SOCIETY OF ACTUARIES
Life Pricing

Exam ILALP

AFTERNOON SESSION

Date: Wednesday, October 28, 2015
Time: 1:30 p.m. – 3:45 p.m.

INSTRUCTIONS TO CANDIDATES

General Instructions

1. This afternoon session consists of 4 questions numbered 7 through 10 for a total of 40 points. 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****
Afternoon Session
Beginning with Question 7

7. (*10 points*)

(a) (*2 points*) Describe the key elements of the Cash Value Accumulation Test (CVAT) and the Guideline Premium Test/Cash Value Corridor Test according to Internal Revenue Code Section 7702.

(b) (*8 points*) For three life insurance products, issued to a male age 98, you are given:

Face amount	100,000
Age coverage ends	100
Guaranteed interest rate	5%
Expense as a percent of premium	10%
Expense per policy per month	10

CSO 2001 Male ANB Table	
Duration t	q_{x+t-1}
1	0.2
2	0.6
3	1.0

Product	Annual Gross Premium (per 1,000)	End of Year Cash Value (per 1,000)		
		Age 98	Age 99	Age 100
1	300	500	750	1,000
2	400	250	500	750
3	650	325	650	975

Determine whether each of the above products complies with Section 7702. Show all work.

8. (*12 points*)

(a) (*8 points*) TJF Life Insurance Company is pricing a new Guaranteed Minimum Withdrawal Benefit (GMWB) rider for its variable annuity product. The rider has the following features:

- The rider guarantees withdrawals of 6% of the initial premium amount per year beginning at age 65 for the lifetime of the owner.
- If a withdrawal is not taken in a given policy year, the premium base on which the withdrawals are determined is increased by 6%.
- If withdrawals in excess of 6% are taken, the premium base on which the withdrawals are determined is reduced to the account value after the withdrawal.

(i) (*1 point*) Explain when stochastic modeling should be used.

(ii) (*1 point*) Describe the disadvantages of using a stochastic model.

(iii) (*3 points*) Describe three commonly used alternatives to stochastic modeling.

(iv) (*3 points*) Explain how each alternative described in (iii) could be used, if at all, in pricing the GMWB rider.

(b) (*4 points*) Describe four ways that behavioral economics could be applied when setting assumptions for the timing and amount of withdrawals for the GMWB rider.

9. (*8 points*)

(a) (*2 points*) Explain the role and responsibilities of the Dividend Actuary in the U.S.

(b) (*6 points*) GLA Life, a Canadian stock company, is establishing a U.S. insurance subsidiary (CEA Life) with a portfolio of participating insurance products.

The following summarizes CEA's Dividend Policy:

(i) *As there is no U.S. experience, the company will combine the participating policyholder accounts for policies issued in both countries;*

(ii) *Due to the expense of establishing the U.S. subsidiary and stockholder return expectations, no dividends will be declared in the first few years; thereafter, the dividend scale which is not guaranteed will be based on factors that may change;*

(iii) *The dividend scale interest rate is based on the portfolio yield earnings of CEA's participating account which also uses the Contribution Principle to equitably allocate the total distribution to participating policyholders;*

(iv) *Smoothing techniques are used to keep the dividend scale interest rate more stable over time, allowing CEA to amortize its investment gains and losses in bonds and stocks over a number of years;*

(v) *CEA's board of directors uses its own discretion to approve the distribution of dividends to participating accounts, based on the recommendations of the Dividend Actuary;*

(vi) *Beyond the actual investment returns earned on the participating policyholder accounts, the dividend scale also takes into consideration the following factors that impact experience: mortality, expenses, and persistency.*

Critique each statement in the Dividend Policy to ensure it complies with U.S. regulations. Justify your answer.

10. (*10 points*) You are given the following Equity Indexed Annuity (EIA) product designs:

Product Design	EIA Index Description	Participation Rate
A	Compound Annual Ratchet (CAR) without life-of-contract guarantee and with a floor of 0% each individual year	75%
B	Simple Annual Ratchet (SAR) with a floor of 0% each individual year	65%
C	Point-to-point (PTP)	60%
D	High Water Mark	55%

You are also given:

- Initial premium is 100
- Guarantee is 90% of premium accumulated at an annual rate of 4%
- Contract period is 5 years
- Risk free rate is 5%
- No dividends are payable
- Volatility is 10%
- Lapse and mortality are ignored for these calculations
- The equity prices of the linked index are:

t	Stock Price at time t (S_t)
0	100
1	105
2	95
3	110
4	120
5	110

(a) (*6 points*) Determine the product design that will provide the highest payoff to the policyholder. Show all work.

10. Continued

(b) (*4 points*) For product design A, the value of the ratcheted premium option is

$$H = P\left\{e^{-r} + \alpha\left(e^{-d}\Phi\left(d_1\right) - e^{-r}\Phi\left(d_2\right)\right)\right\}^n$$

where

$$d_1 = \frac{r - d + \sigma^2/2}{\sigma} \text{ and } d_2 = d_1 - \sigma$$

and

X	0.35	0.40	0.45	0.50	0.55	0.60	0.65	0.70	0.75
$\Phi(x)$	0.6368	0.6554	0.6736	0.6915	0.7088	0.7257	0.7422	0.7580	0.7734

For product design A:

(i) (*1 point*) Calculate the option value. Show all work.

(ii) (*2 points*) Assume non-option expenses are 3 per year. Calculate a participation rate, β, such that the non-option expenses and the option are funded by the premium. Show all work.

(iii) (*1 point*) Recommend changes to the product design to mitigate the risk in a high volatility environment with respect to the stock market values.

****END OF EXAMINATION****
Afternoon Session

USE THIS PAGE FOR YOUR SCRATCH WORK