SOCIETY OF ACTUARIES

Life Pricing

Exam ILALP

MORNING SESSION

Date: Wednesday, May 1, 2019
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 6 questions numbered 1 through 6.

   b) The afternoon session consists of 4 questions numbered 7 through 10.

   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 ILALP.

6. Be sure your written-answer envelope is signed because if it is not, your examination will not be graded.

Recognized by the Canadian Institute of Actuaries.

Tournez le cahier d'examen pour la version française.

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Exam ILALP-Front Cover

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

1. (*10 points*) POC Life has decided to develop a U.S. single-pay equity-indexed annuity (EIA) with a 5-year point-to-point indexing option.

(a) (*1 point*) Describe the differences between variable annuities with a guaranteed minimum maturity benefit (GMMB) and EIAs from POC's perspective.

(b) (*2 points*) Critique the use of a static index-based hedging strategy instead of a dynamic strategy. Justify your answer.

(c) (*3 points*) You are given:

Duration	1 Year	3 Year	5 Year
Constant maturity treasury rate	3.50%	4.00%	4.25%

The guaranteed minimum value is 93% of the initial premium in all years.

Analyze whether the guaranteed minimum value would comply with the Standard Nonforfeiture Law assuming a single premium of 100,000. Show all work.

(d) (*3 points*) The product is redesigned to have a 5% premium load and a 2.5% annual guaranteed crediting rate. POC requires a 1% spread per year for non-option expenses.

You are given:

- Current index price is 1000

Zero Coupon Bonds			
Maturity	1 Year	3 Year	5 Year
Annualized Interest	3%	4.5%	5%

Call option prices			
Strike Price\Maturity	1 Year	3 Year	5 Year
950	50	130	170
1000	25	80	110
1200	5	45	80
1400	3	20	30
1600	1	7	10

Evaluate whether the indexed benefit is feasible. Show all work.

1. Continued

(e) (*1 point*) Propose two changes to the indexed benefit to help the company stay within its option budget if option prices increase significantly. Justify your answer.

2. (*7 points*) You have been asked to establish agent financing plans for the following three companies:

- Company A wants to provide a relatively stable income for their agents while remaining flexible.
- Company B wants to reward high performers at low cost.
- Company C wants to attract more agents.

(a) (*3 points*) For each company above:

(i) Recommend an agent financing plan.

(ii) List the advantages and disadvantages of each company's recommended agent financing plan.

(b) (*4 points*) You are given the following assumptions:

Quarter	Required Commission	Fraction of Agents entering quarter	Estimated Quarterly First Year Premium	Subsidy Percentage
1	2,500	1.00	2,793	150%
2	3,000	0.75	3,147	130%
3	3,500	0.60	3,861	115%
4	4,000	0.45	4,674	110%
Totals	**13,000**		**14,475**	

(i) Calculate the annual financing cost per agent as a percent of premium. Show all work.

(ii) Critique the assumptions above and propose changes where appropriate.

3. (*10 points*) ALX Life is using risk-based pricing to price a 5-year level premium term product.

You are given:

- No cash surrender values (CSV)
- No credit risk
- No renewals nor conversions
- Frictional costs of required capital are zero
- Cost of non-hedgeable risk are zero
- Tax rate is 30%
- End-of-year pre-tax profit is 50 for each year

(a) (*4 points*) ALX Life is considering the following discount rate options:

- Replicating asset portfolio rate
- Risk free rate

(i) List advantages and disadvantages of each discount rate.

(ii) Recommend a discount rate for use in pricing the product. Justify your answer.

(iii) Calculate the value of new business (VNB) using a 4% discount rate. Show all work.

(b) (*3 points*) ALX Life is considering a yearly renewable term (YRT) premium payment structure and a CSV equal to the future unearned premium for both products.

Compare and contrast the YRT structure to the level premium structure with respect to:

(i) Risk exposure

(ii) Lapse experience

(c) (*3 points*) Explain how adding a term conversion option would affect:

(i) Marketability

(ii) Policy administration

(iii) Pricing assumptions

4. (*11 points*) ZRT Life only sells level premium term life insurance in the brokerage market and is changing the traditional functions of insurance agents within independent marketing organization (IMO) channels.

(a) (*3 points*)

(i) Describe an agent's role in the key steps of the customer facing function of distribution.

(ii) Explain how IMOs are changing the customer facing functions of insurance agents.

(b) (*3 points*) Agents who sell ZRT Life's policies are able to choose between a heaped commission structure and a levelized commission structure over the first 5 policy years. The commission structures are:

Heaped commission structure (payable at the beginning of the year)		
Year	Commission as a % of premium	Override as % of commission
1	60%	200%
2-5	5%	0%

Levelized Commission Structure (payable at the beginning of the year)		
Year	Commission as a % of premium	Override as % of commission
1	45%	0%
2-5	45%	0%

Assume the following:

- Agents persistency bonus of 10% of premium if the policy persists for 4 years.
- Discount rate of 5%
- Total annual decrements of 6% that occur at the end of each year
- No chargebacks apply

4. Continued

(i) Determine which commission structure maximizes the net present value (NPV) of commissions. Show all work.

