ILA LP Model Solutions
Spring 2019

1. Learning Objectives:

1. The candidate will understand various insurance products, markets, and regulatory regimes.

2. The candidate will understand the relationship between product features, inherent risks, and the methods and measures to design and price products.

Learning Outcomes:

(1a) Describe insurance product types, benefits, and features including reinsurance.

(1c) Construct, evaluate and recommend product designs that are consistent with market needs, tax and regulatory requirements, and company business objectives.
- Evaluate the feasibility of proposed designs. Recommend designs.

(2c) Develop and evaluate a product's performance, capital requirements, tax and regulatory requirements, and risk profile.

Sources:

Investment Guarantees, Hardy, Ch. 13

LP-102-07: Equity Indexed Annuities: Product Design and Pricing Consideration

LP-123-13: NAIC Standard Non-forfeiture Law for Individual Deferred Annuities

Commentary on Question:

This question tested the candidates understanding of various aspects of Equity Indexed Annuities. Overall candidates did well on this question struggling mainly with part d.

Solution:

(a) Describe the differences between variable annuities with a guaranteed minimum maturity benefit (GMMB) and EIAs from POC's perspective.

Commentary on Question:

Candidates did well on part (a) and were able to correctly identify the differences between Equity Indexed Annuities (EIA) and Variable Annuities with a GMMB (VA). A common mistake was to only list attributes of one product and not compare them.

1. Continued

- EIA contracts are relatively short term compared with VA contracts.
- EIA is in a form of call option while a VA is in a form of a put option.
- The EIA guarantee is usually in the money at maturity where the VA is rarely in the money at maturity.
- EIA funds are invested in the general account while the VA funds are invested in separate accounts.
- The EIA equity indices used for these contracts are price indices, which do not allow for dividend reinvestment and therefore accumulate more slowly than the total return versions of the indices, which are used for separate account products such as variable annuities.

(b) Critique the use of a static index-based hedging strategy instead of a dynamic strategy. Justify your answer.

Commentary on Question:
Candidates did well on part (b) and most were able to correctly identify unique characteristics of both hedging strategies. To receive full credit candidates needed to state advantages/disadvantages of both hedging strategies.

A common way to implement a static index-based hedging strategy is to buy and sell over-the-counter call options; buy a call at a lower strike and sell a call at a higher strike. This is a simple process that can hedge the entire index-based interest guarantee. However, dealing in low volumes can be an issue. Also emerging experience can be different than expected with little to no possibility of adjusting for the difference.

Dynamic hedging consists of creating a portfolio with constant monitoring of the portfolio delta and rebalancing. The cost is the sum of a series of small losses and is unknown until the end of the period. Dynamic hedging does not provide downside protection and requires expertise.

(c) Analyze whether the guaranteed minimum value would comply with the Standard Nonforfeiture Law assuming a single premium of 100,000. Show all work.

Commentary on Question:
Candidates did well on part (c). Common mistakes included using the wrong interest rate, not including the expenses allowance or not using 87.5% of premium. Another common mistake was to accumulate the GMAV with interest even though it was given as 93% of premium.

1. Continued

- Standard Nonforfeiture Law (SNFL) requires a comparison of the SNFL value to the GMAV at each policy anniversary.
- The interest rate to be used for the SNFL is 2%. It is the 5 Yr CMT (4.25%) reduced by 125 bps to 3% and then for an EIA is reduced an additional 100bps to 2%.
- SNFL allows a $50 expense allowance and 87.5% of premium.

SNFL Values:
Year 1: (.875*100,000 – 50)*1.02 = 89,199
Year 2: (89,199 – 50)*1.02 = 90,932
Year 3: (90,932 – 50)*1.02 = 92,700
Year 4: (92,700 – 50)*1.02 = 94,503
Year 5: (94,503 – 50)*1.02 = 96,342

GMAV:
Given in the problem as 93,000 in all years

Because the SNFL value is greater than 93,000 in years 4 and 5 this does not comply with the Standard Nonforfeiture Law.

(d) Evaluate whether the indexed benefit is feasible. Show all work.

Commentary on Question:
Few candidates were able to correctly complete all the calculations in part (d). Many were able to do parts of the question but were unable to correctly compare the option budget to the option cost to evaluate the feasibility.

Several variations of the calculations were also awarded full credit. Many candidates calculated the PV of expense and profit separate from the GMAV cost. A common mistake was to subtract the expense load instead of add it as a cost and/or not take into account that it is an annual amount. Also accepted was to assume a continuous compounded rate of interest. Calculations assuming a single premium of 100,000 were also accepted.

