BEGINNING OF EXAMINATION

1. *(4 points)* Your company is interested in entering the income annuity market and is considering both fixed and variable payout designs.

(a) Describe the types of income annuity payout options.

(b) Describe pricing assumptions for income annuities.

(c) Explain how you would set the assumed interest rate (AIR) for each of the following objectives:
   (i) A competitive first year payout;
   (ii) A payout that has the greatest likelihood of increasing over time; and
   (iii) Minimize expected variability of payouts over time.

Question 2 pertains to the case study.

2. *(12 points)* Saturn Life is interested in acquiring a block of life insurance policies from ABC Life.

You are given the following information about ABC:

- No new life insurance policies have been sold in the last two years.
- There is no reinsurance on the block of life insurance business for sale.
- The pre-tax investment earnings rate in the ABC appraisal is a level 15%.
- The federal income tax rate is 35%.
- ABC will provide a computer model of this business for analysis and due diligence by potential buyers.

ABC has furnished the following present values (in millions) as of 12/31/2001:

	PV@ 18%	PV@ 15%	PV@ 13%	PV@ 9.75%	PV@ 5.5%
Pre-Tax Solvency Earnings	$18.9	$21.0	$22.7	$25.8	$30.9
Taxes	5.2	5.8	6.2	6.9	8.2
Increase in Required Capital	(0.8)	(0.9)	(1.0)	(1.3)	(1.7)
After-Tax Investment Income on the Required Capital	0.5	0.6	0.6	0.7	0.8

(a) *(2 points)* Evaluate the possible discount rates that could be used to value the block of business and recommend the most appropriate discount rate.

(b) *(4 points)* Describe the steps you would take to assure the reasonableness of ABC's computer model of the block of business. Determine any additional information that will be needed from ABC in order to validate the results of the model.

(c) *(4 points)* You are given the following:

- As of 12/31/2001, life insurance solvency reserves are $40 million for the block;
- ABC proposes a transfer of $30 million in cash to the acquiring company;
- Saturn would hold the same amount of solvency reserves as ABC;
- Initial transaction costs would be $1 million;
- Required capital would be $6 million, and
- Saturn would incur a tax savings of $2 million if it assumes the business.

Using an appropriate discount rate, determine whether Saturn should accept the $40 million in liabilities for the $30 million initial cash transfer. Show all your work.

2. Continued

(d) *(2 points)* The CFO of Saturn Life has some concerns about the persistency of ABC's block of business.

(i) Describe actions that Saturn could take to mitigate replacement activity.

(ii) Explain the disadvantages to a policyholder if they were to replace their ABC life insurance policy.

3. *(6 points)* A small Canadian insurance company that primarily sells annuity products would like to increase life insurance sales by developing a Term-to-100 product.

The following information is provided about the proposed product design and pricing assumptions:

- Product has no cash value
- Fully guaranteed premiums
- Issued at ages 30 – 60
- Target market is the middle class
- First year commission only; no renewal commissions
- Investment earnings rate is assumed to be 8% per year
- Lapse rate assumption 5% per year
- Mortality assumption is based on company's annuity experience
- No reinsurance

(a) *(3 points)* Evaluate the appropriateness of the proposed features and assumptions.

(b) *(2 points)* Describe additional considerations to be taken into account in setting lapse rate assumptions for Term-to-100 products.

(c) *(1 point)* Identify the design and pricing assumption changes you would make to market this product in the United States.

Question 4 pertains to the case study.

4. *(13 points)* You have been asked to assist in the financial evaluation of Mercury Life's Universal Life (UL) block of business.

In addition to the information in the case study, you are given the following for 1999 (in thousands):

Mortality (cost of insurance) charges	$101,000
Other charges	115,000
Total mortality and other charges	216,000
Premium	$530,000
Reserves released on death	$149,000
Terminations and surrenders	0
Front end premium loads	0

Assume:

- Mercury's financial statements are presented in accordance with US GAAP.
- Reserves = Account Balance (Fund Values).

