November 2000
Course 8I

Society of Actuaries

**** BEGINNING OF EXAMINATION ****
INDIVIDUAL LIFE AND ANNUITY
MORNING SESSION

Question 1 pertains to the case study
This question should be answered independently.

1. *(6 points)* The CEO of Mercury Life is concerned with the recent trend of sales of their fixed deferred annuity portfolio. In addition to the information in the case study, you are given:

Commissions:	10% of premiums paid in policy year 1
	0% of premiums paid in subsequent policy years
Market-Value Adjustment:	Unlimited and also applies on death and annuitization

(a) Assess features of the current product designs that could be changed to improve sales.

(b) Describe the consumer testing methods Mercury Life could use to redesign their portfolio.

Question 2 pertains to the case study
This question should be answered independently.

2. *(12 points)* Saturn Life's new Chief Financial Officer is reviewing the Term Insurance Income Statement and Balance Sheet (pages 15 and 16 in the case study) with regard to the issues driving profit emergence. He has asked for your assistance with his analysis. You are to assume:

- The statements are prepared in accordance with US GAAP
- Saturn defines Return On Equity as: ROE = A / (.5 x B), where

  A = after-tax income + after-tax invested income on required surplus

  B = (beginning DAC + ending DAC)
  + (beginning required surplus + ending required surplus)
  – A

(a) Explain why the ROE:

(i) exhibits a nonlevel pattern, and
(ii) is greater than the pricing ROI.

(b) Calculate the 2000 projected cash flow and evaluate the relationship between the cash flow, company profit targets and distributable earnings as defined in the case study.

(c) Explain how reinsurance affects ROE.

(d) Describe how the determination of GAAP benefit reserves affects ROE.

Question 3 pertains to the case study
This question should be answered independently.

3. *(6 points)* Mercury Life is considering changes to its field compensation structure. 35% of its single premium deferred annuity sales come from internal replacements. Although the company does not believe these sales are unsuitable, it desires to reduce its internal replacements.

The following three alternatives are being compared to its current structure of paying 3% of the single premium regardless of premium source:

Alternative 1) 4% of the single premium for non-internal replacements, and 1% for internal replacements.

Alternative 2) 2% of single premium regardless of premium source, plus an annual trailing commission equal to 0.25% of the annuity account value.

Alternative 3) 4% for non-internal replacements, and a percentage of the full 4% for internal replacements, the percentage being based on the age of the old policy:

- 0% for policies in force less than 4 years
- 50% for policies in their 5^{th} through 8^{th} year
- 100% for policies in force longer than 8 years

The new alternatives would apply only to sales of new annuity policies.

(a) For each of the three alternatives estimate:

(i) whether the present value of total compensation paid for fixed annuity sales would increase; and

(ii) whether the agent financing cost of Mercury Life is likely to increase.

Explain the rationale for your estimates.

(b) Evaluate how the characteristics of Mercury Life impact the factors that drive the level of agent financing costs.

4. *(6 points)* You are evaluating the emergence of earnings for a company by reviewing its income statement. The company uses an income-based reporting system that is not based on U.S. GAAP or Canadian rules. It sells whole life policies backed by a portfolio of bonds.

Construct a detailed list of questions with respect to reserves and investment income that you would need answered to facilitate your evaluation.

Question 5 pertains to the case study
This question should be answered independently.

5. *(14 points)* Saturn Life is considering a significant redesign of its term insurance line. The following changes are being considered:

- An expansion of the current three-class underwriting system to a new, six-class system with increased underwriting requirements for all policies;
- An addition of a convertibility feature to its ART and 3-year renewable term products;
- A generous bonus payable into Saturn's VUL product upon conversion from all convertible term products;
- A modified re-entry provision on its five-and ten-year level term products which allows the life insured to be re-underwritten at any time. Under this "reset" feature, the policy immediately reverts to ART rates if the life insured fails to qualify as a standard risk.
- Selling the term product line exclusively through direct channels;

(a) *(3 points)* Describe how conjoint analysis can assess consumer preferences for new features.

(b) *(6 points)* Assess the impact of the proposed changes on the expense and mortality assumptions to be used in pricing the product.

(c) *(4 points)* Recommend the margins to be added to the mortality and expense valuation assumptions for the proposed product, applying techniques similar to those used for the Canadian statutory statement. Show all work.

