Introductory Statement on Guidance for Candidates in Responding to Written Answer Questions

- The illustrative solutions are real model solutions, as opposed to an edited best paper. They are intended to show all the main points of a complete answer and the type of details the graders are looking for. Please note that these model solutions may be more complete than what would be expected under exam conditions.

- Answer the question that's asked, don't just do a brain dump on the topic; often when you do, the requested answer doesn't get included. You will not receive points for providing extraneous information that does not answer the question.

- You are expected to be able to apply the material contained in the course of reading. On the exam, you may need to apply the material from a reading to the case study or to another reading. Additionally, you should be able to do relevant calculations even if there are not sample calculations in the material.

- Where you are asked to make a recommendation and justify it, do so. Don't just list advantages and disadvantages of the possible alternatives. Choose one of the positions and support your selection. Please note that sometimes more than one answer can be correct. In those cases we are testing your ability to apply your knowledge to reach a reasonable conclusion.

- Sometimes there may be alternative approaches to answering a question. In these cases credit is given for any approach that is appropriate.

- There is a guideline to allow 3 minutes per question point. For higher order questions this time includes time to read the question and formulate an answer as well as time to write the answer. However, this also means that a one-sentence answer is not a complete answer to a question worth several points.

- The verbs in the questions are chosen for a reason. For example, "list" can be answered with a bulleted list. "Describe" looks for some details about the items. "Explain" expects some discussion of how or why. "Analyze" asks for a more in-depth analysis of the information.

Solution 1

(a)

use duration or convexity to calculate the effect of interest rates changes
could also do stochastic modeling
Macaulay duration = sum ($t \times v^t \times CF(t)$) / sum ($v^t \times CF(t)$)
modified duration = - d (PV CF(I) / di) / PV CF(I)
modified duration = macaulay duration /(1+ i)
few companies use terms beyond duration and convexity

(b)

By matching assets and liabilities, a company can reduce financial effect of changes in interest rates

Exact matching
Calculate liability cash flows and exact match with asset cash flows
Work your way back from last liability cash flow to the first liability cash flow
Must rebalance if asset or liability cash flows deviate from expected
Very difficult to achieve and maintain exact matching
There may not be assets long enough for the longest liabilities

Duration matching
Match the asset duration to the liability duration
More common than exact matching
Must rebalance periodically
Duration works well for small interest rates changes

Horizon matching
Blend of exact matching and duration matching
Cash flow match the early cash flows (eg 5 years)
Duration match cashflows after that

(c)

If disintermediation risk is the greater risk, then the asset duration should be less than the liability duration
If reinvestment risk is the greater risk, then the asset duration should match the liability duration

Solution 2

(a)

i) Historical Results

- VA's are one of core products
- Steady Increase in Annuity Premium
- Meet expected mortality on deferred annuities
- Problem with increasing lapse trend
- Target market is affluent & pre-retired
- After tax ROE of 20% for VA's

ii) Strengths

- Favorable name recognition with affluent, good reputation low cost provider.
- Already in variable market, this is just an extension of primary/core product.
- Strong brokerage distribution.

iii) Weaknesses

- Not known for investment advice.
- Trouble with unfavorable unit expense trends.

(b)

Single and/or joint life
Mortality & expense charges – greatest source of profit
Policy Fee – explicit recovery of acquisition expenses
Pricing measures – ROI, profit Margin, breakeven year
Mortality – must have improvement factor, sex distinct, based on known or assumed characteristics, reflecting realistic death rates,
Expenses – covering future servicing cost, may have inflation factor
Commissions – typically front-end load, generally 2-4% at issue
Premium taxes – typically front-end load
Reserves – PV of payments @ statutory valuation rate & mortality
Surplus Strain

(c) Stochastic Modeling
Stochastic modeling allows you to estimate how frequently the guarantee will come into play and what the average cost is.

Risk structure of guarantee has small cost in most cases and very large in cases where it hits.

Solution 2 (continued)

Results will be volatile with sensitivity to underlying yield assumption, issue age, market volatility and benefit provisions

Step1: Select a distribution function
Step 2: Choose a random number generator
Step 3: Generate stochastic sets of investment returns
Step 4: Calculate results for each set of investment returns
Some assumptions may be adjusted dynamically

Summarize stochastic results
Organized sequentially
By percentile
Graphed to see range of results

The presentation of stochastic modeling results can be more complex than presenting deterministic model results. Some additional thought is required to help resent the results clearly.