(a) Reconcile the change in Mercury's UL income-based policy reserves from the beginning to the end of 1999.

(b) Create a pre-tax Source of Profit analysis for the UL income statement presented in the case study for the year 1999.

(c) The US Statutory Association Blank instructions describe the method for analyzing the increase in reserves for life insurance.

Apply this method to calculate the tabular cost of mortality for 1999 on Mercury's UL block of business assuming the reserve rate of interest is 6%.

4. Continued

(d) Mercury calculates solvency-based reserves in accordance with the NAIC Model Regulation that specifies the minimum standard for the valuation of UL insurance.

Define the "r" factor, explaining how it is used and its purpose.

(e) An Australian insurance company is interested in purchasing Mercury's UL block of business.

The following values were estimated under the Australian Margin on Services method (in thousands):

	Year-end 1998	Year-end 1999
Present value of future profits	$12,950	$12,800
Best estimate liability	$11,300	$11,650

Calculate the income statement operating gain for 1999 under the Australian Margin on Services method for the UL block.

Show all work.

5. *(7 points)* ABC Life is trying to increase its term life sales by increasing sales through non-traditional distribution channels.

You are given the following information for ABC's 5-year level term product:

- ABC's current term pricing is based on its brokerage distribution compensation structure.
- First year brokerage compensation is 75% of first-year premium
- Renewal brokerage compensation is 5% of premium in years 2 – 5
- Total direct distribution costs (beginning of year 1 only)
    - Up to 5,000 policies sold: $5,000,000
    - 5,001 to 8,000 policies sold: $6,000,000
    - More than 8,000 policies sold: $7,500,000
- All other acquisition and maintenance costs are the same for both distribution channels
- Average annual premium per policy: $500
- Average face amount per policy: $200,000
- Pricing horizon: 5 years

(a) Describe the various types of non-traditional distribution channels.

(b) Determine the number of term policies that must be sold through the direct distribution channel to produce profitability equivalent to that of sales through the brokerage distribution channel. In the calculation,

- Use a discount rate of 9.00%;
- Assume no deaths or lapses in your calculations; and
- Assume premiums are payable at the beginning of the year.

Show your work.

(c) Describe any changes needed to the annual Dynamic Capital Adequacy Testing report to reflect ABC's planned strategy to grow its direct distribution channel.

6. *(5 points)* For a CD annuity you are given:

Single premium	$10,000
Issue date	January 1, 2001
Term	3 years
Commissions	3% of premium
Acquisition expense	$50 per policy
Annual maintenance expense	$50 per policy
Investment return	7%
Credited rate	5%
Hurdle rate	12%

Assume:

- No deaths
- No lapses
- No taxes
- Commissions and expenses occur at the beginning of the year
- Statutory reserves are equal to the account value
- Distributable Earnings are equal to the statutory gain
- Year-end statutory surpluses are equal to zero
- Target surplus is zero

Calculate the value-based earnings on this policy, for the calendar year 2001, assuming that actual experience is equal to expected.

Show all work.

7. *(7 points)* Describe accounting considerations and standards used in the preparation of income-based financial statements addressing reinsurance ceded transactions by life insurance companies in:

(i) The United States;
(ii) Canada; and
(iii) Australia.

8. *(6 points)*

(a) Describe Yearly Renewable Term (YRT) reinsurance on a first dollar basis.

(b) Describe how YRT reinsurance and experience refunds can help a ceding company manage its earnings.

(c) You are given the following:

	Policy Year		
	1	2	3
Reinsurance premium	100	100	100
Gross death benefit	250	375	325
Reinsurance percentage	25%	25%	25%

- The reinsurance profit and expense margin is 12%.
- The loss carry forward (LCF) interest rate is 6.25%.
- The reinsurer returns 40% of all profits through the experience refund process.
- Assume there are no reserves or taxes.
- All transactions occur at the end of the year.

Calculate the experience refund for each year.

Show all work.

Question 9 pertains to the case study.