(d) *(1 point)* You are given the following information for a male age 35:

- Pricing mortality:
  Term: 102% of 1975-80 Ultimate Table, adjusted for selection
  VUL: 98% of 1975-80 Ultimate Table, adjusted for selection
- Mortality during the first 15 policy years is adjusted for selection as follows:
  $q_{[x]+t-1} = (t/15) * q_{x+t-1}$ for t = 1, 2, … 15

Assuming the term policy is converted at the end of the fifth year, calculate the cost of the extra anticipated mortality, per thousand of converted amount at risk, for the first year following conversion. Show all work.

Question 6 pertains to the case study
This question should be answered independently.

6. *(11 points)* In an effort to increase Saturn Life's variable annuity sales, you have been asked to lead the product development for a new single premium immediate variable annuity.

The proposed design consists of the following:

- Initial period certain followed by a life annuity.
- During the period certain full or partial withdrawals are permitted but are subject to a surrender charge.
- An account value during the withdrawal period.
- The annuity payment is guaranteed to never fall below a specified percentage of the initial payment.
- The unresolved product features include:
  - The level of the assumed interest rate
  - The certain period length
  - The guaranteed percentage of the initial payment

(a) *(2 points)* With respect to the product development process:

(i) Describe the steps in the process, and

(ii) Explain where you are in the process.

(b) *(4 points)* Saturn Life is planning to distribute this product solely through its direct response distribution channel.

(i) Describe the different methods of direct marketing.

(ii) Assess the potential fit for this product with the type of individual normally served by direct marketing.

(iii) Assess Saturn Life's overall sales potential for this product.

(iv) Explain when these issues will be finalized in the product development process.

6. (Continued)

(c) *(2 points)* With respect to nonforfeiture:

(i) Explain how the nonforfeiture principles apply to this product.

(ii) Compare the nonforfeiture benefits in this product to a traditional immediate annuity.

(iii) Explain when the nonforfeiture issues will be finalized in the product development process.

(d) *(3 points)* With respect to pricing risks:

(i) Assess this product's risks.

(ii) Describe how a reinsurer could help mitigate these risks.

(iii) Explain when an estimate of reinsurance costs should be available in the product development process

7. *(5 points)* XYZ Insurance Company uses the portfolio average method for determining the earned rate backing its participating whole life product line. Policy loans are recognized in the dividend formula using the block average method.

You are given the following information:

- Current earned rate based on portfolio average method: 8%
- Fixed policy loan rate: 6%
- Percentage of policy loans in the portfolio: 20%
- Expected new money rate: 10%

Assume all rates are net of investment expenses.

Management is considering changing the dividend formula to use the direct recognition method for policy loans. They have proposed using an earned interest rate of 8.75% in illustrating policy values without loans.

(a) Explain the appropriateness of reflecting policy loans in the investment income factor of a dividend formula.

(b) Evaluate management's proposal for new product illustrations.

(c) Describe alternative methods to enhance the illustrated earned rate for new business.

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

****BEGINNING OF EXAMINATION 8****
INDIVIDUAL LIFE AND ANNUITY
AFTERNOON SESSION

Question 8 pertains to the case study

This question should be answered independently.

8. *(8 points)* Mercury Life's strategy for continued growth involves the development of a new term life insurance portfolio. These products would introduce preferred risk premium rates for the first time along with an internet marketing channel. The products will be targeted for sales to affluent 30 - 40 year olds.

(a) Analyze the strategic fit of this proposal in relation to Mercury's current profile.

(b) Describe considerations in managing Mercury's use and adequacy of company capital for this strategy.

Question 9 pertains to the case study

This question should be answered independently.

9. *(8 points)* You are the actuary responsible for pricing, illustration compliance and cash flow testing for Mercury Life's universal life block of business.

(a) *(6 points)* Assuming that Mercury Life is a U.S. company, describe considerations in setting experience assumptions for:

(i) Cash flow testing for reserve adequacy

(ii) Demonstrating compliance with illustration regulations

(b) *(2 points)* A new universal life product will include:

(i) A preferred risk class, and

(ii) A 15^{th} year persistency bonus of 10% of the accumulated interest paid since policy issue

Assess the impact on your pricing assumptions.

Question 10 pertains to the case study

This question should be answered independently.

10. *(17 points)* Mercury Life wants to double its Universal Life (UL) growth rate while maintaining strong financial results and ratings.

Assume that the hurdle rate and the equity growth rate for the UL business is 10%.