(d)

$Payment_t = Payment_{t-1}*(1+NIF_t)/(1+AIR)$ or
$AnnUV_t = AnnUV_{t-1}*(1+NIF_t)/(1+AIR)$

$NIF_t = AccUV_t/AnnUV_{t-1}$

The initial payment is calculated based on the AIR.

High AIR will have high initial payments that will drop faster than AIR if NIF is low and rise slower if NIF is high. Low AIR will have opposite effect. Payment stream reflects relation ship between actual NIF's and AIR.

Table with no floor

Year	3% AIR	5% AIR
2	1,904	1,938
3	1,922	1,920
4	1,978	1,938
5	2,074	1,993

Solution 2 (continued)

1,904 = 2,120 * 0.925/1.03
1,922 = 1,904 * 1.04/1.03
1,978 = 1,922 * 1.06/1.03
2,074 = 1,978 * 1.08/1.03

1,938 = 2,200 * 0.925/1.05
1,920 = 1,938 * 1.04/1.05
1,938 = 1,920 * 1.06/1.05
1,993 = 1,938 * 1.08/1.05

Table with floor

Floor = 1,908 for AIR 3% or 1,980 for AIR 5%
Simply replace payment less than floor with floor payment. The floor does NOT become the payment for calculating the next payment. The unfloored payment is used for that purpose.

Year	3% AIR	5% AIR
2	1,908	1,980
3	1,922	1,980
4	1,978	1,980
5	2,074	1,993

When designing a payment floor, the company should recognize that the cost of the floor increases as the AIR increases. This means that any charge for the benefit should rise as the AIR increases or the level of the guarantee should decrease as the AIR increases. Additionally, the company may want to limit an individual choice of AIR.

Solution 3

(a) Personal History

maximum total cholesterol level is appropriate
maximum blood pressure is consistent with market practice
should not allow people with diabetes to qualify as preferred

Lifestyle

tobacco use rule is restrictive, should reduce requirement to 12 or 24 months
maximum number of moving violations is appropriate for preferred NS, may want to
reduce number of violations to 0 or 1 for super preferred NS
regular exercise - may not be appropriate due to verification problems

Family History

may be used less often than personal history -- need to remain aware of validation problems
family history heart disease death prior to age 65 - consistent with market standard
family history cancer death prior to age 70 - may not be appropriate, depends on type of cancer
may also want to consider total chol/HDL ratio, DUI, stroke, avocation

(b) q (Pref - 3 class) = .38 * 1.56 = .593

q (Super Pref - 4 class) = (1 - discount) * q (Pref - 3 class) = .95 * .593 = .563

q (Pref - 4 class) = [(q (Pref - 3 class) - (q (Super Pref - 4 class) * % Qualifying)]/(1 - % Qualifying) = [.593 - (.563 * .35)]/(1-.35) = .609

(c) To determine the amount of mortality discount

- aggregate mortality table
- screening tools
- strictness & criteria used to qualify
- company practice regarding underwriting exceptions
- % of applicants whom would qualify for preferred class

To determine the % Qualifying

- decide range based on rate & determine underwriting criteria
- the lower the assumption, the lower the rate, but agents/clients may be dissatisfied

Solution 3 (continued)

- more underwriting exceptions & higher not taken rates
- the higher the assumption, less complaints, more qualifying
- number of applying for preferred exceeds expectations due to agent reaction
- Actual to expected may differ due to:
  - producer's client base
  - underwriting criteria different from competition
  - underwriting concessions

Solution 4

(a) The actuarial contribution should be calculated by a practical method. The considerations include:

1. Historical contributions
   - Need to accumulate the historical contribution by historical after-tax investment rates on surplus
   - Accumulation must be consistent with way surplus generated in a given line
2. Future contributions
   - Need to determine the interest rate used
   - Interest rate can be either
     - Anticipated after-tax interest rates
     - Risk-adjusted discount rate for different line of business
   - Rate should be consistent with projections of future contributions to surplus
3. Non-par lines
   - Need to consider whether to include non-par earnings in the calculation of actuarial contribution
4. Equitable
   - Interpolation may be used to calculate for policies within line of business
   - All eligible policies should be included
5. Acquisition
   - For block of business acquired by the company, the acquisition cost should be allocated to that block (a negative contribution) before calculating actuarial contribution
6. Merger
   - Should consider contribution made by policyholders before merger
7. Reinsurance
   - Risk reinsurance should be included in the calculation of actuarial contribution
   - Financial reinsurance should be ignored
8. Data
   - Use historical and current data
   - Some historical data may not be available
   - Approximations may be required

