Question 1

a) 1) Life only- payments while annuitant is alive
2) Life with n-years certain – payments to the beneficiary until the end of n-years if the annuitant should die
3) Unit Refund Annuity – payments for the life of the annuitant with an extra payment upon death equal to original fund less payments made
4) Joint and survivor - upon first death payments continue to the survivor in the same amount or at a predetermined reduced fraction. May also have a certain period
5) Payments for a specified period – payments cease after n-years

b) 1) interest rates
- should reflect current rates available in the capital market with adjustments for profit requirements
- can use current spot rate curve to discount each benefit by duration with a constant rate for all cash flows beyond the last spot rate

2) mortality
- should be sex distinct unless unisex is required by state
- should reflect realistic rates for annuitant population with some margin for mortality improvement

3) premium tax, commissions, and administrative expenses
- premium taxes are assessed up front
- commissions are typically up from and may be recovered with up-front load
- administrative charges are used to cover costs of eg. Monthly check, monitoring annuitant to ensure still alive , etc.
- asset based charges for variable design

Question 2

a)

1) discount rate for purchasing block of business should be based on the rate company owners expect
2) should not discount at rate less than after tax cost of capital, so would not discount at less than 13% (Saturn's after tax cost of capital)
3) discounting 9.75% after tax rate investment rate not good, usually only used to compare different streams of amounts
4) 5.5% debt rate too low, investors will accept lower rate on debt due to safety of debt
5) pre-tax investment earnings rate from ABC appraisal of 15%not good, before tax interest rates have no theoretical basis. Since Saturn's aggregate after tax ROE is 15%, may consider looking at 15%
6) Recommend 18%, since Saturn's shareholders demand 18% after tax return on investment. In no event would I accept less than 13%, the after tax cost of capital. Consider opportunity costs.

b)

1) perform static valuation
2) check how well model reproduces starting in force numbers
3) request in force numbers for reserves, units, policies, cash values, premiums, tax
4) perform dynamic validation
5) check reasonability of model going forward
6) results of model compared to previous year's actual results – check items such as reserve increase
7) request experience assumptions, review for reasonableness, appropriateness, consistency, trends used, sources of data
8) ask for any sensitivity tests

c)

1) I will calculate at 18%, the buyers desired rate of return
2) Minimum Assets=Solvency Reserve + Required Capital + Tax + Transactions Costs – Embedded Value
3) Embedded Value=pv(after tax solvency earnings) – pv (Incr required capital) + pv (after tax investment income on required capital)
4) EV =(18.9-5.2) - -0.8 + .5 =15.0M
5) Min Assets=40 + 6 – 2 + 1 -15.0 =30.0M
6) Recommend to accept the deal, since getting $30M and require $30M

d) i)

1) have quality customer service
2) get educational materials for staff
3) have computer detections of internal replacements
4) train sales people to build client relationships and sell based on need
5) compensate agent for high retention by persistency bonus or other recognition program
6) keep products competitive

7) increase face of existing policy
8) decrease premium of existing policy

ii)

1) incur first year expenses on new policy
2) since older premiums could be higher
3) has to be re-underwritten/premiums could be higher
4) surrender period starts over
5) suicide provision starts over
6) incontestable period starts over
7) could have tax consequences on termination of policy

Question 3

a. No Cash Value- O K since Canada has no minimum cash values required; no standard Nonforfeiture law

Fully Guaranteed Premiums – risky for company since no way to adjust premiums for actual experience if worse than anticipated in pricing.

