
SOCIETY OF ACTUARIES
Life Pricing

Exam ILALP

MORNING SESSION

Date: Wednesday, November 1, 2017

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.

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

1. (10 points) EFG Life is developing a Single Premium Equity Indexed Annuity (EIA).

You are given:

- 90% participation with minimum guaranteed interest rate of 2%
- 3-year index period
- Single premium = 1200
- Participation rate = 100%
- Cap = 10% with no floor
- Margin = 1%
- Index growth method is point-to-point with annual ratchet
- No surrender charge

Year	Index Value
0	980
1	850
2	930
3	1200

- (a) (2 points) Compare and contrast the following methods for computing Index-Based Interest:
- Point-to-point
 - Averaging
 - Ratcheting
- (b) (4 points) Calculate the surrender value at the end of each period. Show all work.
- (c) (3 points)
- (i) Describe each of the following risks as it applies to the EIA:
- Low interest rate environment
 - High equity volatility
- (ii) Recommend EIA product design changes to mitigate each of these risks. Justify your answer.

1. Continued

(d) (1 point) Calculate the price of the put option using the following additional information:

- Assume put-call parity
- Call option price = 10
- Risk-free rate = 10% and $T = 2$ year
- Current index = 980 and Strike price = 1200

Show all work.

2. (10 points) A 10-year term life insurance product was priced using the following assumptions:

Annual premium per policy	1,000
Level face amount per policy	100,000
Policies inforce at the beginning of year 8	461
Interest rate for discounting in all years	3%
Expenses per policy (beginning of year)	25
Lapse rate in all years*	10%

* Apply lapse rate after mortality rate

Year	Expected Mortality Rate
8	0.010
9	0.011
10	0.012

- (a) (6 points) An experience study was conducted in year 7 and the future expected lapse rate was revised to 2% per year beginning in year 8.
- (i) (5 points) Calculate the change in the present value of future profits at the end of year 7 using the revised lapse assumption. Show all work.
- (ii) (1 point) Describe two possible reasons for lower actual lapse experience.
- (b) (2 points) You are developing a new 10-year term life insurance product and are evaluating different product designs:
- Design A: Level face amount with attained age premium
 - Design B: Decreasing face amount with a level premium
- (i) Describe the challenges presented by each of these product designs.
- (ii) Recommend changes to each product design to address these challenges. Justify your answer.
- (c) (2 points) You are considering adding a guaranteed renewal option with attained age premiums to your current 10-year term product.
- Evaluate the impact to the mortality assumption after the initial 10-year term. Justify your answer.

3. (10 points) Your company is pricing a new Guaranteed Lifetime Withdrawal Benefit (GLWB) for its Variable Annuity (VA).

- (a) (3 points) Explain how the problem of information asymmetry can result in a gap between expected GLWB withdrawal utilization and actual policyholder behavior.
- (b) (7 points) The following memo was prepared to document the surrender and withdrawal utilization assumptions used in pricing.

To: Chief Actuary
From: Pricing Department
Subject: Documentation of GLWB pricing assumptions

This memo documents assumptions for the new GLWB rider for our VA product.

Surrender Rates: *The surrender assumption will be the same as our existing VA product without a GLWB rider. These assumptions were developed by the Valuation Department based on fully credible company specific data.*

Withdrawal Benefit Utilization: *As this is the first GLWB rider priced by the company, we do not have any company specific experience to base our pricing assumptions on. Therefore, we have used the “Variable Annuity Guaranteed Living Benefit Utilization – 2013 Experience” study by the SOA and LIMRA as the basis of our pricing assumptions. The study indicates that, as of 2013, there has been withdrawal utilization on 23% of all contracts with GLWB riders. We believe that our policyholders will have greater utilization, so we assumed a 30% utilization rate. We used a higher rate for tax-qualified plans and a lower rate for non-qualified plans, since owners of tax-qualified annuities are more likely than owners of non-qualified annuities to utilize their benefits.*

Critique the memo based on:

- (i) How the assumptions compare to the SOA/LIMRA experience study.
- (ii) How the communication in the memo follows the proposed ASOP on setting assumptions.