9. *(5 points)* As Marketing Actuary for Saturn Life, you have been asked to evaluate a proposal from yourlife.com to be included on their Internet site. The site is designed to help visitors find the lowest cost annually renewable term (ART) life insurance.

You are given the following information on the site design and cost structure:

- After a visitor has entered personal information, the site provides a list of the five lowest cost insurance companies, their ART rates, and links to the insurance companies' web sites.
- Visitors can also search for insurance companies by name, obtain rates, and find links to their web sites.
- For a monthly fee, yourlife.com will include Saturn Life in its rate comparison database and provide a link to Saturn Life's web site.
- There is an additional charge to Saturn Life every time yourlife.com provides a top five list that includes Saturn Life.
- There is an additional charge every time a visitor uses a link from yourlife.com to Saturn Life's web site.
- Saturn Life would have the opportunity to purchase ads at yourlife.com.

Evaluate the channel design and channel management considerations that need to be taken into account in entering this relationship with yourlife.com.

Question 10 pertains to the Case Study

10-12. *Use the following information for questions 10 - 12.*

Mercury Life enters an agreement to acquire Saturn Life.

10. *(8 points)*

(a) *(6 points)* Compare the field management compensation of a typical agency-building channel with that of a typical non-agency building brokerage channel and evaluate any differences.

(b) *(2 points)* Recommend the channel that will best position the combined company to achieve strong sales and profitability. Justify your response.

Question 11 pertains to the Case Study

10-12. *Use the following information for questions 10 - 12.*

Mercury Life enters an agreement to acquire Saturn Life.

11. *(5 points)* Explain issues that will need to be resolved in analyzing emerging mortality experience for the combined company's term and universal life products.

Question 12 pertains to the case study.

10-12. *Use the following information for questions 10 - 12.*

Mercury Life enters an agreement to acquire Saturn Life.

12. *(6 points)* Mercury uses cashflow analysis techniques for internal management purposes and intends to approximate the liability cashflows for the Saturn block of fixed deferred annuities using the following formula:

$$\text{Mercury cashflows} \times \frac{\text{Saturn block account value}}{\text{Mercury block account value}}$$

For Saturn's fixed deferred annuity products you are given:

- There are no market value adjustments on surrenders or partial withdrawals;
- All products contain a surrender charge based on a percentage of account value that decreases from 10% in the first year to 0% in year 15;
- Saturn credits portfolio-based interest on the block with a bailout provision that permits surrender for the full account value if the credited rate falls below 5%; and
- All of Saturn's deferred annuities offer a two-tiered crediting design.

Explain considerations in projecting liability cashflows and evaluate the appropriateness of Mercury's intended approximation for the Saturn block with respect to:

(i) Market rate;
(ii) Credited rate strategy;
(iii) Lapse rate function, and;
(iv) Expense inflation.

Question 13 pertains to the case study.

13. *(14 points)* The CEO of Saturn Life proposes to develop and market a dividend paying participating Universal Life (par UL) product to compete with Mercury Life's participating Whole Life product, the leading product in the market. The CEO forecasts $50 million of first year premium from sales during the first twelve months. Cost of insurance rates, expense loads, and the interest crediting rate are fixed and guaranteed by the terms of the contract.

(a) *(1 point)* List the risks, according to Kotler's *Marketing Management*, to the successful development of a new product and assess Saturn's par UL product proposal with respect to each of these risks.

(b) *(3 points)* Describe objectives and issues for establishing a financial structure for dividends.

(c) *(1 point)* Explain considerations Saturn Life needs to make in selling participating policies as a stock company.

(d) *(7 points)* Saturn Life uses US GAAP for its management accounting basis.