Recommendation : shorten guarantee period since no experience with this product

Issue Age: popular at older ages

Recommendation: Target the upper class

Target Market – popular with estate planning and used in the Back- to Back market

Recommendation: add renewal commission to improve persistency and servicing by agent

Earnings Rate – Use conservative long term interest Rate; 8% too high for today's environment

Recommendation: use lower earned rate

Lapse Rate – Lapse supported product; company experiences losses if lapse rates are lower than pricing assumption

Recommendation: Use lower lapse rate; CIA maximum lapse rate is 3%

Mortality – annuity mortality not appropriate for life insurance; Live insurance products are generally underwritten

Recommendation- use industry life insurance table or reinsurance experience

Reinsurance – small company, risky product, new to market, large net amount at risk

Recommendation – use reinsurance to assist with pricing and design and smooth profits

b. Market sophistication – Sophisticated market has lower lapses

Issue Ages and Lifestyles- older ages have lower lapses

Back- to- Back Annuities – T100 premiums paid by immediate annuity; lapses should be close to zero

Quality of sale – needs based selling; distribution channel; quality of service by agent

Size of policy – large sales have lower lapses

Commission Structure – levelized commissions have lower lapses

Viatical Companies

c. Must add cash values to comply with U.S. standard nonforfeiture law

Consider adding ETI, RPU, APL

Lapse Rates will be higher; cash value provides an incentive to lapse

Question 4

A

Beginning 1999 policy reserves	1,899,000
Add premium	530,000
Add credited interest	133,000
Less COL charges	<101,000>
Less other charges	<115,000>
Less reserves released on death	<149,000>
End of year 1999 policy reserves	2,197,000

B Sources of profit for UL

1 Investment income earned over interest credited

152,000- 133,000 = 19,000

2 Mortality charges over death benefits

101,000 -- 50,000 = 51,000

3 Expense charges over maintenance and acquisition expenses less change in DAC

115,000 – 20,000 – 154,000 + 47,000 = -12,000

4 surrender charges = 0

Total pre- tax earnings:

19,000 + 51,000 – 12,000 + 0 = 58,000

C

$$C - I = (M_o + P) - (M_1 + V^T + V^D)$$
$$= 1,899,000 + 530,000 - 2,197,000 - 149,000$$
$$= 83,000$$
$$and, I = i\left\{\frac{M_o + M_1 + V^D + (C - I)}{2}\right\}$$
$$= 6\%\left\{\frac{1,899,000 + 2,197,000 + 149,000 + 83,000}{2}\right\} = 129,840$$
$$\rightarrow C = 83,000 + 129,840 = 212,840$$

D.

Guaranteed maturity premium (GMP) = amount of level premium to ensure the fund will be sufficient to mature the contract

Guaranteed maturity fund (GMF) = the accumulation of the fund assuming GMP is paid at guaranteed rates and charges deducted

r= ratio of actual fund of GMF at valuation date and used in calculation of UL reserves:

reserves = $r\{PV(Benefits - GMP) - expenseallow\}$

Where PV (Benefits) is calculated starting from the max {actual fund, GMF} allowing for charges & guarantees

The purpose of r factor is to adjust reserve formula based on the actual fund performance compared to GMF. The intent of the formula is to treat UL plans in a way similar to permanent plans.

E.

Policyholder liability = best estimate liability + future profits

YE 1998 = 11,300 + 12,950 = 24,250

YE 1999 = 11,650 + 12,800 = 24,450

Therefore, the change in liability is $200 increase.

premium	530,000
inv. Income	152,000
Death benefits	<50,000>
Expenses	<174,000>
Incr in liab	<200,000>
Operating gain	268,000

Question 5:

Part A

Types for Upscale Markets

1) Financial Planners
   Mostly Ex-Agents
   Fee-based compensation common

2) Stockbroker and Mutual fund Salesperson
   Focus on Variable Annuity products

3) Accountants (CPA)
   Previously used for referrals
   Can now receive commissions

Types for Middle Markets

1) Worksite Marketing
   Offer products to people at their workplace
   Meet with customers by one on one meeting, group presentations, and payroll stuffers
   Guaranteed or simplified issue

2) Banks
   Successful in Europe
   Important channel for annuity business
   Common receive salary and incentive/bonuses
   Licensed Bank employees, In Branch agents, and third party agents

3) Direct Marketing
   Direct mail, Print media, Broadcast media, Telemarketing, Internet

Part B

Solve for number of policies for the profitability of the direct distribution channel to equal the profitability of the brokerage distribution channel. Let N= number of policies.

