SOCIETY OF ACTUARIES
Life Pricing

Exam ILALP

MORNING SESSION

Date: Wednesday, May 4, 2016
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.

Tournez le cahier d'examen pour la version française.

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Exam ILALP-Front Cover

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

1. (*9 points*) VMD Life has an inforce block of Universal Life policies.

(a) (*2 points*) With respect to ASOP 2:

(i) Describe the determination process for adjusting non-guaranteed charges or benefits.

(ii) Describe the criteria used in the grouping of policy classes for adjusting non-guaranteed charges or benefits.

(b) (*4 points*) You are given the following mortality exposure data for age 50 Male Non-Smokers (MNS) for a calendar year:

Number of Lives	Description
500	Alive at the start of the year, alive at the end of the year
200	Alive at the start of the year, lapsed September 30
100	Policies issued on May 1, alive at the end of the year.
15	Alive at the start of the year, died on June 30.
5	Policies issued on March 1, died on October 1

(i) (*3 points*) Using the Balducci assumption, calculate the actual mortality rate for an age 50 MNS. Show all work.

(ii) (*1 point*) The expected mortality assumption for an age 50 MNS is 15 per 1,000. Determine whether a change to Cost of Insurance (COI) rates for age 50 MNS is warranted. Justify your answer.

(c) (*3 points*) Identify six disclosures that should be included in an actuarial communication justifying a change in COI rates.

2. (*10 points*) Critique each of the following statements. Justify your answer:

(i) (*4 points*) *In the U.S., the Cash Value Accumulation Test (CVAT) is used for Whole Life products, and the Guideline Premium Test (GPT) is applied to Universal Life products, since the tests are well suited for these respective products. One similarity between the two tests is in the area of policy administration. Some differences between the two tests include different interest rates and mortality rates. For example, if a product guarantees at any point in the contract a rate of 7% for 5 contract years, then 5.5% for 5 years, then 4% for 5 years, and then 3% thereafter, the interest rate used in the tax calculations for the CVAT is 4% for 15 years, and then 3% thereafter, and for the GPT is 7% for 5 years and then 6% thereafter.*

(ii) (*4 points*) *In Canada, an exempt policy is subject to income taxation, but not when there is an actual or deemed disposition of an interest in the policy. The policy gain of the disposition is the amount by which the adjusted cash surrender value exceeds the adjusted cost basis (ACB) to the policyholder. The key factors in determining the adjusted cost basis of an exempt life insurance policy are the cash surrender value and the net single premium. Relatively large premium deposits in comparison to the Net Cost of Pure Insurance (NCPI) will have the effect of dramatically reducing the ACB. The pattern of the ACB increases each policy year especially if the NCPI exceeds the premium deposit in a given year.*

(iii) (*2 points*) *The two key components of a life insurance contract in the U.S. and Canada are savings and investment. As long as the relationship between savings and investment in the policy are within U.S. or Canadian guidelines, there is no tax payable on the inside build-up of cash values. On partial withdrawals in U.S. and Canada, amounts distributed are not taxable to the policyholder until they exceed the premiums paid.*

3. (*11 points*)

(a) (*2 points*) Describe the theory of interest rate parity.

(b) (*9 points*) ABC Life is a U.S. life insurance company. ABC's Japanese subsidiary sells a variable annuity with a 1-year Guaranteed Minimum Accumulation Benefit (GMAB) rider denominated in Japanese Yen (¥). The variable annuity assets are invested in a Tokyo Stock Exchange index fund (TPX).

A stochastic interest rate and equity return model is used to determine the returns on this product. The stochastic model is limited to 3 scenarios and uses historical volatilities.

You are given:

	Continuous Interest Rate	
	Japan	U.S.
Scenario 1	1.11%	2.51%
Scenario 2	0.91%	2.43%
Scenario 3	1.05%	2.65%

Premium:	¥1,000,000
GMAB Base:	¥1,000,000
GMAB Exercise and Maturity:	1 year after issue
Exchange rate on policy issue date:	¥110 equals 1 $U.S.
Historical volatility between ¥ and $U.S.:	5%
Historical volatility of TPX:	20%

You are given the following random numbers generated by a normal distribution for the purposes of modeling exchange rates and equity returns:

Scenario	Z for Exchange Rates	Z for Equity Returns
1	0.7556	-0.5694
2	-1.2865	0.3707
3	1.5581	-1.2066

(i) (*3 points*) Calculate the projected amount of ¥ that could be exchanged for 1 $U.S. at the end of year one for each scenario. Show all work.

