

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

- 1.** (4 points) You are determining a crediting strategy for a new fixed single premium deferred annuity product. The Chief Actuary suggests a renewal crediting strategy equal to the portfolio rate on assets allocated to the product less a target spread.
- (a) Describe the four rate components that can be used to determine a credited interest rate.
  - (b) Describe the expected performance of the product using the Chief Actuary's suggestion in:
    - (i) An increasing interest rate environment, and
    - (ii) A decreasing interest rate environment.
  - (c) Recommend a renewal crediting strategy that reduces the impact of changing interest rate environments. Justify your answer.

**2.** (5 points)

- (a) Identify considerations in setting the mortality assumption for an immediate annuity.
- (b) An income annuity will be sold directly to a labor union group. The labor union group exhibits high mortality during employment. After retirement, mortality gradually returns to normal levels.
  - (i) Evaluate the various techniques used to reflect substandard mortality in immediate annuities.
  - (ii) Select the best technique to reflect the mortality for this group. Justify your answer.
- (c) Given the following information:
  - 2,000 lives
  - 5 deaths occurred during the year
  - (i) Calculate the 95% confidence interval for this mortality rate.
  - (ii) Determine the number of lives required in order to be 95% confident that the mortality rate is between 0.002 and 0.003.

**3.** (8 points) You are adding a new Guaranteed Minimum Death Benefit (GMDB) to your variable annuity product.

- (a) Explain design considerations specific to a GMDB.
- (b) Describe advantages and disadvantages of the methods used to estimate the cost of a GMDB.
- (c) Predict the impact of adding the GMDB on the following assumptions:
  - Lapse
  - Annuitization
  - Mortality
  - Partial Withdrawals

**This question pertains to the Case Study.**

- 4.** (9 points) An independent marketing company has priced a new whole life product for Saturn Life to introduce to the U.S. market. You are given the following information:
- The product is underwritten on a guaranteed issue basis
  - The maximum face amount is \$25,000
  - First year commissions are 150% of annualized premium
  - Unearned commissions are charged back on surrenders in the first year
  - Renewal commissions are 5% of premium
  - Reserves are calculated using the 1980 CSO curtate mortality table and 4% interest
  - Pricing mortality is 150% of the 1980 CSO in the first policy year, grading down to 100% by the end of year 20
- (a) (1 point) Identify the three areas of the company that are critical to the product development process and describe each area's role in the process.
- (b) (2 points) Evaluate the product relative to Saturn's target markets.
- (c) (5 points)
- (i) Identify potential risks of the proposed product.
  - (ii) Recommend actions to reduce those risks.
- (d) (1 point) Given the following information per policy:

Issue Age	Net Annual Premium
39	\$79
40	80
41	81

Duration (t)	${}_tV_{40}$	${}_tV_{41}$
4	\$270	\$275
5	\$280	\$285
6	\$290	\$295

- Gross Annual Premium is \$100
- The company uses mean reserves
- Premiums are paid quarterly
- The policy was issued on May 1, 2000

Calculate the mean reserve, deferred premium and unearned premium as of December 31, 2004, for a policy issued at age 40. Show all work.

5. (12 points) XYZ Life has a closed block of Universal Life business.

You are given (amounts in millions):

Statutory liabilities	\$1,000
Surrender value guarantee	\$50
Required capital:	
- Equity	\$200
- Debt	\$300
Statutory surplus	\$350
Cost of capital:	
- Equity	16%
- Debt (after-tax)	6%
Present Value of future shareholder cash flows for in-force business	\$850
Market value of allocated capital and surplus	\$800

- (a) (3 points) Describe considerations in setting the risk discount rates (hurdle rates) to calculate economic values.
- (b) (4 points) Determine the European Embedded Value. Show all work.
- (c) (2 points) XYZ Life has received an offer from ABC Financial to purchase this block of business. You are given (amounts in millions):
- ABC establishes the same statutory liabilities
  - Offered purchase price equals \$600
  - Pre-tax transaction costs are \$10
  - Tax reserves equal \$970
  - ABC's tax rate equals 40%
  - ABC's required capital is \$450

Determine ABC's estimate of the embedded value for the block of business implicit in their offer.

- (d) (3 points) Explain the following financial management issues when making an acquisition:
- Reasons for acquiring a block of business
  - Prerequisites for a buyer to acquire a block of business
  - Factors in determining a purchase price

**6.** (9 points)

- (a) (1 point) Describe the features of a two-tiered annuity product.
- (b) (5 points) With respect to two-tiered annuities;
  - (i) Explain the statutory reserve requirements in the U.S.
  - (ii) Contrast U.S. Statutory reserve requirements with Canadian reserve requirements.
- (c) (2 points) Determine which of the major asset classes have the following relative characteristics according to *Atkinson and Dallas*:
  - (i) High liquidity
  - (ii) Low liquidity
  - (iii) High quality (or low default cost)
  - (iv) Low quality (or high default cost)
  - (v) Long duration or maturity
  - (vi) High yield, excluding capital gains
  - (vii) High yield, including capital gains
  - (viii) Predictable cash flows
  - (ix) Volatile cash flows
- (d) (1 point) Explain how the assets backing a two-tiered annuity would need to differ from those backing a traditional deferred annuity. Justify your answer.

