To improve product profitability, surrender charges are set slightly above the industry average and agent commissions are set slightly below the industry average.
- The expense assumption is based on the DXF's fixed annuity expense study (i.e. 60 per FA contract on an annual basis) and is set at 55 annually per VA contract because VA expenses are expected to be lower than FA expenses.
- The mortality assumption is the same as the fixed annuity block since the VA will be sold to the same customer base as the FA
- Annuitization rates are assumed to be immaterial, because the FA experience demonstrated that very few policyholders choose to annuitize
- Return of premium guaranteed minimum death benefit is standard on all policies.

<u>Results:</u>

- When running a stochastic analysis, the cost of the death benefit guarantees was 0.05% of the account value per year for the return of premium benefit and 0.15% of the account value per year for the step-up benefit. These cost assumptions were vetted and reconstructed by the Financial Risk Management area using their option pricing model.
- In one of the stochastic scenarios, where the first five years' annual equity fund returns were -1%, 6%, 7%, 9%, 1%, the model's calculated values for death benefits were demonstrated to be consistent with the product design.
- The policyholder fund allocation assumption appears to be appropriate given that the company has seen similar elections in brokerage accounts of other products.
- These results will be useful for the Investments area for setting up their hedging strategy.

3. **Continued**

(a) (*3 points*) Critique three assumptions in the VA Pricing Model Review report.

ANSWER:

(b) (*2 points*) Describe two governance and controls principles from *ASOP 54: Pricing of Life and Annuity Products* that have been demonstrated in the report.

ANSWER:

(c) (*2 points*) Recommend product features and/or assumption changes, based on behavioral economics insights, required to accommodate each of the following policyholder behavior changes:

(i) A higher percentage allocation to fixed income funds

ANSWER:

(ii) An increase in annuitization rates

ANSWER:

(d) (*3 points*) You are given the following additional information for Policyholder 1 (i.e. Age 40) in the table above:

- An initial premium of 10,000
- No withdrawals

Calculate the Death Benefit for each of the first five policy years. Show all work.

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

4.

(*11 points*) JXR wants to deploy a new underwriting program that requires no fluids with the following objectives:

- Reduce new business underwriting expenses by 10 per application,
- Improve the ratio of policies sold to applications submitted due to increased underwriting efficiency and reduced burden on applicants.

You are given the following information about the program:

- Available for all new life insurance applications for a 5-year non-renewable term product.
- There is a maximum issue age and a maximum face amount.
- Uses traditional (e.g., prescription drug history) and non-traditional (e.g., credit history and/or public records) information.

Program Assumptions

Expense Assumptions (current)	**Cost**
Acquisition Expense per App	40
Acquisition Expense per premium	30%
Maintenance Expense per premium	5%

Sales Assumptions (in units)	**Current UW**	**New UW**
Applications	2	1.5
Issued Policies	1	1

Additional Assumptions	**Rate**
Discount Rate	3%
Tax Rate	25%
Average Premium per policy	26

Assume:

- No option and guarantee costs
- No required capital friction charge
- No non-hedgeable risk charge in all years

4. Continued

Current Income Statement (per policy)

	1	2	3	4	5
Premium Income (BOY)	26.00	25.86	25.62	25.27	24.83
Investment Income (EOY)	-2.49	2.20	0.69	0.49	0.23
Claims (EOY)	0.12	0.14	0.22	0.26	0.29
Expenses (BOY)	109.10	1.29	1.27	1.26	1.23
Increase in Reserves (EOY)	48.73	-1.43	-7.64	-15.76	-23.90
Pre Tax Net Income	-134.44	28.06	32.45	40.01	47.44
Tax on Income	-33.61	7.02	8.11	10.00	11.86
Net Income	-100.83	21.05	24.34	30.01	35.58

Income Statement with New Program (per policy)

	1	2	3	4	5
Premium Income (BOY)	26.00	25.86	25.62	25.27	24.83
Investment Income (EOY)	-1.29	2.20	0.69	0.49	0.23
Claims (EOY)	0.17	0.19	0.30	0.35	0.40
Expenses (BOY)	W	1.29	1.27	1.26	1.23
Increase in Reserves (EOY)	48.73	-1.43	-7.64	-15.76	-23.90
Pre Tax Net Income	X	28.01	32.37	39.91	47.33
Tax on Income	Y	7.00	8.09	9.98	11.83
Net Income	Z	21.01	24.28	29.94	35.49

Note: EOY = End of Year; BOY = Beginning of Year

(a) (*6 points*)

(i) (*2 points*) Calculate net income in year 1. Show all work.