The premiums and all other costs of the two channels are the same, therefore in order to solve for the number of policies need to set the direct costs to the brokerage costs.

For Brokerage

PV Commissions = Σ (Commissions $_t$ * Discount Factor $_{t-1}$)
= 500*.75 + Σ (500*.05/(1.09)^(t-1)) For t= 2 to 5
= 455.99 per policy

For Direct

5,000,000	if N < 5,001
6,000,000	if 5,000 < N < 8,000
7,500,000	if N > 8,000

Solve:

5,000,000/5,000 = 1,000 per policy
6,000,000/8,000 = 750 per policy
7,500,000/N = 455.99 per policy

N=16,447.73

Therefore, ABC Life must sell 16,448 policies to make the profitability equivalent under both distribution channels.

Part C

In the annual DCAT report, the following are needed:

A) Executive Summary
B) Introduction to DCAT (Methods, assumptions, process, procedures, etc)
C) MCCSR and RBC ratios
D) Base Scenario (results and analysis)
E) Adverse Scenarios: results, possible ripple effects and recommended suggestions to remedy/relieve the risk. Also, sensitivity testing.
F) Analysis of risk by line of business
G) Conclusion and recommendation
H) Appendix: include company profit/key objectives, assumed management action (e.g. capital injection)

The principle goal of DCAT is to prevent insolvency. Need to identify relevant risk categories and determine those requiring further analysis. Relevant risk categories requiring further analysis:

1) New Business Risk:
Lower Sales:
Cause rise in per unit costs
Higher Sales:
Increase in surplus strain
2) Expense Risk
Significant change, the expense per unit will initially rise and the expense control for set-up also needed provision. High contact costs
3) Persistency Risk
The persistency will affect the expense as well. All of the costs are incurred in the first year, where only some costs are incurred in the first year for the brokerage channel. With new distribution channel, the company needs to determine if lapse experience will be different between the two distribution channels.
4) Mortality Risks
Since direct distribution channels mostly include simplified or guaranteed issue, this may lead to anti-selection, e.g. selective lapsation, which will worsen mortality.

Question 6

Value-Based Earnings for 2001
= Increase in Economic Value in 2001 + Earnings Distributed to Shareholders in 2001

Economic Value 12/31/2001
= Adjusted Statutory Capital & Surplus 12/31/2001 + Value of Business Inforce 12/31/2001

Statutory Profit
= Premium + Net Investment Income – Benefits – Commissions – Expenses – Increase in Statutory Reserves

Statutory Profit
For 2001: 10,000 + 672.00 – 0 – 3%*10,000 – 50 – (10,500.00 – 0) = 228.00
For 2002: 0 + 731.50 – 0 – 0 – 0 – 50 – (11,025.00 – 10,500.00) = 156.50
For 2003: 0 + 768.25 – 11,576.25 – 0 – 0 – 50 (0 – 11,025.00) = 167.00

Where

Statutory Reserves are equal to the account value
12/31/2000: AV = $0.00
12/31/2001: AV = $10,000 * 1.05 = $10,500.00
12/31/2002: AV = $10,500 * 1.05 = $11,025.00
12/31/2003: AV = $11,025 * 1.05 = $11,576.25, which is paid out as a benefit at the end of 2003

Net Investment Income is earned on premium less expenses plus beginning of year Statutory Reserves
2001: ($10,000 – 3% * $10,000 - $50 - $50 + 0$) * 7% = $672.00
2002: ($0 – 0 – 0 – $50 +$10,500) * 7% = $731.50
2003: ($0 – 0 - 0 – 0 - $50 + $11,025) * 7% = $768.25

Economic Value At 12/31/2000 = $0
Economic Value At 12/31/2001 = $156.50 / 1.12 + $167.00 / 1.12^2 = $272.86
Earnings Distributed to Shareholders in 2001 = 2001 Statutory Gain = $-228.00

Value-Based Earnings in 2001 = $272.86 - $0 + $-228.00 = $44.86

Question 7

i) **Accounting Considerations and Standards in the U.S.**

SFAS 113 is the primary guidance for ceded reinsurance accounting under U.S. GAAP.

