

****BEGINNING OF EXAMINATION 8****
INDIVIDUAL INSURANCE – U.S.
MORNING SESSION

- 1.** (4 points) A recent mortality experience study shows that the substandard portion of the company's life insurance policies has worse than expected experience.
- (a) Explain reasons substandard mortality experience may be higher than expected.
 - (b) Describe methods to reflect substandard risks in life insurance products.
 - (c) Determine the best method to reflect each of the following substandard risks:
 - (i) Obesity with diabetes
 - (ii) Recovering from a temporary impairment
 - (iii) Hazardous occupation
 - (iv) Normal blood pressure but family history of coronary artery disease

2. (5 points) A U.S. life insurance company is proposing a flexible premium deferred annuity with the following features:

- Each deposit receives a guaranteed interest rate for the first five years based on new money rates with an annually renewable interest rate thereafter.
- The minimum interest rate credited on funds and used in determining minimum nonforfeiture amounts is guaranteed to be no less than 3%.
- The surrender charge is 15% of the current contract year deposit, plus 10% of the prior contract year deposit.
- Surrender charges are waived upon annuitization.
- Return of principal is guaranteed during the first contract year.
- A death benefit is not provided during the deferral period.
- The annuitization bonus is 2% of account value.
- An annual fee of \$75 is charged at the beginning of each contract year.
- An administrative load of 6% is applied to each deposit.

(a) Determine changes needed to the proposed product design in order to meet the requirements of the Standard Nonforfeiture Law for Individual Deferred Annuities.

(b) For a contract purchased on January 1, 2005, you are given:

Five-year constant maturity treasury rates	
January 1, 2005	5.85%
January 1, 2006	5.50%
January 1, 2007	5.25%
January 1, 2008	4.75%
January 1, 2009	4.00%
Credited interest rate from January 1, 2005 to January 1, 2010	4.00%
Nonrefundable state premium tax rate	2.00%
Initial deposit paid on January 1, 2005	\$50,000
Additional deposit paid on January 1, 2008	\$5,000
Partial withdrawal on January 1, 2009	\$10,000

Calculate the minimum nonforfeiture value allowed as of December 31, 2009 according to the Standard Nonforfeiture Law. Show all work.

3. (5 points) You are given the following assumptions for a variable annuity product with a guaranteed minimum death benefit (GMDB):

Account Value at time 0	\$1,500
Death Benefit at time 0	\$1,750
Deposit Paid to Date	\$1,750
Net Asset Charges	1.00%
Valuation Rate	5.50%
Assumed First Year Drop	-14%
Assumed Fund Recovery	14%
Death Benefit Guarantee Type	Roll-up
Roll-up Interest Rate	5%
Duration of Contract	5 years

Valuation Time (t)	0	1
Surrender Charges as a percentage of deposit paid	7%	6%
GMDB Mortality Rates per thousand	-	17.192
Survival Function	1.0000	0.9828

t	Projected Integrated Reserve
2	1,409.22
3	1,419.49
4	1,425.54
5	1,416.31

- (a) (1 point) Explain the calculation of the integrated reserve according to Actuarial Guideline 34.
- (b) (4 points) Calculate the integrated reserve at time 0, according to Actuarial Guideline 34. Show all work.

Question 4 pertains to the Case Study.

4. (9 points) Saturn Life is developing a new variable annuity product that will provide:

- 50 different investment options.
- A variety of guaranteed death, annuity, income and withdrawal benefit options.
- Asset-based expenses that vary with the account value of the policy.

- (a) Define each step in the product development process according to LOMA.
- (b) Determine and define for this product development project the applicable:
- (i) corporate growth strategy,
 - (ii) marketing strategy and
 - (iii) type of innovation.
- (c) In developing expected lapse assumptions for the new product:
- (i) List the factors affecting lapse rates.
 - (ii) Explain how the expected lapse assumptions would be impacted by each of the proposed design features, and justify your answer.
- (d) The entire product development project is expected to cost \$10 million. Saturn's variable annuity products are expected to return 1% of premium annually after-tax. The projected increase in sales is:

Year	Without New Product	With New Product
1	10%	210%
2	10%	60%
3	10%	10%

Calculate the project's break-even year. Show all work.