(ii) (*6 points*) Calculate the GMAB liability at issue in $U.S. Show all work.

4. (*10 points*) You are given the following information for XYZ Life's three new UL products with secondary guarantees:

	UL Product		
Values at Issue	**A**	**B**	**C**
Embedded Value	30	12	2
PV(Equity)	350	178	20
PV(After-tax Stockholder Earnings)	33	19	3
PV(Premiums)	1,000	550	75

		UL Product		
	Year	**A**	**B**	**C**
Distributable Earnings	1	-100	-60	-6
	2	110	32	1
	3	70	20	1
	4	30	10	1
	5	10	5	1
Required Capital (End of year)	1	5	4	1
	2	8	9	2
	3	9	3	5
	4	5	4	6
	5	2	9	3
Excess Reserves (End of year)	1	10	5	7
	2	4	4	4
	3	3	7	4
	4	2	9	2
	5	1	3	1

- XYZ's hurdle rate is set using a weighted average cost of capital method.
- XYZ's capital structure is 70% equity and 30% debt.
- Stockholders demand a return of 13% after-tax.
- Pre-tax cost of debt is 7%.
- Corporate tax rate is 40%.

(a) (*3 points*) Identify the product with the highest profit margin that meets the hurdle rate. Show all work.

4. Continued

(b) (*3 points*) Calculate the modified break-even year for each product. Show all work.

(c) (*3 points*) Assume that the results above are for male non-smokers and have been prepared using a deterministic model.

(i) Identify risks involved with this pricing model.

(ii) Propose additional analysis to help manage the risks.

(d) (*1 point*) XYZ's board of directors proposes to link the CEO's compensation to the annual ROE from the biggest closed block of business. Explain why this proposal may not be in the long-term best interest of the company.

5. (*9 points*) You are given the following for an Equity Indexed Annuity (EIA) product:

Premium	Single Premium
Index	S&P 500
Index period	3 years
Index growth method	Point-to-Point
Ratchet	Annual
Participation Rate (PR)	100%
Floor return	0%
Guaranteed Minimum Account Value	Minimum Standard Nonforfeiture Law (SNFL) requirement
Standard Nonforfeiture Law (SNFL) premium (or deposit) percentage	87.5%
SNFL interest rate	3%

You are also given the following S&P 500 index values:

Time	S&P 500 Index Value
0	1,000
1	1,070
2	1,284
3	963

(a) (*2 points*) Calculate the Indexed Account Value at time 3 for a 100,000 policy issued at time 0. Show all work.

(b) (*3 points*) Propose changes to the product to mitigate the high volatility of the index.

(c) (*4 points*) With respect to the funding of the above EIA product, you are given the following at time 0:

- Net Earned Rate is 7.50%
- Pricing Spread is 2.50%

Strike Price	Annual Cost of a one year Call Option
100	9.00%
106	5.00%
108	3.00%

5. Continued

(i) (*1 point*) List 4 factors that can affect the ability of the initial option budget to adequately fund the Index-Based Interest levels in future years.

(ii) (*3 points*) Recommend a cap level for the product assuming static hedging is used. Justify your answer.

6. (*11 points*) With respect to whole life policies:

(a) (*3 points*) Evaluate the impact on the relevant section 7702 and 7702A tests for each of the following:

(i) Changing the statutory mortality table from 1980 CSO to 2001 CSO.

(ii) Increasing the statutory valuation interest rate from 4% to 5%.

(b) (*1.5 points*) Describe how Canadian Net Cost of Pure Insurance mortality rates are determined before and after the terminal age of the prescribed tax mortality table.

(c) (*1.5 points*) Describe the policyholder taxation problem that occurs with U.S. policies that mature beyond age 100.

(d) (*5 points*) Tax authorities in the U.S. are considering changing the method used to end the 2001 CSO mortality table for tax purposes. Currently, it is assumed that the 2001 CSO mortality tables end using the blended method starting from age 95. Explain how the following methods impact the tax free build-up of cash values for a whole life product for the relevant section 7702 and/or 7702A test using the:

(i) Blended method, blending from age 95 to age 100

(ii) Forced method, with ultimate age 100

(iii) Forced method, with ultimate age 121

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

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