For the first year policy projection you are given:

Solvency Based Income Statement (in thousands)	
Premium	$50,000
Investment Income	228
Death Benefits	5,000
Surrenders	308
Reserve Increase	17,500
Commissions	45,000
Fixed Expenses	1,750
Net Income	(19,330)
Dividend	0

Solvency Based Balance Sheet (in thousands)	
Assets	$19,250
Reserve	17,500
Required Capital	1,750

Income-Based Information (in thousands)	
Benefit Reserve	$29,368
Initial DAC	$43,000
DAC Amortization Factor	50%
DAC Interest Rate	4%

13. **Continued**

Policy information	
Interested Credited in First Year	$1.2 million
Cost of Insurance	36.95% of premium
Surrender Charge	2.475% of premium
Expense Loads	3% of premium
Initial Death Benefit	$500,000 per policy
Number of Policies	5,000
Annual Lapse Rate	5%

Assume:

- No taxes.
- Deaths occur prior to lapses.
- Lapses occur at end of policy year.
- Policies are all equal size.
- No dividends are paid in year 1.
- ROE is based on end of year US GAAP Equity.
- The ROE is the same for all years.
- The Statutory ROI is equal to the ROE.

(i) Describe the appropriate SFAS accounting treatment of this product design.

(ii) Calculate the end of first year DAC balance and construct the first year management basis income statement and balance sheet. Show all work.

(iii) Calculate the first year ROE and evaluate whether the ROE would be acceptable to Saturn Life. Justify your assumptions and show all work.

(e) *(2 points)* Recommend a course of action for the development of the product. Justify your response.

14. *(6 points)*

(a) *(2 points)* Describe and evaluate the following price setting methods:

- Markup Pricing
- Target Return Pricing
- Perceived Value Pricing
- Value Pricing
- Going-Rate Pricing

(b) *(3 points)* You have been asked to price a direct-marketed 1-year level term product.

You are given the following initial estimates of the product's costs:

Underwriting expenses per thousand of face amount issued	$20
Total administrative costs	$20,000
Mortality cost per thousand of face amount issued	$4
Capital requirement	$27,300
Average size	$5,000
Expected sales	1,000 policies
Desired return	9.15%

Determine the difference between the break-even volume using:

(i) the Markup Pricing method; and
(ii) the Target Return Pricing method.

Show all work.

(c) *(1 point)* Your primary competitor is currently the market leader and has high brand awareness. However, its ratings are not as high as yours. You are targeting your premiums to be lower than theirs. Describe the possible reactions the competitor will have to your new product.

15. *(5 points)* ABC Life wants to enter the highly competitive survivorship insurance market. The initial product specifications proposed by the Marketing Department include:

- Whole life dual status base plan design, with face amount paid upon second death
- Minimum face amount of $250,000
- No cash values
- Automatic increases to the death benefit are not part of the design
- Policy split nd estate preservation riders are each available at no additional cost
- Standard insurance rates are offered if both individuals are rated Table E (225% of standard mortality) or less
- Policy is issued on a standard basis even if one of the insured's life expectancy is less than one year

Evaluate the appropriateness of this design, and recommend changes you would make before launching this product into the marketplace.

16. *(3 points)* Describe the four separate steps of the Canadian Asset Liability Method.

17. *(8 points)* You are given the following annuity payments:

Payment Date	Payment
January 1, 2003	$60,000
July 1, 2003	$70,000
January 1, 2004	$65,000
July 1, 2004	$80,000
January 1, 2005	$70,000
July 1, 2005	$90,000

(a) Describe the Modified Duration method of duration matching including any problems associated with it.

(b) Calculate the Modified Duration of the annuity payments as of July 1, 2002, based on an interest rate of 5%. Show all work.

(c) Describe the Exact Matching method of duration matching including any problems associated with it.

(d) Non-callable bonds have been purchased to exactly match the annuity payments as of July 1, 2002 using the Exact Matching Method.

Information about the bonds is shown in the following table:

Time to Maturity	Semi-annual coupon rate
0.5 year	4.0%
1.0 year	4.5%
1.5 years	5.0%
2.0 years	5.5%
2.5 years	6.0%
3.0 years	6.5%

Determine the number of bonds with a maturity of 2 years that were purchased.

(e) Describe the Horizon Matching method and its appropriateness for the annuity payments.