Question 5 pertains to the Case Study.

5. (13 points) As the product actuary for Mercury Life, you have been asked to analyze the feasibility of adding an equity indexed annuity to the fixed annuity product line.

- (a) (5 points) You are given the following product design:
- The index period is 6 years.
 - The investment earnings rate is 5.5%.
 - The first year commission is 4.0% of premium.
 - Other expenses and profit equal 5.0% of premium.
 - Guaranteed minimum account value is calculated using 90% of premium and 3.00% interest.
 - Index account value is calculated using 100% of premium and 100% participation rate guaranteed for 6 years.
- (i) Calculate the affordable option budget. Show all work.
- (ii) Determine changes and additions to the product design that would reduce the actual option costs down to the affordable option budget.
- (b) (1 point) Explain the impact of equity volatility on equity indexed annuity pricing.
- (c) (5 points) You are given the results from the initial pricing run:

Time	Profit
0	- 25
1	60
2	0
3	0
4	42
5	12
6	- 70

Assume Mercury Life is willing to pay 5% for borrowed money.

- (i) Calculate the ROI for this product using the Generalized ROI Calculation Method. Show all work.
- (ii) Assess the calculated ROI compared to Mercury Life's profit objective.
- (iii) Explain practical problems related to calculating ROI.
- (d) (2 points) Evaluate the feasibility of adding an equity indexed annuity with respect to Mercury Life's target market.

6. (9 points) You are reviewing a block of flexible premium UL policies.

- (a) Describe steps to determine the minimum cash surrender value for this type of product according to the NAIC Universal Life Model Regulation.
- (b) Your analysis reveals a widening gap between value-based reserves and cash values. You believe a new experience study is needed to revise the value-based reserve lapse assumptions.
- (i) You are given:
- The existing lapse assumption is based on an internal study conducted in 1999 of lapses of permanent life policies during the period 1996 to 1998, which included data from an acquisition in 1996.
 - Current portfolio lapse data cannot distinguish between fixed and flexible premium UL policies.
 - Industry experience is trending toward lower lapse rates.

Explain how the key principles in studying experience to set assumptions provide guidance for these specific issues.

- (ii) Describe considerations when adjusting a best estimate experience assumption with provision for adverse deviation.
- (c) An illustration for a male, issue age 45, flexible premium UL policy indicates the coverage remains level for the life of the policy assuming the policyowner continues to pay the same annual premium since issue.

You are given:

Current Annual Premium	\$160
Guaranteed Maturity Premium	\$200
CRVM Net Level Premium	\$150
Valuation Net Level Premium	\$125
Guaranteed Maturity Fund at Duration 10	\$900
Actual Fund at Duration 10	\$700
Cash Value at Duration 10	\$650
PV of Benefits at Duration 10	\$2,500
$\ddot{a}_{45:\overline{50} }$	13.75
$\ddot{a}_{55:\overline{40} }$	11.25

Calculate the 10th year

- (i) CRVM minimum terminal reserve.
 (ii) Statutory gain or loss upon surrender.

Show all work.

7. (7 points) XYZ Life produces value-based financial statements.

You are given:

- The hurdle rate is 12%.
- The risk-free rate of return is 4.0%.
- The inflation rate is 1.5%.
- Beta is 2.0.

- (a) (1 point) Describe the CAPM formula and calculate the implied rate of return on average equity investments.
- (b) (2 points) Describe validation techniques used to evaluate the accuracy and reliability of model office projections used in value-based financial analysis.
- (c) (4 points) ABC Life offers the same term life insurance product as XYZ. XYZ's premiums are 5% higher than ABC's. Both companies have the same inflation, investment and hurdle rates.

XYZ has priced the product to achieve an IRR of 13%.

- (i) Compare first year earnings for XYZ for the following reporting methods.
- US GAAP,
 - Value-based financial reporting, and
 - Level ROE financial reporting.
- (ii) Determine which company would report higher first year earnings under each of the reporting methods. Justify your answer.