A reins arrangement without much risk transfer must be accounted for as a deposit by the ceding company.

A reinsurance arrangement that does transfer significant risk should not result in the removal or reduction of assets or liabilities (including reserves) from the ceding company's GAAP balance sheet.

Proceeds from reinsurance transactions that represent recovery of acquisition costs (e.g. excess first year expense allowances) should reduce the DAC asset on the direct business.

Thus, only net acquisition costs are to be deferred and amortized in proportion to revenues net of revenues transferred to the reinsurer.

Under U.S. GAAP, there can be no immediate recognition of a gain at the start of the arrangement, unless it is an assumption treaty.

ii) **Accounting Considerations and Standards in Canada**

The most significant determinant in accounting for reinsurance is whether or not risk has been transferred.

The effect of reinsurance ceded is to be considered directly ion determination of the policy liability (or For YRT and coinsurance, record the business retained by the ceding company on a basis net of reinsurance.)

For YRT the reinsurer would set up an actuarial liability and the ceding company would show a corresponding reduction.

For coinsurance the reinsurer would set up accounts based on its proportionate share of the policy and the ceding company would show corresponding reduction in mirror fashion.

Disclosure of all significant ceded business should be provided either directly or in the notes to the financial statements.

The netting of reinsurance from gross business written does not remove the obligation of the ceding company to the insured parties, the ceding company remains directly liable to the insured.

iii) **Accounting Considerations and Standards in Australia**

Required to disclose policy liabilities gross of reinsurance on the balance sheet.

The policy liability must first be calculated net of ceded reinsurance (net policy liability)

The reinsured policy liability is calculated separately as the best estimate liability.

Therefore, the policy liab gross of reinsurance is the sum of the net policy liab and the reinsured policy liab.

Question 8

Yearly – premium paid once per year
Renewable – not a one yr contract, ongoing
Company – can terminate in accordance with treaty
Reinsurer can only terminate in accordance with treaty
Term – only mortality risk reinsured, policy can be any kind of ins (not just term)
YRT prems often bear no relation to prems of policy reinsured

Naar_pu(t) = Net Amount at risk per unit in force = DB_pu(t) – SolvRes_pu(t)
NAAR may by approximated as Death Ben Less cash value
YRT death benefits are percentage reinsured times NAAR.
The same reinsured % applies to every policy

YRT premium rates expressed as percentage of

a) company's mort. Table
b) std industry table

Trend – recently to increase number of risk classes

Most YRT treaties are administered quarterly or monthly

Shifts possible – on earnings, capital, revenue, assets and liabs from one co to another

Most commonly – stabilizes the co's mortality risk
Effect on Pattern of Earnings
YRT focus mort risk – therefore, difference in pattern affects incidence of earnings by pol yr
Reinsurance can be used to obtain funds at a lower cost.
Financing of strain occurs exactly when needed.
Reinsurer expertise vital – negotiating experience refund formula, reserving, new product pricing etc.
Purpose of exper refund=reinsurer returns portion of profits, if there is very favorable mortality experience (over significant period reinsurer allowed to accumulate past losses and net against current profits.

Calculations: Year	1	2	3
Reinsurance DB (t)	62.5	93.8	81.3
Result (t)	25.5	-5.8	6.8
Profit (t)	25.5	0	6 8
Loss(t)	0	5.8	0
Ineligible Profit(t)	0	0	6.1
Eligible Profit (t)	25 5	0	0.6
LCF (t) is 0 at t= 0	0	5.8	0.3
Experience Refund(t)	10.2	0	0.3

where Reins DB (t) = %*tot DB(t)

Profit(t) = Profit or loss in year t, equal Result(t)>0
Loss(t) = Loss in year t, equal (-1) * Result(t), if result(t)<0
LCF(t) = accum of past losses, net of inelig profits, at rate of 6.25%

Eligible Profit(t) = Portion of profit eligible for experience refund (profit in excess of accum past losses)

Experience Refund(t) = Experience Refund Payable in yr t = 40% * Eligible Prof(t)

Question #9

Compare the cost of yourlife.com to existing channels
    Cost per policy will vary by sales because some costs are fixed (e.g. monthly fee) and some are variable (e.g. top five)

Will yourlife.com reach a new customer segment?