4. (10 points)

- (a) (1 point) List the future benefits included in the calculation under IRC 7702.
- (b) (1 point) Identify the errors in the following statement associated with the calculation of the guideline premium limits under IRC 7702:

“For a 100,000 level death benefit Variable Universal Life (VUL) policy, the Guideline Single Premium (GSP) can be calculated to provide an endowment benefit of 125,000 at maturity age 90”.

- (c) (2 points) Assess whether the following benefits will increase the guideline premium limits under IRC 7702:
- (i) Disability waiver of premium benefit with no explicit charge.
- (ii) Optional long-term care rider with an additional charge.

Justify your answer.

- (d) (5 points) You are given the following information for a VUL policy for a male, issue age 50:
- Level death benefit is 100,000
 - 10-year non-renewable level term insurance rider for 25,000 on the insured’s spouse with an annual charge of 500

Annuity Factor using 4% Interest	Annuity Factor using 6% Interest	Net Single Premium using 4% Interest	Net Single Premium using 6% Interest
$\ddot{a}_{50:7} = 6.2$	$\ddot{a}_{50:7} = 5.8$	$A_{50:10} = 0.150$	$A_{50:10} = 0.125$
$\ddot{a}_{50:40} = 18$	$\ddot{a}_{50:40} = 15$	$A_{50:40} = 0.400$	$A_{50:40} = 0.350$
$\ddot{a}_{50:45} = 19$	$\ddot{a}_{50:45} = 17$	$A_{50:45} = 0.450$	$A_{50:45} = 0.400$

Calculate:

- (i) The initial guideline level premium
- (ii) The 7-pay premium

Show all work.

4. Continued

- (e) *(1 point)* Determine the interest rate to be used in calculating the guideline single premium on a VUL policy with a 0.25% separate account administration fee and a 0.50% charge for mortality and expense.

5. (11 points)

- (a) (1 point) Define a “lapse-supported” product.
- (b) (2 points) Assess whether a secondary life settlement transaction has a positive or negative impact on each of the parties typically involved. Justify your answer.
- (c) (4 points) You are given the following information for a whole life policy:

Policyholder/Insured	Male, attained age 73
Insured’s Life Expectancy	4 years
Death Benefit	1,000,000 (paid at end of policy year)
Annual Premium	15,000 (paid at beginning of policy year)
Current Cash Surrender Value	300,000

The policyholder is considering selling his life insurance policy to a secondary life settlement company.

- (i) Discuss considerations this policyholder should take into account when deciding to sell his life insurance policy to a secondary life settlement company.
- (ii) Calculate the maximum price the secondary life settlement company should offer to achieve an internal hurdle rate of 10%. Show all work.
- (d) (2 points) Assess the impact on the life insurance company if many policyholders take an offer from a secondary life settlement company.
- (e) (2 points) Propose strategies life insurance companies can use to limit their exposure to the secondary life settlement market.

6. (9 points) GFE Life sells a Variable Annuity (VA) with a Guaranteed Minimum Death Benefit (GMDB) rider.

You are given:

- GFE currently has a static hedge in place for the GMDB rider based on expected assumptions for mortality and lapses
 - GMDB is currently in-the-money
 - Actual lapses are higher than the pricing assumption of 5% per year
 - Actual mortality experience is lower than expected
- (a) (2 points) Explain why hedging may not completely mitigate the shortfall risk on this product.
- (b) (3 points) GFE is evaluating alternatives to using a static hedge.
- (i) Describe three risk management techniques that GFE could use as an alternative.
 - (ii) Outline the advantages and disadvantages of each technique.
- (c) (1 point) Describe four factors that could affect the lapse experience on this product.
- (d) (1 point) Recommend whether a one-sided or two-sided factor approach for dynamic modeling of lapses is more appropriate for this product. Justify your answer.
- (e) (2 points) Senior management plans to increase sales of this product by offering a wider range of investment options.

Evaluate the impact of management's plan on the cost of the GMDB.

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

USE THIS PAGE FOR YOUR SCRATCH WORK