(a) For each of the following valuation methods, explain its primary purpose and assess the financial impact of rapid growth:

(i) Solvency-Based Valuation
(ii) Income-Based Valuation
(iii) Value-Based Valuation

(b) Explain calculations needed to convert distributable earnings from a solvency-based method to an income-based method assuming that Mercury Life is a U.S. company.

(c) Assume:

- Income-based surplus is equal to solvency-based surplus, except for the deferral of acquisition expenses.
    - Surplus earns (is charged, if negative) interest at an after-tax rate of 4.5%.
- The value of the business in-force at the beginning of the year is $500 million.
- For new business issued in 2000, the 12/31/2000 present value of future distributable earnings is $100 million.
    - Actual experience in 2000 is equal to expected.

Calculate the year 2000 value-based earnings for the UL line.

(d) Evaluate the alignment of the UL growth objective with respect to:

(i) The market targeting and segmentation strategy of Mercury Life,
(ii) The price-quality strategy of the UL product, and
(iii) Product profitability and strategic management.

(e) Analyze UL product risks that need to be considered from a capital adequacy perspective.

11. *(6 points)* You are given the following information about a re-entry term product sold by a mid-sized life insurance company:

Product type:	15-year renewable and convertible term
Coverage pattern:	Level death benefit
Rate structure:	Re-entry term
Policy fee:	None
Coverage expiry:	Age 80
Conversion expiry:	Age 80
Minimum issue size:	$25,000 face amount
Issue ages:	35 to 75
Premium guarantee:	Fully guaranteed
Female rates:	Use a 4-year setback
Riders:	Accidental death benefit
Distribution:	Independent insurance agency (brokers)
Commission schedule:	10% of premium in all policy years

(a) Evaluate the existing product design and recommend improvements.

(b) List key pricing issues associated with re-entry term products.

12. *(6 points)* You are developing a new Single Premium Deferred Annuity product. The director of marketing has suggested the following product design to increase market share:

Crediting strategy:	Average of the credited rates of your top 3 competitors, excluding interest rate bonuses
Surrender charge:	5% of account value in the first policy year, grading to 0% in the sixth policy year
Bailout rate:	Credited rate at policy issue
Surrender charge free withdrawal:	20% of account value in each policy year

The current investment policy requires that bond investment grades be AA or higher, and that the duration of the assets match the projected duration of the liabilities.

(a) *(5 points)* Describe risks associated with each of the design elements, and recommend changes to reduce these risks.

(b) *(1 point)* Explain benefits of using stochastic modeling to manage the risk.

13. *(7 points)* You are acting as a peer reviewer for another actuary who has prepared a report for senior management with respect to the company's capital adequacy over the next five years. The executive summary of the report includes the following statements:

> "Using cash flow modeling I have looked at the capital needs of our individual life business. Based on our current in force and planned sales in the context of our current five-year strategy I project that the line of business will have sufficient capital to meet its needs."

(a) Describe contents required in the report by the Actuarial Standards of Practice.

(b) Identify major issues to be addressed in order to make these statements in the executive summary.

14. *(4 points)* For a block of disabled life business, you are given:

	Incurral Year				
Total Cash Paid (000's) By End of Calendar Year	1995	1996	1997	1998	1999
1995	$500				
1996	$1,200	$450			
1997	$2,000	$1,150	$600		
1998	$2,300	$2,500	$1,300	$750	
1999	$3,500	$4,000	$2,400	$1,500	$650

	Incurral Year				
Claim Reserve plus Liability (000's), End of Year	1995	1996	1997	1998	1999
1995	$3,500				
1996	$3,000	$5,550			
1997	$2,300	$4,050	$1,900		
1998	$2,200	$2,300	$1,200	$2,250	
1999	$1,500	$500	$100	$1,500	$3,350

(a) Assess the reserve adequacy, ignoring interest. Show all work.

(b) List the steps of a cash flow testing process you can use to establish adequacy of reserves.

15. *(4 points)* You are the pricing actuary for ABC Life. Its 10-year level premium term product, TERM10, is a market leader. You have priced this product to obtain a 12% ratio of pre-tax profits to premiums. The target market is high-income individuals.

XYZ Life, your main competitor, has just introduced a 10-year level premium term product, LOWCOST10. At every issue age, the LOWCOST10 premiums are 5% lower than those of TERM10. XYZ Life's normal practice is to heavily advertise all new products.

(a) Analyze how the introduction of LOWCOST10 will affect the demand elasticity of TERM10.

(b) Propose options for ABC Life to consider as a response to XYZ's product.

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