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

(ii) (*1 point*) Calculate the internal rate of return. Show all work.

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

4. Continued

(iii) (*1 point*) Calculate the value of new business. Show all work.

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

(iv) (*2 points*) Recommend whether JXR should proceed with the new underwriting program if it will cost 1 million to implement. Justify your answer.

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

(b) (*2 points*) Define the following post level term structures:

(i) Traditional approach

ANSWER:

(ii) Simplified re-underwriting

ANSWER:

(iii) Graded

ANSWER:

(iv) Continuing class

ANSWER:

(c) (*3 points*) Explain how adding a post level term renewal feature with simplified re-underwriting to the non-renewable product would impact product design and profitability.

ANSWER:

5.

(*10 points*) You are given the following information for KXW Life:

	Life Business	**Annuity Business**
PV of future profits	2,000	1,000
Time value of financial options and guarantees	50	0
Mortality risk costs	10	0
Regulatory capital requirement	400	160
Required Capital	500	200
Additional taxes and investment costs incurred by shareholders	40	30
Market value of capital allocated to the business	700	350
Free surplus	100	50

(a) (*1 point*) Describe why the capital held by KXW may differ from the regulatory capital requirement.

ANSWER:

(b) (*4 points*) Calculate the Market Consistent Embedded Value (MCEV) of KXW. Show all work.

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

5. Continued

(c) (*5 points*) The following sensitivity tests on the MCEV of KXW's life and annuity block are available:

Set #	Sensitivity	% change in MCEV
1	**Risk-free rates decrease 100bps**	-8.0%
	Risk-free rates increase 100bps	+2.5%
2	**Mortality improvement of 5% for life business**	+3.0%
	Mortality improvement of 5% for annuity business	-1.2%

(i) (*1 point*) Describe the purpose of MCEV sensitivity testing.

ANSWER:

(ii) (*2 points*) Explain possible reasons for the relative asymmetric magnitude of each set of sensitivities.

ANSWER:

(iii) (*2 points*) Recommend two methods of risk transfer that KXW can use to manage the overall level of risk and amount of required capital. Justify your response using the sensitivity tests provided above.

ANSWER:

6.

(*11 points*) ABC Life is pursuing a coinsurance agreement with XYZ Re which includes the following terms:

Policy Assumptions	
Plan of Insurance	Whole Life
Face Amount	500,000
Amount Reinsured	250,000
Premium Rate per 1000	15
Annual Policy Fee	50
Mean reserves per 1000	
Year 1:	1.00
Year 2:	7.00
Commissions	
Year 1:	95%
Year 2:	8%
Premium Tax	2%
Expenses	
Underwriting and Issue:	455 per policy
Maintenance:	20 per policy annually

Ceding Company and Reinsurer Assumptions		
	ABC Life	**XYZ Re**
Initial Surplus:	1000	1000
Investment Rate of Return:	10%	10%
Reinsurance Expenses:		
Issue:	(included in policy expenses)	20
Maintenance:		10

Reinsurance Allowance Assumptions	
Policy Year	**Expense Allowance**
1	100%
2-10	20%
Over 10	10%

6. Continued

Assumptions:

- Investment income is assumed to be earned only on assets present at the beginning of the calendar year and not on cash flows.
- Policy and reinsurance premiums are assumed to be paid on an annual basis.
- Expenses are assumed to be incurred at issue and on policy anniversaries.
- No deaths or surrenders are assumed.
- Federal Income Tax effects are ignored.
- All calculations are rounded to the nearest dollar.
- XYZ Re will reimburse for premium tax.

(a) (*5 points*) Calculate the following for ABC and XYZ:

(i) Gains from Operation Sheet for Year 1. Show all work.

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

(ii) Balance Sheet for Year 1. Show all work.

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

(iii) Gains from Operation Sheet for Year 2. Show all work.