(b)

Positive contribution:

- The variable component of the consideration is allocated by certain criteria (such as face amount, premium, policy count)

Solution 4 (continued)

Negative contribution

- For single policies, the negative contribution should be set to zero before allocating consideration
- For multiple policies (e.g. base + multiple riders), either
  - The individual negative contribution set to zero and then sum the total
  - Sum the total first and set to zero if the total is negative
- For classes of business, either
  - Set the negative contribution of individual policies with the classes equal to zero (positive contribution can still receive consideration)
  - Set the whole class equal to zero

(c)

Method 1: Set individual negative component = 0

Product	Base Contribution	Rider Contribution	Total Contribution	Contribution %	Fixed Allocation	Variable Allocation	Total Allocation of shares
A	50	0	50	50%	5*1M =5 million	(100-20)*0.5 =40 million	45 million
B	0	25	25	25%	5*1M =5 million	(100-20)*0.25 =20 million	25 million
C	0	0	0	0%	5*1M =5 million	(100-20)*0 =0	5 million
D	15	10	25	25%	5*1M =5 million	(100-20)*0.25 =20 million	25 million

Solution 4 (continued)

Method 2: Sum total and set to zero if negative

Product	Base Contribution	Rider Contribution	Total Contribution	Contrib'n %	Fixed Allocation	Variable Allocation	Total Allocation of shares
A	50	-25	25	50%	5*1M =5 million	(100-20)*0.5 =40 million	45 million
B	-25	25	0	0%	5*1M =5 million	(100-20)*0 =0	5 million
C	-25	0	-25 (set to 0)	0%	5*1M =5 million	(100-20)*0 =0	5 million
D	15	10	25	50%	5*1M =5 million	(100-20)*0.5 =40 million	45 million

Solution 5

(a)

- Cost Driven Pricing where Price = cost + margin
- Competition, distribution and other factors are not aligned to support the Cost Driven Pricing approach
- Competition Driven Pricing - bases its price on the competitors prices and desired marketing hierarchy
- Flexible Pricing or variable pricing uses competitive bidding or a negotiated contract in a group insurance setting
- Penetration Pricing - charges a low price to build market share and sales
- This is not a flexible or variable pricing situation since there is not bidding, negotiating or group sales
- Penetration Pricing fits this situations competitive pressures and market research information. It should be used to explore the resulting profit, revenue and market share trade offs.
- Customer Driven Pricing - focuses on setting a price acceptable to the customer or distributor
- Focus can be on raising commissions to encourage sales
- Focus can be on improving product value such as payout rates or claims paying ability
- Psychological Pricing - customers find certain price ranges more appealing than others
- Price Skimming - sets price at highest possible initially at product launch while demand is high
- Promotional Pricing - sets prices lower to possibly create demand on other products
- Price Skimming is rarely if ever used in Insurance.
- Promotional Pricing could be done at commonly quoted prices such as 65 to stimulate activity at other ages however the commodity and large investment nature of the product makes this unlikely to have significant success

(b)

ProdCashFlow(t) = Prem(t) - Ben(t) - Exp(t) = 50-6.6-6.4 = 37

PreTax Solv Earn(t) = Prod CashFlow(t) + InvInc(t) - (SolvRes(t) - SovRes(t-1))
= 37+13.7-(198-150) = 2.7

AfterTax Solv Earn(t) = PreTaxSolvEarn(t) x(1-TaxRate(t)) = 2.7*(1-.40)= 1.62

DistEarn(t) = AfterTaxSolvEarn(t) - (ReqCap(t) - ReqCap(t-1))
+ InvIncReqCap(t)x(1-TaxRate(t))
= 1.62 - (2.95-1.5) +.2*(1-.40) = .29

Solution 6

(a)

Comparison of equity indexed annuity versus a conventional FPDA

(i) Advantages:

- Equity index allows participation in equity market so upside potential without downside risk
- Attractive to conservative customer that wants higher return

Disadvantages:

- More complicated for policy holder to understand
- May have to be registered with the SEC
- Risk that options are not properly hedged

Comparison of equity indexed annuity versus a variable annuity

(ii) Advantages

- Variable annuity has downside risk that may be unlimited but equity indexed annuity is floored at nonforfeiture value
- May not have to register with the SEC

Disadvantages:

- Policyholder does not get full participation in the equity index
- Insurance company does not pass full risk to policyholder.
- Risk that options are not properly hedged

(b)