How likely will Saturn be in the top five?
    What other companies are represented by yourlife.com?

What functions will yourlife.com do?
    Gather personal info?
    Take applications directly?

Will customers want to use a web site to buy insurance?
    Available 24 hours
    Do customers want a broker for advice?

How much control does Saturn have over yourlife.com?

Can the agreement be altered if necessary?

How good is yourlife.com as a company?
    Reputation
    How long has it existed

Will this cause conflict with the brokerage channel?

Question 10a

10a)

- Compare the field management compensation.
  - Agency Building Channel = ABC
  - Non-Agency Building Brokerage Channel = NABBC

- Evaluate any differences

	ABC	NABBC	VESTED
1. SALARY for (MANAGEMENT) [NOT AGENTS] - Is inconsistent with independent distributor philosophy of NABBC - Ties manager closer to company - Compensates for functions that don't lend themselves to incentive pay - No salary means less fixed costs for NABBC	YES	NO	-
2. FIRST YEAR OVERIDES	YES	YES	-
3. RENEWAL OVERRIDES - Represents an extra cost for NABBC relative to ABC, but may encourage better persistency	RARE	TYPICAL	
4. VESTING OF OVERRIDES		WIDE SPREAD	
5. SERVICE FEES		YES	NOT USUALLY
6. BONUSES			NOT USUALLY
7. EXPENSE ALLOWANCE / BUSINESS MANAGEMENT FACTOR (a) Company provides agency office and support (b) Generally, manager assumes all agency expenses in NABBC, Through new ones may receive home office subsidies. - So they generally run their office at lower cost than ABC companies	(a)	(b)	

	ABC	NABBC	VESTED
8. SHARING OF NEW AGENT FINANCING COST - Common in both systems but specific design will vary.	YES	YES	

10b)

Saturn Life has established itself within the marketplace as a high quality low cost provider.
Its primary market is affluent families, especially those which are not yet retired.
The company has been successful controlling costs to maintain a competitive term product line.
Its distribution systems have been growing. Mercury Life has a strong well-trained career agency system with plans to sell some insurance and annuities through banks.
Although the costs of brokerage channel is more variable, the career system is established and relatively successful.
There is a level of sales at which the fixed costs and variable costs of the two channels would be cost neutral. The agency system is relatively successful although it would be difficult, the two distribution channels should be combined into the career agency system. In this way the high costs of an agency system would be leveraged by the higher total sales.
The company would retain control of the sales force which also supports the agency system. Mercury's current sales force is highly productive and well trained so they could more easily get their SEC licenses and also adsorb the Saturn products.

Question 11

Consider the following items:
Age Nearest or Age Last Birthday – What approach is used to calculate the issue age of the policy?

Sex distribution, Smoking/Nonsmoking distribution

Underwriting standards – Liberal underwriting vs. strict underwriting. Types of tests performed – blood tests, urine, driving record, etc.
Need to analyze underwriting practices of both companies
Underwriting limits – blood test @ $100,000

Policy Size distribution

Marketing Methods – Direct Marketing usually has higher mortality experience.
Distribution Channels – Agency channels tend to have better mortality than other channels

Consider the credibility of the data

Need to confirm which of the following items were considered in calculating ratios – need to be consistent
ETI
RPU
GI business
Substandard
Joint-Life
Number of years to include – balance credibility vs. need for current data
Amount of insurance vs. policies as basis

Who bears the 'cost' of converted term policies?

Term policyholders or permanent policyholders

Anti-selection

Brokerage tends to shop around for best rates and are more lapse-sensitive because of that.

If the new company changes its underwriting guidelines, it must be reflected in structuring the mortality study

Saturn's term lapse have been increasing

Wealthy people usually have better mortality experience

Both companies target affluent market.