8. (4 points) Senior management would like to introduce a commission schedule that eliminates vesting entirely. In return, agents will be paid higher commissions. Currently, all commissions vest to agents at the time of a sale.

You are given:

Current renewal commission scale:

t	1	2	3
r_t	3%	3%	3%
O_t	0	0	0
P_t	1.0	0.90	0.80

Proposed renewal commission scale:

t	1	2	3
r_t	5%	5%	5%
O_t	0	0.05	0.10
P_t	1.0	0.95	0.90

where:

t = policy year

r = commissions as a percent of the gross annual premium

O_t = probability that premium on new business is written by agents who leave before business enters policy year t

P_t = probability that the annual premium for the policy year t will be paid

- The discount rate is 3%.
- Expected sales under current compensation scale are \$10.0 million of premium.
- Expected sales under proposed compensation scale are \$10.5 million of premium.
- Expected expenses excluding commissions are 10% of premium.

Select the commission schedule that produces the highest net revenue for the company. Show all work.

- 9.** (4 points) ABC Life is concerned about the trend of its fixed annuity sales relative to the rest of the industry.
- (a) Describe available sources of data that may be used to evaluate the trend in fixed annuity sales.
 - (b) Describe issues for ABC to consider in deciding whether to withdraw from the fixed annuity market.

****END OF EXAMINATION****
MORNING SESSION

****BEGINNING OF EXAMINATION 8****
INDIVIDUAL INSURANCE – U.S.
AFTERNOON SESSION
Beginning with question 10

Question 10 pertains to the Case Study

- 10.** (4 points) Mercury Life plans to enter the individual term life insurance market using a brokerage distribution system.
- (a) Assess this plan in relation to Mercury’s strengths and weaknesses.
 - (b) Assuming Mercury’s goal is to increase market share through broker relationships:
 - (i) Determine the appropriate pricing objective.
 - (ii) Describe the advantages and disadvantages of this objective.
 - (c) Assuming Mercury’s goal is to increase market share through consumer relationships:
 - (i) Determine the appropriate pricing objective.
 - (ii) Describe the advantages and disadvantages of this objective.

- 11.** (6 points) Your company is proposing to sell a block of life insurance business to another company.
- (a) Describe factors to consider before deciding to sell the block.
 - (b) Explain reinsurance structures available to facilitate the sale of a block of life insurance business.
 - (c) Describe goodwill and explain its impact on the transaction.

Question 12 pertains to the Case Study.

12. (8 points) You are given the following information with respect to Saturn Life's term insurance financial statements:

- Saturn uses the same definition of GAAP free cash flow and GAAP surplus as found in TSA 38 *Strategic Management of Life Insurance Company Surplus*.
 - Solvency-based reserves are equal to GAAP income-based reserves.
 - After-tax investment income on required capital for 2003 is \$2,750,000.
- (a) With respect to annual GAAP ROE:
- (i) Explain possible reasons for a non-level pattern.
 - (ii) Explain possible reasons a particular year differs from the pricing ROI.
- (b) Calculate Saturn's 2003 GAAP free cash flow. Show all work.
- (c) Saturn is considering a change to YRT reinsurance from the existing coinsurance arrangement.

You are given the following information:

- The YRT reinsurance is on a 90% quota share basis.
- The average YRT reinsurance premium on 2003 issues is \$0.55 per \$1000.
- Average first year mean reserve credit on YRT reinsurance is \$0.60 per \$1000.
- Average first year mean reserve credit on coinsurance is \$0.71 per \$1000.
- There were no deaths on contracts issued in 2003.

Revise the 2003 pre-tax shareholder earnings assuming term policies sold in 2003 are reinsured under the YRT arrangement, ignoring any impact on DAC and investment income. Show all work.