**7.** (8 points)

- (a) (3 points) With respect to term life insurance:
- (i) Describe methods used to vary premiums by face amount.
  - (ii) Explain the rationale to support each method.
- (b) (2 points) Describe the following tests and indicate their purpose in preferred underwriting:
- (i) Dried Blood Spot testing
  - (ii) Oral fluid testing
  - (iii) Cotinine testing
- (c) (2 points) The following tests are proposed for \$500,000 of preferred term issued at age 45:
- Oral fluid
  - Paramedical
  - Motor Vehicle Report
  - Prostate Specific Antigen

Evaluate the proposed tests compared to the typical requirements found in the Society of Actuaries' survey of preferred underwriting practices.

- (d) (1 point) For a product with three underwriting classes, you are given:
- Standard aggregate mortality rate of 2.90 per thousand
  - 30% qualify for preferred rate
  - 10% qualify for elite preferred rate
  - Preferred class mortality rate is 20% lower than the standard mortality rate
  - Elite preferred class mortality rate is 30% lower than the standard mortality rate

Calculate the expected mortality rate for the elite preferred class, the preferred class and the residual standard class. Show all work.

**8.** (5 points) You are determining benefit reserves and DAC under U.S. GAAP for the following products:

- (i) Participating Whole Life, and
- (ii) Non-participating Whole Life.

Describe the criteria used to select the assumptions for:

- mortality
- interest
- lapse
- dividend
- expense

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

**\*\*BEGINNING OF EXAMINATION 8\*\***  
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**AFTERNOON SESSION**  
*Beginning with question 9*

- 9.** (3 points) With respect to Last-Survivor and First-to-Die Life Insurance Products:
- (i) Describe product features important to each product.
  - (ii) Explain the uses of these products in their target markets.



**10.** (8 points) Direct Life, a U.S. insurance company, sells term life and supplemental accident and health insurance through direct response marketing. Direct Life is purchasing Acme Agents, a regional broker dealer, to distribute a new immediate variable annuity.

- (a) Describe the corporate growth strategies (according to LOMA) planned by Direct Life.
- (b) In preparation for completing due diligence on Acme Agents:
  - (i) Identify the “good” internal controls the SEC has recommended in marketing variable products.
  - (ii) Describe prohibited sales practices.
- (c) Direct Life is given the following information regarding Acme Agents.

2005 Revenues (millions)	
Financial Planning Fees	\$5
Deferred Annuity Commissions	\$20
Immediate Annuity Commissions	\$1
Insurance Commissions	\$4
Mutual Fund Commissions	\$50
2005 Expenses (millions)	
Variable Expenses	\$40
Fixed Expenses	\$20

Assume:

- Hurdle rate is 15%
- Tax rate is 0%
- Inflation rate is 0%
- Variable expenses are a constant percent of revenues
- Earnings occur at the end of the year
- Acme Agents will sell the business for seven times 2005 earnings
- Following the purchase of Acme Agents
  - Direct Life will invest \$5 million annually in Acme Agents
  - All existing revenues will increase 20%
  - A new immediate annuity product will add \$1 million to annual revenue
  - Fixed expenses will increase 25%
  - Revenues and expenses will remain constant at the new levels

Determine whether Direct Life should pay Acme Agent’s selling price, assuming 10 years of sales. Show all work.

**11.** (8 points) The following fixed annuity product has been proposed for sale in the U.S.:

- Surrender Charge = 12% of deposits in year one, grading down by 1% per year
- Death Benefit is the Surrender Value
- Commissions = 10% of deposits
- Front End Load = 1% of deposits
- Annual Contract Charge = \$75 (deducted at the end of the year)
- Guaranteed Interest Rate = 2.5%
- No other expenses

(a) (3 points) You are given the following information on constant maturity treasury (CMT) rates. Assume a \$10,000 deposit and the CMT rates do not change during the quarter:

Date	1 Year CMT	5 Year CMT	10 Year CMT
Q1 2005	2.01%	4.11%	5.26%
Q2 2005	2.07%	4.27%	5.34%
Q3 2005	2.22%	4.49%	5.05%
Q4 2005	2.36%	4.14%	4.99%

- (i) Calculate the minimum nonforfeiture amount at the end of each of the first three policy years for contracts to be sold in 2006. Show all work.
  - (ii) Demonstrate that the cash surrender values do not meet the minimum nonforfeiture requirements. Show all work.
  - (iii) Propose changes to the product design in order to comply with the Standard Nonforfeiture Law.
- (b) (5 points)
- (i) Describe the major components of career agent compensation for annuity contracts according to LIMRA's Marketing for Actuaries.
  - (ii) Recommend changes to the compensation structure to encourage persistency.