Reinsurance – retention levels, types of reinsurance, reinsurance rates, expense allowances

Question 12

I. Market Rate
- The rate that competitors are crediting
- Used to determine if the crediting rate is competitive and how likely policyholders are to lapse
- The group of competitors will likely be different between Saturn and Mercury.

II. Credited rate strategy
- All strategies key off one or more of the 3 following rates:
  - i) Fixed rate
  - ii) Earned rate less spread
  - iii) Market rate

- May be able to credit a lower rate for Saturn since the surrender charges are high and long
- Mercury credits new money rates whereas Saturn credits portfolio rates

III. Lapse rate function

- No excess lapses if credited rate is equal to market rate
- Different distribution channels will likely have different lapse patterns
- Saturn's brokers are more likely to replace policies than Mercury's captive agents
- The high surrender charges on Saturn's products should discourage lapses
- The shock lapses (after the SC period) will be at different times since SC period is 7 years fro Mercury and 14 years for Saturn
- Two-tiered annuities for Saturn help improve persistency
- Market value adjustment on Mercury's SPDA will discourage lapses when rates increase (not on Saturn's)
- Bailout provision on Saturn's product will increase lapses if rates drop below 5%

IV. Expense inflation

- Likely to have different maintenance expenses between the products.
- Commonly assume government bond less fixed %
- For high lapse scenarios, may need to ensure provision for overhead expenses is adequate

Mercury's approach for approximating Saturn's cashflows is not appropriate because there are some significant differences between the products.

Question 13

Part A

Risks:
- CEO pushes idea through in spite of negative market research
- Overestimating the market size - likely exists as CEO is making forecast
- Product is incorrectly positioned in market, not advertised effectively, or overpriced
- Product is not well designed
- Development costs are higher than expected
- Competition fights back harder than expected

- Difficult to get $50 MM sales; Mercury sales on $17 MM in 99; Need more market data

Part B

According to Cody,
- Be able to predict the effect of dividends of future changes in experience
- Be related to Stat and GAAP reserves
- Be equitable to all policyholder classes by reason of derivation from actual experience
- Consider all expenses and explicitly account for them or purposely leave them out
- Be related to the Analysis of Operations
- Take into account the amortization of issue expenses
- Any smoothing should preserve equity
- Investment Income factors should take into account any Investment Year Method, policy loans, & taxes
- should consider fixed or variable loan rates, & whether with or without direct recognition of policy loans
- All profits from non-par business and subs should be accounted for

Part C
- Company may not take unfair charge for profits to be paid to stockholders
- Consider limits on transfer of earnings & surplus from par policies
- Stockholders demand higher ROI than mutual companies

Part D

(I)
- SFAS 97 applies to Universal Life
- Cash values aren not fixed and guaranteed by the terms of the contract
- Premiums may be varied by the policyholder

(ii)
- Under SFAS 97, DAC is amortized using Estimated Gross Profits (EGPs)
- DAC(t) = DAC(t-1) * (1+I) - k * EGP(t) * (1+I)^ 5
- EGP(t) = Mortality Gain + Expense Gain + Interest Gain + Sureender Gain + other assessments (such as dividends)
  = (COI(t) - Claim Cost) + (Expense Load(t) - Expenses(t)) + (Investment Income - Interest Credited) + Surrender charges(t) + other
- EGP(t) = (18,475 - (5000 - 29368*(5000/2,500,000)/[1-5000/2,500,000*(1-.05)]) + (1500-1750) + (228-1200) + 1238 + 0 = 13,552
- DAC(1) = 43000*1.04 - 13,552*.5*1.04^.5 = 37,809

SFAS 97 Income Statement

Investment Income	Contract Charges	Total Revenue	Claim cost	Interest credited	Comm	Expenses	DAC Amort	Total Exp.	Net Income
228	21,213	21,441	4,938	1,200	2,000	1,750	5,191	15,079	6,362