- 13.** (13 points) Your company is proposing to offer a new flexible premium UL product in the Canadian market with the following features:
- The introductory credited interest rate is 12% and is guaranteed for the first 12 months.
 - The credited rate after the first 12 months is based on one of two options:
 - The return on fixed income assets, or
 - An equity index based on the S&P 500.
 - Commission of 60% on all premiums paid in the first year.
 - Production bonus of 100% on first year commission earned.
 - There are no commission chargebacks.
 - Surrender charges apply for the first 10 years.
 - Every five years, a contingent bonus of 1% of account value is paid, provided the average credited rate has exceeded 4% over the life of the policy.
- (a) (4 points)
- (i) Describe each of the following prohibited sales practices:
- Misrepresentation
 - Twisting and churning
 - Rebating
- (ii) Evaluate the exposure of the proposed product to each of these practices.
- (b) (1 point) Explain the advantages and disadvantages of flexible premium UL compared to fixed premium UL.
- (c) (4 points) Determine the impact on lapsation for policies with the fixed income crediting option under a declining return scenario, assuming the credited rate is:
- (i) The earned rate less a targeted spread.
- (ii) The market rate less a targeted spread.
- (d) (4 points) Explain the factors used to determine the amount of DAC amortization in the first policy year for this UL product with respect to U.S. GAAP.

14. (12 points) ABC Life currently sells a guaranteed, 10-year level premium term product in the U.S. market. After the initial 10-year period, coverage is annually renewable. Recent sales results have been disappointing. ABC is developing an indeterminate premium version to replace the current product. Under the new design, premium rates will be guaranteed for the first two years of the contract.

- (a) Describe the types of product innovations as outlined in LOMA.
- (b) With respect to indeterminate premium term products:
 - (i) Describe the product design.
 - (ii) Explain the advantages and disadvantages compared to a guaranteed premium product design from the company's perspective.
- (c) ABC has no mortality experience for an indeterminate premium product.

Describe factors ABC needs to consider in using its own existing mortality data to set the mortality assumption used to price the new product.

- (d) Describe the following methods of calculating reserves for renewable term products:
 - (i) Unitary method.
 - (ii) Contract Segmentation method.

15. (8 points)

- (a) Describe the following methods of matching assets and liabilities.
- (i) Exact matching,
 - (ii) Duration matching,
 - (iii) Horizon matching, and
 - (iv) Product cash flow matching.
- (b) You are given:

Time	Liability Cash Flow
1	25
2	25
3	100
4	100
5	0
6	0

Calculate the modified duration and convexity of the liability cash flows using an interest rate of 7%. Show all work.

- (c) The investment department suggests an asset portfolio with modified duration equal to the liability cash flow modified duration, with the following asset cash flows:

Time	Asset Cash Flow
1	4.68
2	0.32
3	234.07
4	0.32
5	0.00
6	10.72

- (i) Evaluate the effectiveness of using the proposed asset portfolio to immunize the liability cash flows.
- (ii) Describe ways to improve the asset and liability matching for this portfolio.

Show all work.

16. (5 points) You are given:

Cash Claims Paid by Year of Incurral

Incurral Year

Calendar Year	2000	2001	2002	2003	2004
2000	5				
2001	10	6			
2002	4	12	7		
2003	3	7	14	7	
2004	1	2	2	13	6

End of Year Claim Reserve

Incurral Year

Calendar Year	2000	2001	2002	2003	2004
2000	15				
2001	10	16			
2002	8	5	17		
2003	5	4	6	18	
2004	4	3	5	6	17

- (a) Describe the common tests of claim reserve adequacy.
- (b) Evaluate the sufficiency of the claim reserves. Show all work.

17. (4 points) A U.S. insurance company has historically sold only whole life insurance. Sales have been declining steadily over the last few years. Senior management expects to introduce a universal life product that provides the customer with more flexibility.

- (a) Describe features of a universal life product that provide flexibility to the customer.
- (b) The following product design is proposed:
- The premium load is 15%.
 - The guaranteed interest rate is 5.00%.
 - A surrender charge applies for 5 years.
 - The policy fee is \$5 per month.
 - Unscheduled premium payments are not permitted.
 - There are no riders.
 - The policy loan interest rate is equal to the current interest rate.
 - The guaranteed interest bonus is 1% beginning in year 11.

Evaluate the proposed design and recommend any changes.

****END OF EXAMINATION****
AFTERNOON SESSION