Minimum interest guarantee

- Typical industry standard

Participation

- Standard industry range is between 75% and 100%
- 85% is appropriate
- There is a trade-off between participation rate and hedging costs

Equity index formula

- Expensive formula for the company
- Harder to hedge because requires path-dependent options
- Recommend using an average of the index over the final 6 to 24 months

Solution 6 (continued)

Equity index

- Using the DJIA is probably a bad idea because of liquidity
- Recommend using the S&P 500 because of recognition, credibility, and high trading activity

Investment strategy

- OTC is specialty market for customized hedges so it's costly
- If use average formula, could buy exchange traded options

Investment hedge administration

- Hedging weekly can be expensive, recommend hedging monthly or
- Use threshold approach, only buy once a certain threshold is reached (e.g. $X in premium)
- Set up a master contract and append additional transactions to reduce costs

Solution 7

(a)

FAS 91 – investment contract accounting
GAAP Reserve = PV future cash flows discounted at assumed crediting rate

- DAC is calculated based on the difference of account value on assumed crediting rate and value calculated at the breakeven rate considering deferrable expenses.
- No Pads
- Values locked in

Stat Reserve – CARVM

- present value of benefits
- discount rates specified by regulation
- locked in

adequacy can be assessed with cash flow testing

- usually use stochastic modeling
- focus on C-3 risks, reinvestment risk
- consider assets matching liabilities
- what are modeling assumptions for assets (eg consider defaults)
- GPV might also be used

(b)

- use FAS 91 type of accounting as there is no life contingency
- the premium is not considered as revenue
- it is treated as a deposit and does not enter into the income statement
- benefit payments do not appear on the income statement
- it is treated as a release of deposit
- the commission is deferred and amortized
- amortization is an adjustment to the spread
- earnings come from the investment spread so earnings will not be level
- will fluctuate with the actual investment income realized
- loss recognition testing is not done.

(c)

Advantages of modco financial reinsurance

- No transfer of assets at inception
- ABC controls investment policy
- No issue of whether reserve credit should be taken (if reinsurer not licensed in ABC's state of domicile)
- ABC faces reduced counterparty risk

Solution 7 (continued)

- Reinsurer effectively deducts entire reserve increases, even if the reserve is not deductible

Disadvantages of modco financial reinsurance

- Asset transfer at termination of contract exposes ABC to potential capital loss
- More complicated to administer than coinsurance because of modco adjustment

Financial implications

- proportional sharing of premium, benefits, 1st year expense allowance and reserve increase provides some surplus relief
- reinsurance receivable asset may be required

Solution 8

(a) Weighted average market attractiveness score is:

25% * 3 + 25% * 5 + 50% * 2 = 3 => MEDIUM

Weighted average business strength score is:

60% * 4 + 20% * 4 + 20% * 5 = 4.2 => STRONG

Plotting the two averages onto the matrix, we get the following:

		Business Strength		
		Strong	Average	Weak
Market Attractiveness	High	A	A	B
	Medium	A	B	C
	Low	B	C	C

The zones labeled 'A' represent good opportunities. Therefore, Saturn should proceed with the entry into the reinsurance market.

(b) (i) Saturn's ART product:

- increasing premiums – healthy lives will lapse when increase becomes too high & will seek cheaper coverage elsewhere => mortality will worsen
- preferred underwriting classes and very strict rules (no u/w exceptions) will keep mortality down
- distribution channel – mortality tends to be higher for brokers & direct response
- affluent target market => better mortality

Mercury's UL product:

- distribution channel – exclusive agency system => better mortality
- target market – older buyers (pre-retired / retired) => avg. age will be higher and mortality slightly higher

Solution 8 (continued)

- affluent target market => better mortality
- average policy size = $125k => larger face amounts have better mortality
- no preferred u/w and poor monitoring of u/w criteria => worse mortality

(ii) It would not be appropriate to use Saturn's ART product pricing mortality assumption to price YRT reinsurance on Mercury's UL product.

- although both companies target affluent people, Saturn's mortality experience is based on younger population than Mercury's
- Saturn has strict u/w criteria and reviews them frequently; Mercury's criteria is loose and hasn't been reviewed recently
- Saturn has preferred u/w classes; Mercury does not
- Saturn's ART mortality will show deterioration in later durations due to selective lapsation from premium increases; not an issue for Mercury's UL
- distribution channels are different – broker/direct for Saturn (higher mortality); agency force for Mercury (lower mortality)

There are too many difference in mortality drivers between the two company's expected experience – should not use ART pricing mortality to price the reinsurance.