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

(b) (*2 points*) Calculate the differences between the Balance Sheet for the above coinsurance arrangements and each of the following:

(i) Funds Withheld Coinsurance arrangement. Show all work.

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

(ii) Modified Coinsurance arrangement. Show all work.

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

6. Continued

(c) (*4 points*) ABC Life has decided to move forward with the reinsurance agreement as described above and would like to include the following treaty terms to improve profitability and reduction of risk:

- XYZ Re is required to terminate the reinsurance agreement after 10 years
- ABC Life will retain the assets for investment purposes while still obtaining the surplus relief
- ABC Life will be insulated from selling assets at a loss when surrenders or policy loans increase while asset values are low
- XYZ Re will be responsible for funding any increases to the reserve, less a credit for the investment income
- XYZ Re is required to guarantee the future performance of the reinsured business

With respect to coinsurance:

(i) Assess ABC's ability to claim the reserve credit under each of the terms proposed.

ANSWER:

(ii) For each treaty term, if appropriate, propose changes to make them acceptable for the credit reserve.

ANSWER:

7.

(*9 points*) HLC Life is launching an innovative single premium annuity product where payments to the annuitant are tied to the current market interest rate. You are given:

- Three-year period certain
- Payments start one year after the date of the single premium
- Annual payments are equal to the single premium multiplied by the current market interest rate
- 100 million of single premium sales projected

(a) (*3 points*) Critique the following statements in relation to creating an asset portfolio to back the above liabilities:

A. The classical immunization can be used to duration match the asset portfolio with the duration of the liability.

ANSWER:

B. An alternative strategy is to use the cash-flow matching to eliminate all risks.

ANSWER:

C. An interest-rate swap can be used to provide a better match between assets and liabilities.

ANSWER:

7. Continued

(b) (*3 points*) HLC decides to use an immunization strategy to manage the assets backing the annuity block.

Analyze the impact to the immunization strategy for each of the following events:

(i) Annuitant mortality has increased

ANSWER:

(ii) Interest rates rise

ANSWER:

(iii) Short-term bonds used in the immunization portfolio become unavailable for reinvestment

ANSWER:

(c) (*2 points*) HLC Life also enters into an interest rate swap with the following specifications:

- The floating-rate payments are made annually at year end.
- The term of the swap is 3 years
- The notional amount is 100 Million
- Current yield curve:

Year	**Spot Rate**
1	3.00%
2	3.50%
3	3.20%

Calculate the implied swap rate. Show all work.

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

7. **Continued**

(d) (*1 point*) Propose two product changes that can mitigate interest rate risk. Justify your answer.

ANSWER:

8.

(*10 points*) SXR Life is a small insurance company without a robust investment department and has limited knowledge regarding a variety of topics. Currently SXR is 100% invested in Investment Grade Corporate Bonds.

SXR sells a small portfolio of products including 10-year and 15-year Term Life Insurance, Universal Life Insurance, Single Premium Immediate Annuities, and Critical Illness Insurance.

SXR is in growth mode and would like to expand their product offering to include Deferred Annuities, and Long Term Care insurance.

SXR is considering the addition of the following assets to their investment portfolio:

- Municipal Debt
- High Yield Corporate Bonds
- Commercial Paper
- Real Estate

(a) (*4 points*) Assess the appropriateness of the above assets for:

(i) The current product portfolio

ANSWER:

(ii) The addition of Long Term Care insurance to the current product portfolio

ANSWER:

(b) (*3 points*) Describe liquidity stress tests which may be performed for the Long Term Care insurance product to address liquidity risk.

ANSWER:

8. **Continued**

(c) (*3 points*) You are proposing the use of an asset liability approach for SXR.

(i) (*2 points*) Propose a specific approach to asset allocation strategy that meets the demands of the growth strategy that SXR Life would like to pursue.

ANSWER:

(ii) (*1 point*) Explain the advantages for using the asset liability approach instead of the asset only management approach.

ANSWER:

9.