- 12.** (12 points) XYZ Life's year-end management reports indicate that XYZ may not have sufficient cash to pay policyholder dividends and company expenses for the following calendar year. The president suggested reducing all policyholder dividends by 50% to alleviate XYZ's cash shortfall.
- (a) (1 point) Describe characteristics of management reporting that support the identification of cash flow issues.
  - (b) (3 points)
    - (i) Assess the effects on XYZ's liquidity risk of reducing policyholder dividends by 50%.
    - (ii) Explain strategies XYZ could use to mitigate liquidity risk.
  - (c) (2 points) Describe methods that could be used to change the dividend scale paid to policyholders if the decline in the scale is temporary.
  - (d) (6 points)
    - (i) Describe the tests that the Illustration Actuary must perform to demonstrate compliance with the NAIC Life Insurance Illustrations Model Regulation.
    - (ii) Assess the impact that the reduction to policyholder dividends may have on the work that a U.S. Illustration Actuary must perform.
    - (iii) Assess whether a Canadian actuary, in determining suitable illustration scenarios, will be able to use the reduced scale of dividends in the primary range of scenarios developed.

**13.** (10 points) Current low interest rates and a volatile stock market have hurt sales of variable and fixed annuities. Management wants to introduce an Equity Indexed Annuity (EIA).

- (a) (2 points)
- (i) Explain potential issues with introducing an EIA in the current economic environment.
  - (ii) Recommend product design features to address these issues.

- (b) (1 point) You are given:
- Participation rate is 70%
  - Cap is 6%

Proxy Index Values						
$t$	0	0.2	0.4	0.6	0.8	1.0
Closing level	100	105	108	95	98	110

Calculate the credited rate for year 1, under the following index growth rate methods:

- (i) Point-to-point
- (ii) Average

Show all work.

- (c) (3 points) This product will offer a choice of recently introduced indices. Management proposes using the highest historical growth rate of several existing equity indices for sales illustrations.

Assess management's proposal with respect to the Canadian Institute of Actuaries' note on Insurance and Annuity Illustrations.

- (d) (4 points) You are given the following statements with respect to U.S. GAAP reporting for EIAs:
- (i) "We apply FAS97 just like variable annuities. We treat the hedges we bought under FAS133."
  - (ii) "We only care about the values of options at the valuation date. We can get those from the trading desk."
  - (iii) "We promised the Board that the earnings on these EIAs will be stable."
  - (iv) "We use the Moody's corporate bond rate at issue as the discount rate to value embedded derivatives."

Explain the application of U.S. GAAP with respect to these statements.

**14.** (7 points) You are given the following information for a UL product that is no longer sold:

- The policy will lapse if the Account Value (AV) goes negative
- No surrender charges are assessed on this product
- No per policy expense charge
- Pricing was done on an integrated basis
- Cost of insurance (COI) charges are insufficient to cover the death benefits
- Valuation discount rate is 5%

(\$ millions)

Year	Premium	AV (EOY)	COI Charges	Excess Death Benefits	Interest Margin
1	\$25,000	\$24,503	\$309	\$519	\$490
2	0	23,874	384	641	477
3	0	22,982	534	884	460
4	0	21,864	658	1,081	437
5	0	20,559	759	1,235	411

(a) With respect to the “profits followed by losses” test under SOP 03-1:

- Describe the test.
- Calculate the test results for this product. Show all work.

(b) You are given:

- First year expense deferral is \$250
- No other expenses are incurred
- k-factor is 47.92% for a DAC schedule with no SOP 03-1 liability
- k-factor is 52.19% for a DAC schedule reflecting an SOP 03-1 liability

Calculate the impact of the SOP 03-1 liability on the DAC balance in year 2. Show all work.

**15.** (6 points)

- (a) Explain the determination of estimated gross profit for investment contracts subject to SFAS 97.
- (b) You are given the following for a fixed single premium deferred annuity subject to SFAS 97:

Present Value of Estimated Gross Profit at issue	\$12,250
Deferrable Expenses at issue	\$8,000
Front End Load at issue	\$3,000
Earned Interest Rate	8.00%
Credited Interest Rate	6.50%
DAC Balance at end of year 2	\$6,500
Unearned Revenue Liability at end of year 2	\$2,300
Account Balance at end of year 2	\$93,125
Account Balance at end of year 3	\$91,240
Net Cash Flow in year 3	(\$381)
Estimated Gross Profit in year 3	\$1,775

Calculate the pre-tax shareholder profit in year 3. Show all work.

**16.** (6 points) You are responsible for managing capital at a stock life insurance company.

- (a) Describe the advantages and disadvantages of using equity and debt to raise capital.
- (b) You are given the following information:

Cost of debt	6.2%
Risk-free rate	5.0%
Risk premium	7.0%
Tax rate	40.0%
2006 Total debt	\$294,400,000
2006 Total equity	\$184,000,000

Profit Center	2006-2010 Average GAAP ROE	2006 Beginning GAAP Equity (millions)	2010 Ending GAAP Equity (millions)
A	7.4%	\$23	\$37
B	6.5%	\$11	\$17
C	10.2%	\$57	\$74
D	6.8%	\$93	\$139
Total Company	8.0%	\$184	\$277

Evaluate the performance of each profit center and the overall company.

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