(c) Canadian GAAP valuation assumptions:

- Canadian financial reporting is same for GAAP and solvency
- mortality should be based on best estimate assumption with a PAD
- if pricing assumption is same as best estimate, then pricing assumption OK to use.
- should not include mortality improvement beyond valuation date
- 3% margin => need more information to determine if appropriate
- standard range for MfAD is $3.75/e_x$ to $15/e_x$ per thousand
- Since product (YRT reinsurance) is new to Saturn, a higher margin is necessary
- Locking in of assumptions is not permitted under Canadian GAAP

Conclusion: there are too many issues with the proposed best estimate assumption and MfAD to be used in Canadian GAAP valuation.

Solution 9

(a)

Description of the product features

i. Insurance company can only increase the premium when an external event occurs e.g. an increase in treasury rates. Insurer does not have unrestricted right to increase premium.
ii. Policyholder can get a refund of premium when premium is increased and the policy is cancelled.
iii. Policyholder is protected against premium increase due to guarantee provided by affiliated company
iv. Gross premiums are set relatively high, however the contract includes guaranteed cash values, dividends, or premium refund over a period of time.
v. Policyholder has right to enter into new plan with little or no underwriting and select rates

(b)

Explanation of how product features are affected by AXXX.

i. Reserve determined assuming premium is guaranteed for entire period
ii. Reserve determined assuming no refund
iii. Combined reserve over two companies must be at least as great as if the policy were guaranteed by single company.
iv. Premiums used in valuation should be net of policy guarantees
v. Treat initial and re-entry periods as one for reserve calculation assuming original issue age and issue date.

Solution 10

(a)

General guidelines for performing an audit

- personal integrity
- courtesy
- clear understanding of the person requesting the audit
- plan audit in advance
- use sampling principles to test
- identify and communicate a key auditor and key auditee
- item "checking to" should be obtained
- test all links in the audit trail
- write an audit report

(b)

Items to highlight in the workplan

- spot checks
  - test inventory
  - test calculations
- independent full recalculations
- aggregate progress of reserves from one period to the next
- tests of relationships of reserve items to other financial items

(c)

Assessment of the PAD

- PAD should add conservatism
- Non par has higher PAD than par
- Data not as credible
- Use of inter-company experience increases PAD
- PAD should increase over the Flagship product assumptions
- DACs should increase with higher PAD

Solution 11

(a) Internal and external constraints:

Systems – Computer and administrative systems might have to be modified or replaced
Competition – will have to be competitive with other companies offering similar product/if not competitive will not get sales
Surplus – XYZ may not have enough to place a lot of new business and cover cost of developing a new product
Tradition – employees and field force may resist change to new product
Expertise – XYZ may not have the people to be able to develop/administer and sell the new product
Legal –new product must comply with legal requirements / model regulations
Economy/Interest Environment - will impact the product and sales

(b) Product characteristics that distinguish Fixed Premium UL from Flexible Premium UL.

- fixed premium requirement
- may have vanish premium option
- under the vanish option premiums no longer are paid if the actual C.V. > min. guar. C.V.
- or premiums no longer are paid if the actual C.V. exceeds current rate net single premium
- accumulation account may be annual vs monthly
- min guar set of benefits and cash values
- have to determine if commissions paid on vanish premiums
- may have a low premium version where guaranteed death benefits drop after a period of years
- may have option to pay a higher premium instead of having the death benefit proportionately reduce

(c)

Model Reg Min Cash Value=A-B-C-D
A is p.v. future guaranteed benefits
B is p.v. future adjusted premiums at guaranteed interest and mortality
C=D=0 for this example
P^a=Adjusted Premium

Solution 11 (continued)

P^a=p.v. of future guar benefits from issue
plus .01 times either amount of ins if uniform, or avg amount of ins first 10 policy yrs
plus 1.25 times the smaller of (Nonforfeiture net level prem, .04 times amnt of ins or avg amount of ins first 10 policy yrs)
all divided by annuity of 1 per year from issue at guar int and mort
Nonforfeiture net level prem=pv of guar benefits at issue/annuity of 1 per year from issue using guar. interest and guar. mortality

Current 5th year cash value:
${}_5CV_{35}$=current fund issue age 35 duration 5 –surrender charge factor for issue age 35 duration 5*annual premium
${}_5CV_{35}$=6396-1.25*1200
${}_5CV_{35}$=4896

Nonforfeiture net level = 21620/18.2 =$1187.912
P^a=(21620 + (.01*100000) + 1.25 (smaller of .04*100000 and 1187.912))/18.2
=24,105/18.2=1324.45
Model Reg Min Cash Value= 25908 - 1324.45*17.21=3114