(ii) List the reasons why an agent might prefer a lower NPV of commissions based on a heaped structure versus a higher NPV on a levelized basis.

(c) (*2 points*) ZRT Life received the following concerns from prospective policyholders:

- *"I glanced at the contract and it's probably a good product with various options, but I'm not sure if it meets my needs."*
- *"Besides, I'm only 30. Why do I need life insurance?"*
- *"This is a very big decision, and I don't want to pay money for nothing."*

Recommend changes that can be made to address the above concerns with respect to:

(i) Product design

(ii) Communication to consumers

(d) (*3 points*) ZRT Life's senior management is worried about the disruption that technological innovation is bringing to insurance distribution, and are seeking to transform ZRT Life by embracing new digital methods of distribution.

(i) Explain the role ZRT Life's agents should play in the transformed organization.

(ii) Propose five digital distribution methods ZRT Life can use to enhance the marketing of term insurance.

5. (*11 points*) You are given the following information for a flexible premium UL policy:

- Male, Age 50
- Death Benefit Option 1 (Level Death Benefit)
- Face Amount: 300,000
- Guaranteed Interest Rate: 5%
- Expenses: 10% of premium, current and guaranteed
- Planned premium paying period is 5 years

Values calculated below assume guaranteed charges with respect to Internal Revenue Code Sections 7702 and 7702A:

	3%	4%	5%	6%
GLP	7,334	6,414	5,630	4,962
GSP	143,439	111,159	87,274	69,411
7-Pay Premium	20,289	16,163	13,036	10,644
NSP	129,095	100,043	78,546	62,470

The following is a portion of the UL policy illustration:

Yr	Age	Premium Outlay	Account Value	Death Benefit	Cash Surrender Value	Accumulating Fund of Exempt Test Policy
1	50	12,000	11,465	300,000	-	13,391
2	51	12,000	24,360	300,000	4,872	26,783
3	52	12,000	37,732	300,000	15,093	40,174
4	53	16,000	55,738	300,000	33,443	53,566
5	54	16,000	74,386	300,000	59,509	66,957
6	55	0	77,092	300,000	77,092	80,349
7	56	0	79,844	300,000	79,844	93,740
8	57	0	82,635	300,000	82,635	107,132
9	58	0	85,466	300,000	85,466	110,541
10	59	0	88,329	300,000	88,329	114,027

(a) (*6 points*) Determine if this policy meets the requirements for:

(i) IRC 7702 using the Guideline Premium Test (GPT), assuming the cash value corridor test requirement is met

(ii) IRC 7702A

(iii) Canadian 2017 New Exempt Policy Rules

5. Continued

(b) (5 *points*) Evaluate the impact on the IRC 7702 and 7702A tests for the following changes:

(i) Guaranteed interest rate changed to 3%

(ii) Guaranteed expense load changed to 30%

(iii) Period planned premium for 5 years is changed to single pay which equals 70,000

(iv) Adding an Acceleration of Death Benefits Rider to the policy

Show all work.

6. (*11 points*) MSP Life is reviewing its hedging program for the guarantees on its variable annuity (VA) business.

The guarantees include:

- A one year Guaranteed Minimum Maturity Benefit (GMMB) with the guaranteed value equal to original amount
- A Guaranteed Minimum Death Benefit (GMDB) that pays a death benefit equal to the account value plus 30% of the earnings in the contract
- A Guaranteed Minimum Withdrawal Benefit (GMWB), which guarantees that the policyholder can receive their entire principal amount back, as long as the withdrawals are no more than 6% of the original principal amount each year

(a) (*6 points*) MSP uses a dynamic hedging program following the Black-Scholes Merton approach for the GMMB. Rebalancing is done monthly. However, MSP is considering using a move-based strategy with a 5% trigger instead.

You are given:

- No decrements
- No bond transaction costs
- Stock transaction costs are 0.25% of the amount traded
- Constant force of interest is 3%
- Present value of hedging error is -3.972
- Present value of transactions costs is 0.366

Single Simulation of Monthly Hedging Results			
t (time, in months)	Stock Price	Stock Part of Hedge	Bond Part of Hedge
0	100.000	-44.725	52.476
1	99.250	-46.563	54.463
2	104.500	-38.635	44.111
3	105.250	-37.612	42.563
4	103.000	-42.090	47.629
5	102.750	-43.141	48.490
6	100.000	-49.993	56.293
7	101.000	-48.887	54.353
8	99.000	-55.870	62.003
9	99.500	-57.025	62.449
10	100.000	-58.859	63.464
11	103.500	-44.591	46.587
12	110.000	0.000	0.000

Calculate the total hedging error using the move-based hedging strategy. Show all work.

6. Continued

(b) (*2 points*) MSP uses the actuarial approach and deterministic assumptions based on the average mortality and average withdrawal rates to model its GMDB and GMWB.

Identify which combination of assumptions and guarantees is most likely to result in a mispricing of the cost of the guarantee. Justify you answer.

(c) (*3 points*) MSP wants to use the static replication approach to hedge its GMDB.

(i) Describe the portfolio of commonly available assets that would allow MSP to most closely replicate the liability generated by the GMDB.

(ii) Identify three reasons why the static replication portfolio may not exactly offset the guaranteed payments.

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

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