(*6 points*)

(a) (*4 points*) You have been assigned to manage a new portfolio backing a new product with initial capital of 1,400,000. You decide to invest half into equities and the other half into a single bond. The Linked Internal Rate of Return (LIRR) method is used to approximate the Time-Weighted Rate of Return (TWR) by using an annual Money-Weighted Rate of Return (MWR). You are given the following information about the portfolio:

- Equities do not pay dividends
- Bond 1 is a 4-year Corporate with 4% coupon issued on January 1, 2021 for 700,000 par value
- A 400,000 deposit is made into the portfolio on January 1, 2023 and is immediately invested into a 1-year Corporate newly-issued bond with a 5% coupon
- Coupons are paid semi-annually
- Proceeds of bond coupons and maturities are reinvested into equities
- End-of-Period Market Values (MV) of the portfolio:

Period	MV
Q2 2021	889,000
Q4 2021	912,450
Q2 2022	926,450
Q4 2022	951,773
Q2 2023	1,400,950
Q4 2023	1,455,045
Q2 2024	1,484,146
Q4 2024	1,537,353
Q2 2025	1,552,726
Q4 2025	1,568,254

Assess how well the 5-year approximation of TWR compares to the true TWR at the end of 2025. Justify your answer and show all work.

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

9. **Continued**

(b) (*2 points*) Your company offers a level death benefit term product with a 5-year level premium period followed by annually increasing premiums based on best estimate assumptions. You are given a projection for the first five years of liability cashflow (in thousands):

Year	**1**	**2**	**3**	**4**	**5**
Cashflow	-1,694	2,130	328	-518	-1,224

Assume investment income is the primary source of liquidity and liquidity risk should be minimized.

Describe two disadvantages of modeling mortgage-backed securities (MBS) as the only investment based on the projected liability cashflow. Justify your answers.

ANSWER:

10.

(*5 points*) TXL Life's pricing model includes assets for the VM-20 deterministic reserve (DR). TXL does not have credible experience for the lapse rates assumed in pricing so extra lapses were assumed at the end of years 5 and 10 in its pricing assumptions.

TXL sensitivity tested the year-5 lapse assumption, and its pricing model produces the following annual cashflows (in thousands):

Year	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Base	433	179	363	-83	-555	-902	362
Lapse Increase	-423	-19	149	-172	-518	-748	222
Lapse Decrease	1,322	437	624	47	-553	-1,027	519

(a) (*2.5 points*) Describe three potential impacts on the expected total investment yield if lapses increase. Justify your answer.

ANSWER:

(b) (*2.5 points*) Describe the expected impact on the discount rate for the VM-20 DR calculation if lapses decrease. Justify your answer.

ANSWER:

11.

(*12 points*) BLX Life sells UL policies in the U.S. and has interest in the growing market for life settlements.

(a) (*3 points*) Critique each of the following statements:

A. Viatical settlements are the same as life settlements.

ANSWER:

B. Policyholders are better off selling their policies through a life settlement because the policyholder will get the market value of the policy which is always more than the cash value of the policy.

ANSWER:

C. The price of life insurance products will increase if the life settlement business succeeds.

ANSWER:

D. It is better for a policyholder considering a life settlement to have multiple medical underwriters assess their life expectancy.

ANSWER:

BLX has followed developments in the use of credit behavior for risk selection in life insurance which has led to the development of TransUnion's TrueRisk Life Score and the LexisNexis Risk Classifier Score.

(b) (*2 points*) Outline four categories of credit attributes that quantify behavioral risk for the TrueRisk Life Score including two attributes for each category.

ANSWER:

11. **Continued**

Credit data encodes a number of conscientious behaviors making the TrueRisk Life Score an objectively measurable proxy for conscientiousness, which is positively associated with mortality.

(c) (*2 points*) Explain the influence of 'conscientiousness' in segmenting mortality outcomes.

ANSWER:

Investors are targeting BLX's UL policyholders with life settlement offers.

The investors plan to offer life settlements to each older age policyholder with a TrueRisk Life Score greater than 90 and a Risk Classifier Score of less than 200.

(d) (*3 points*) Explain the advantages and disadvantages for the investors in using these scores to target older age policyholders.

ANSWER:

(e) (*2 points*) Describe the potential impacts to BLX's mortality and lapse experience if the investors proceed with using the TrueRisk Life and Risk Classifier scoring tools to target older age UL policyholders for life settlements.

ANSWER:

****END OF EXAMINATION****