The 5th year current cash value complies with the UL Model Reg., since the current 5th year cash surrender value of $4896 is greater than the UL Model Reg. Cash Value of $3114

(d) Benefits of Reinsurance
- reduces the need for outside capital/ provides surplus relief
- transfers risk/reduces risk
- may allow XYZ to write more new business
- may have lower cost
- can be arranged quickly
- access to capital as needed
- most flexible tool co has for managing financial position/used to smooth earnings
- can be designed to have beneficial effect on taxes

Surplus Notes
- rating agencies may view surplus notes as debt
- coupon and maturity payments subject to ongoing approval of insurance regulators
- if insurance regulators prevent payment of coupon/maturity payments XYZ not in default

Solution 12

(a)

Should Consider:

- Company Resources
- Product Variability
- Market Variability
- Stage in Product Life Cycle

i) Undifferentiated Marketing

- Uses the same marketing strategy for the entire market
- This approach offers the lowest cost
- Not appropriate for a sophisticated product like UL

ii) Concentrated Marketing

- Would work well because company is selling only one product
- Works better for new products
- Would be a good choice because the US insurance market is very diverse

iii) Differentiated Marketing

- Uses different marketing tactics for different segments
- Good for sophisticated product like UL, and diverse US market
- But expensive, and not needed as company is selling only one product
- Also, Undifferentiated and Concentrated are better suited for a new product

Overall, concentrated marketing strategy would be best suited for this company to market the product.

(b)

COI Charges:

- Level COI charges will result in prefunding of future mortality costs
- Should switch to a YRT type scale

Policy Charge:

- $60 charge is within the normal range and is OK

Solution 12 (continued)

Investment Options:
- US market is used to more funds
- Should add additional options
- In US – if offer equity funds must register with SEC. Need to remove the funds if want to avoid SEC registration.

Minimum DB:
- 75% is typical in Canada. With min DB, avoid securities regulation.
- For US market, should increase DB to 100% of premium – this is more common.

Surrender Charges:
- OK, but in US need to check that they comply with nonforfeiture laws.

Bonus:
- Some states don't allow persistency bonuses
- Eliminate the bonus to avoid this issue.

(c)

Factors to consider when setting future premium assumptions under CALM
- Historical premium payment patterns
- Method of premium payment
- Sophistication of policyholder
- Interest rate scenarios
- Distribution system and other marketing practices
- Policy duration or attained age
- Liability cashflows should consider assumptions about policyholder behavior
- If competitive market rates are higher, policyholders are more likely to stop premium payments
- More sophisticated policyholders will base premium pattern on investment returns of the product

Solution 13

(a)

Refer to the market share/ market growth matrix with stars, dogs, cash cows and question marks.
OWI with high market share, negative market growth = a cash cow
Mercury Life with low market share and growing market = a question mark.
If Mercury seen as low growth then could be considered a dog

Primary role of a cash cow is to provide income
Hold strategy can be used for a cash cow. Goal is to maintain market position
Harvest strategy can be used for a cash cow. Maximize income and allow market share to decline.

Question marks have high growth potential. They need more investment than they can self-generate in the short term.
Build strategy can be used for question marks
Sacrifice short term earnings to increase market share
A harvest strategy may be considered with question marks.

Dogs – harvest strategy or withdrawal strategies are appropriate.
Dogs are unlikely to become profitable

(b)

Positive considerations for OWI policyholders

- Lower premiums
- Flexibility
- More appropriate products and features
- Evaluate members needs

Negative considerations for OWI policyholders

- High acquisition costs
- Higher premiums relating to poorer health and higher attained age in the group
- Loss of existing cash value
- New suicide and contestable provisions
- Tax liabilities when existing policies end.

Solution 13 (continued)

(c)

- similar product needs and preferences – OWC members purchase insurance through the club
- distinguishable needs and behaviors from other groups – older and smaller face amounts
- potential sales, costs and profits are big enough to be measured
- Potential profit is high enough – it is not clear if the membership is large enough
- Accessible through available distribution channels – not certain that members will respond favorably to Mercury Life.
- Stable size and composition – OWC membership is declining
- Segmentation is measurable and observable – OWC membership is easily identified

(d) Possible actions to consider.