Invested Assets	DAC	Benefit Reserve	GAAP Equity
19,250	37,809	29,368	27,691

GAAP Equity = Required Capital + Solvency Reserve - GAAP Benefit Reserve + DAC
GAAP Equity = 1,750 + 17,500 - 29,368 + 37,809 = 27,691
ROE = Net Income(t) / GAAP Equity (t)
ROE = 6,362 / 27,691 = 22 975%

(iii) 22.975% > 18%, so the ROE is acceptable

Part E

As a market challenger, Saturn needs to determine whether the company can penetrate this market.
To determine whether to enter this market segment Saturn needs to:

(1) Survey the market - talk to consumers & distributors regarding wants & needs.
(2) Analyze the sales objective proposed by the CEO using market research and concept testing
(3) Product Development Phase - produce product accordingly after profit analysis

Recommendation: Before developing the product, Saturn needs to do market research and profit testing based on achievable sales goal.

Question 14

i. Markup pricing
Add a standard markup to the product's cost
Viewed as being fair to customers and company
Doesn't consider competitor's prices
Price = Unit Cost / (1-Desired Return)

Target Return Pricing
Price is set to yield target ROI
Realize ROI if costs and sales turn out to be accurate
Price=Unit Cost + (invested Capital * Desired Return) / Unit Sales

Perceived Value
Charge a price that the consumer perceives is appropriate
Need market research to determine the market's perception of the product

Value Pricing
Set a low price for a high quality offering (i.e. rating)
Need to attract a large volume of consumers
Need to become a low cost producer

Going Rate Pricing
Charge the same price the competitor's charge

ii. Breakeven Volume

Markup Pricing

Variable cost = (underwriting per thousand + mortality per thou)
Variable cost = 20/thou + 4/thou = 24/thou
Fixed cost/unit sales = (administrative cost)/(sales * average size/thou) = (20,000)/(1000 * 5) = 4/thou
unit cost = variable cost + (fixed cost/unit sales) = 24/thou + 4/thou = 28/thou
Price = 28/(1-.0915) = 30.82/thou
Breakeven Volume = (fixed cost) / (price-variable cost) / (avg size/thou) = 20,000 / (30.82-24) / 5 = 587 policies

Target Return Pricing

Price = 28 + ((.0915 * 27,300)/(1000*5)) = 28.50/thou
Breakeven Volume = 20,000 / (30.82-24) / 5 = 889 policies

Difference in breakeven volume = 889-587 =302 policies

iii. Maintain Price
If you can keep market share due to strong brand awareness

May be able to regain market share later

Maintain price but improve the product

Reduce price – good strategy if:
Costs go down as volume increases
They keep market-share
Market-share would be difficult to regain later

Increase the price and improve the product

Launch a lower priced fighter line

Question 15

Minimum fare amount of $250,000 is too small. This product is sold in the estate market. With face amounts of $1,000,000 needed to make the product worthwhile.
No cash value is the best situation for the policyholder. The main feature is the death benefits no the cash value having no cash value means lower premiums, a plus in this market. However, no cash value may not be good for tax reasons. Will want to test impact of various cash values / premium levels in sensitivity testing.

Dual Status

a) More complicated to administer ⟶ need 3 sets of rates
b) Large jumps in reserves, CVS upon 1st death
c) I would change to individual, exact method

- Smooth values
- Allows for contagion to be incorporated easily
- Allows substandard inclusion
- Administrative cost probably the same

Auto Increases

I would change to incorporate increase.

- Index to CPI with overall max
- Adjust underwriting to incorporate
- Allow for increase in value to estate
- Make sure reinsurance can handle

Policy Split

a. if no explicit cost how will extra admin charges be accounted for?
b. Require re-underwriting or not? How to pay for
c. I would offer the split option for free if study shows that admin and antiselection costs are minimal and spread the cost among other policies, otherwise, I would charge for the option to those who want option (not to those who use option or all policyholders)
d. Make sure the sum of the face amounts is less than or equal to the original face amount.
e There could be some anti-selection, so limit to certain events such as divorce, business dissolution, or tax charges