1. Make no changes
   Mercury Life currently uses an agency building operation
   Traditional agency system is too expensive in markets where the average face amount is small
   Direct marketing can offer more economical approaches to learning about and purchasing insurance
   Direct marketing is an easy way to reach members of special interest groups
   It would be easy to design direct mail targeted to Old World Club members
   Old World Clubs of the USA has endorsed Mercury Life and is likely to allow use of its mailing list
   Specialty markets can be neglected if they are not recognized in the marketing organization
   Existing approach has achieved excellent penetration

2. Use Mercury Life's distribution system
   Mercury Life currently uses an agency building operation
   Studies show that most consumers desire an agent's advice and guidance
   Because Old World Club members are clustered in specific cities, it would be convenient to serve them with agents
   Existing policyholders are prime sources for future purchases
   It is not clear that the OWI business is large or promising enough to support its own distribution system

Solution 13 (continued)

3. Keep some of OWI's methods, but with Mercury Life agents performing certain functions
   Ex: Mercury Life agents could to informational programs at Old World Club meetings
   This would create multiple face-to-face sales situations for the agent
   The agent can fully explain the product options and answer questions
   Ex: Mercury life agents could do telephone contacts
   This would create fresh "door-opener" conversations
   Agent involvement can improve persistency

Solution 14

Learning Objectives: Understanding that in product design you also need to take into consideration the nonforfeiture

Cognitive Skill: Analysis

(a) Assess the appropriateness of this annuity design with respect to the Standard Nonforfeiture Law, and identify any necessary changes.

- Minimum Nonforfeiture = Net considerations accumulated less withdrawals less $50 annual contract fee less indebtedness to company less service charges assessed less premium tax paid by company.
- Minimum Nonforfeiture Interest Rate = Min of 3% or Max (1%, 5 Year Maturity Treasury Rate – 1.25%). Although the current 3% interest rate satisfies the SNL, a rate lower than 3% may be specified which still satisfies the law.
- Surrender charge is too high in first few years because valuation net premium is less than 87.5% of gross premium suggesting that the surrender charges should be < = 12.5% per annum.
- Annual contract charge of $100 exceeds the $50 annual charge allowable under SNL.
- Cash Surrender Value must be greater than minimum nonforfeiture value or paid-up annuity benefits must not be less than the minimum nonforfeiture amount at the time of surrender.
- With no death benefit in the deferral period, need to state this prominently in the contract.
- Providing a return of principal in the first contract year satisfies the minimum surrender charge in year 1.

(b) Evaluate the proposed product design.

- Surrender Charge:
  a. This is high and violates the SNL.
  b. Typically, surrender charges are calculated as a percentage of premium (i.e. 10% of premium) and then grade to 0% over time.
- Waiving of Surrender Charges:
  a. Is a standard feature and should be continued.
  b. Make sure the annuity is priced to accommodate this.

Solution 14 (continued)

- No bailout or medical bailout:
  a. Should consider adding both a bailout and a medical bailout provision.
  b. Due to the age of those who purchase annuities, the medical bailout adds little additional cost but is valued highly in the market.
- Return of principal guaranteed in 1st year:
  a. This provision is good in the case of ABC's policy and generally is only applicable during the first year.
  b. Will result in increased reserves.
  c. Need to make sure agents don't churn the business, so ensure the commission is charged back at time of surrender.
- No death benefit at time of surrender:
  a. This is unusual.
  b. Need to provide a death benefit for competitive reasons.
  c. The death benefit is usually set equal to the account value of the annuity.
- 2% annuitization bonus:
  a. The 2% bonus is an acceptable feature as it enhances persistency.
  b. This bonus is designed to reflect the savings relating to expenses and commissions.
  c. It is more common to provide a bonus in the 2% to 10% range.

Solution 15

(a)

(i) Transition Probability Approach
- with investment department –develop a universe of yield curves C_i
- develop matrix of probabilities of going from curve C_i to C_j
- start with current yield curve

(ii) Successive Ratios Model
- ratio of successive yield rates (Y_{n+1}/Y_n) assumed lognormally distributed
- need correlation factor between short term and long term rates
- create bivariate dist. with that correlation factor

(b) Categories of risk Mercury faces on UL product

Pricing Risks (C-2)
- mortality worsens (epidemic)
- higher lapses than expected
- higher expenses (inflation)
- average size distribution different than priced for

Credit Risks (C-1)
- assets default or decrease in value
- increased risk in current conditions

Interest Rate Risk (C-3)
- high rates lead to surrenders –need to sell assets at reduced values
  - disintermediation
- low rates – mean fewer surrenders
- assets may need to renew at lower rates
  - reinvestment risk (larger concern in current conditions)