Estate Preservation Rider

a) This is a low cost benefit due to low early duration deaths of both spouses. However, should still charge for it.
b) Double the benefit
c) Term up to 4 years: 3 yr. legal requirement plus 1 yr for sale and trust set-up

Sub standards

a) underwriting concessions ore made as long as one of the insured's is standard.
b) if one is standard and the other is substandard, they must be table D or better. Criteria should be changed to one insured being standard and the other table D or less.
c) Should include a small provision in the overall mortality rate ***if at least one insured is substandard***

Policy should not be issued at standard rates if one of the policyholders has a life expectancy of < 1 year. Considered to be uninsurable. If these uninsurable lines allowed, extra mortality cost must priced for.

Question 16

Step 1 Select the expected Experience Scenario and perform a valuation (exclude PAD)

- Base interest scenario should reflect current conditions of capital market as of valuation date
- Scenario should be best estimates of future experience
- Development of cash flows include premium, deaths, surrenders, dividends, COI charges and asset cash flows consistent with best estimates and base interest rate.

Step 2 Select margins for Non-interest rate risk

- Margins selected should ensure the resulting liability value is increased for every duration.
- Should take into account the interactions between assumptions

Step 3 Determine the Margin for Interest Rate Risk

- Run stochastic scenario tests. Solving for the initial assets producing zero surplus at the end of the projection.
- Determine the PADs from the results
  - If large number of scenario tested, Acceptable to use one standard deviation from mean
  - If small number of scenario tested or only 7 prescribed scenario tested, then use the PADs producing highest liability

Step 4 Take into account the Pass-through Produce Features

- Reduced PAD's if adverse experience can be passed to policyholders
- Should consider PREs and the willingness of the company to actually pass the costs

Finally, combine all of the above and perform a final valuation.

Question 17

1. Macauley Duration = $\frac{\sum tv^t Cashflow_t}{\sum v^t Cashflow_t}$

Modified Duration = $\frac{MacauleyDuration}{1+i}$

- Match duration of assets to Duration of liabilities so that small chances in interest will affect both equally
- Should consider convexity in case interest charges are large

Problems

- Rebalancing is necessary
- Assets change due to prepayments and defaults (cashflows)
- Liability cashflows

- It is possible to match duration, but not match cashflows

B.

t	$(1.05)^t$	CF_t	PV Cashflow	tPV Cashflow
.5	1.0247	60k	58,554	29,277
1.0	1.05	70k	66,667	66,667
1.5	1.0759	65k	60,413	145,125
2.0	1.1025	80k	72,562	145,125
2.5	1.1297	70k	61,962	154,905
3.0	1.1576	90k	77,745	233,236
			397,903	719,829

Macauley Duration = $\frac{719,829}{397,903} = 1.8091$

Modified duration = $\frac{1.8091}{1.05} = 1.7229$

Exact Matching

- Match asset and liability cash flows starting at the longest liability until are cash flows are matched

Problems:

- Liabilities may easily be over 30 years long, but asset may not be available
- Liabilities cashflows can very from those expected
- Assets can default or have prepayments

D $$\#\text{ of bonds} = \frac{AccountBalance - \sum_{t=1}^{n} coupon * \#bonds}{Coupon_t + Maturity_t}$$

Start at longest duration

$$\text{Bonds (year 3)} = \frac{90{,}000}{1000 + \frac{.065}{2}(1000)} = 87.167$$

$$\text{Bonds (year 2 ½)} = \frac{70{,}000 - 87.167\left(\frac{.065}{2}(1000)\right)}{1000 + \frac{.06}{2}(1000)} = 65.211$$

$$\text{Bonds (year 2)} = \frac{80{,}000 - 87.167\left(\frac{.065}{2}(1000)\right) - 65.211\left(\frac{.06}{2}(1000)\right)}{1000 + \frac{.055}{2}(1000)} = \boxed{73.198}$$

E Horizon Matching

- Combination of exact matching and duration matching
- During the 1st year, use exact matching, followed by duration matching
- After several years, later cashflows are exactly matched
- Not needed for this situation as the liabilities are short in duration... Exact matching would work fine