Problems with agencies may result in lower sales than planned for

Government legislation may make product unattractive

Solution 15 (continued)

(c)

Type	% of Mercury Assets	Default Risk	Prepayment/Call Risk	
Gov't Bonds	10	no	no	-but lower yield
Corporate Bonds	40	yes	usually	-depends on quality
High Yield Bonds	10	high	antiselection	-risk higher in current environment
Mortgages	10	yes	yes	-especially since low rates
CMBS	10	no	no	
CMOs	5	yes	yes	
Policy Loans	10	no	no	
Cash and Short Term	5	no	no	
Real Estate	0			
Stocks	0			

Solution 16

(a)

Product Development Process Steps

1. Product Planning
   - Product Development Team reviews product mix, strategies
   - Engage in
     i. Idea Generation – collect ideas
     ii. Screening – quick evaluation of ides with check lists and/or concept testing.

2. Comprehensive Business Analysis
   - Market Analysis
   - Product Design Objectives
   - Feasibility Test
   - Marketing Plan
   - Preliminary Sales Forecast.

3. Technical Design
   - Product Form
   - Product rates and pricing
   - Set schedules
   - Set budgets

4. Product Implementation
   - Product Regulatory Filings
   - Prepare Training and Sales material
   - Develop system and administration processes
   - Promote product

5. Sales Monitor and Review
   - Compare actual and planned results
   - May need to modify product or withdraw if necessary

Solution 16 (continued)

(b) Screening is a quick "weeding out" process.

Screen	Assessment of Mercury
Initiative fits company objectives?	Yes, company wants to enter bank channel
Is it costly to implement?	No, low cost product and distribution
Does market need product?	Big potential new market, few sales today
Do systems have to change?	Product exists today, should be cheap changes
Fit with other products?	Product exists, may need minor changes
Fit with channel?	May create channel conflict if not careful
Will product displace existing sales?	No, this is a new market
Can company quickly develop expertise in this channel?	Don't know, however this is a major risk of the project.

(c) Factors for Mercury to consider when relying on industry mortality tables;

- What is the company's underwriting criteria relative to industry?
- What is the company's criteria for preferred classes?
- What distribution channel?
  - Agents usually have higher quality business, is bank business brokerage?
- What is the target market?
  - Wealthy tend to be healthier, is this the bank customer profile?
- Selective Lapsation?
  - Concern with term product
- Reinsurance quotes on the business?

(d) Please note that the heading for the chart should read "Mortality Rates (qx)". The additional wording of Per Thousand Lives In Force is not required for this solution.

- because the rates are significantly different must calculate rates with survival tables
- calculate survivorship on each basis (qx (1-qx))
- for 1000 lives these are (900, 630, 315, 94.5) and (800,400,120, 12) respectively

Solution 16 (continued)

- weight survivors 50/50 (850, 515, 217.5, 53.3)
- 1 - survivor ship rates for qx (1-850/1000, 1-515/850 etc)
- mortality rates (.15, .39, .58, .76, 1.0)
- where tables are dramatically different, rates at higher ages will be lower than straight average

Solution 17

Value Based Earnings = Economic Value (t) – EV(t+1)
+ actual current period distributable earnings(t)

Where EV(t) = EV (t-1) * (1+ hurdle rate) – DE (t)

Expected DE (t) = Premium + Investment Income – Benefits – Commission
– Expected Maintenance Expense – Increase in Reserve

Actual DE (t) = same as above
but replace expected Maintenance Expense with actual

Premium = 3000x1000+30x1000=3,030,000
Inv Income = 900,000
Benefits = 3,000,000
Commission = 3030000x15%=454,500
Expected Maint Expense = 10x1000+5%x3030000=161,500
Actual Maint Expense = 12x1000+6%x3030000=193,800

Expected DE = -1,686,000

Actual DE = -1,718,300

Expected EV(2002) = 10,000,000 * (1.1) – -1,686,000 = 12,686,000

Must adjust for the Change in PV Maint Expenses

2002 Expected PV (maint exp) = 2001 Expected PV (maint exp)x1.1–expected maint exp
= 2,000,000 x 1.1 – 161,500
= 2,038,500

Increase in actual PV Maint Exp = 2,038,500 x 193,800/161,500 = 407,700

Actual EV (2002) = Expected EV (2002)- 407,700
= 12,278,300

Value Based Earnings (2002) = EV(t) – EV(t-1) + actual DE(t)
= 12,278,300 – 10,000,000 + -1,718,300
= 1,560,000