Many candidates identified the 1000-strike call to purchase but did not relate it back to the GMAV and struggled with relating the option premium dollar cost back to the option budget which many calculated as a percent of premium.

1. Continued

The general formula to calculate the cost of the indexed benefit is:
Premium = GMAV Cost + Present Value Expense/Profit + Hedge Cost

GMAV Cost and PV Expense/Profit
Calculating the required future value of the GMAV with expense includes accumulating the premium net of load, .95P (5% premium load), at 3.5% which is the guaranteed minimum rate (2.5%) plus the spread for non-option expenses (1%) for 5 years.

Future Value of GMAV with Expenses = .95 * P * (1.035)^5 = 1.128 * P

The present value is calculated by discounting 5 years using the 5-year zero coupon bond rate.

GMAV Cost and PV Exp/Profit = 1.128 x P * 1/(1.05)^5 = .884 * P

Hedge Cost (this is also called the Option Budget)
Hedge Cost = Premium – GMAV Cost – PV Expense/Profit

Hedge Cost/Option Budget = P - .884 * P = .116 * P

Option Cost
To calculate the option cost the GMAV needs to be calculated to identify the correct option to buy.
GMAV = .95 * P * (1.025)^5 = 1.075 * P
The 1000 strike 5 year call is the closest option strike just below GMAV so that would be the best option to fund the index. The call option has a premium cost of $110 per each option.

The units of option as a proportion of premium = .95 * P / IndexValue(@ time 0) = .95 * P / 1000

The cost of the option as a proportion of premium would be units of option as a proportion of premium multiplied by the cost of the option.
= .95 * P / 1000 * 110 = .1045 * P

The option cost of .1045 * P is lower than the option budget of .116 * P so therefore the indexed benefit is feasible.

1. Continued

(e) Propose two changes to the indexed benefit to help the company stay within its option budget if option prices increase significantly. Justify your answer.

Commentary on Question:
Most candidates were able to propose changes to help stay within the option budget. Common mistakes were to not fully explain or incorrectly explain why and how the proposed changes would help decrease costs. Other proposed changes that were fully and correctly justified were also given credit.

- Reduce the participation rate which reduces the amount of options required to be purchased which would decrease the total option cost.
- Introduce a cap on the index return which results in selling an additional call option to decrease the total net option price.
- Switch to an average index which would decrease to volatility which should decrease the option cost.

2. Learning Objectives:

2. The candidate will understand the relationship between product features, inherent risks, and the methods and measures to design and price products.

Learning Outcomes:

(2b) Assess and critique performance measures, risk measures, and modeling approaches. Recommend their uses in product management.

Sources:

LP-136-15: Marketing for Actuaries, 2000 Edition, Chapters 4 pp. 12 - 31

Commentary on Question:

This question was trying to test candidate's understanding of different types of agent financing plans and how to estimate financing costs of agent financing plans

Solution:

(a) For each company above:

(i) Recommend an agent financing plan.

(ii) List the advantages and disadvantages of each company's recommended agent financing plan.

Commentary on Question:

Candidates didn't do well on this part. Only some candidates were able to provide the correct agent financing plans corresponding to the requirements provided in the question and fully describe each plan's advantage and disadvantage. Also, many candidates confused compensation structures for financing plans and some candidates failed to recognize the key features in different types of agent financing plans.

Company A recommendation - Line-of-credit or advances plans

Advantages:

- Income is relative stable as long as account credits and debits are constants.
- Large fluctuations in production may still yield a relatively stable income
- Fairly flexible by incorporating advantages from other types of plans

Disadvantages:

- Agent could experience a decline in income after financing because commissions are withheld
- Production does not have to be smooth.
- Most costly due to development and administration

2. Continued

Company B recommendation – Variable training allowance plan (TAP) or subsidy plan

Advantages:

- Production driven; high producers rewarded proportionately
- Agents experience effect of production on income
- Less costly

Disadvantages:

- Income can fluctuate more than for established agents

Company C recommendation – Salary plans

Advantages:

- Level income regardless of production
- Attractive to prospective agents, making it easier for management to recruit

Disadvantages:

- High producers not rewarded proportionately – lead to retention problems
- Costly if agents don't produce at expected levels
- Income may change considerably when agent goes off financing and onto straight commissions
- Require close supervision

(b)

(i) Calculate the annual financing cost per agent as a percent of premium. Show all work.

(ii) Critique the assumptions above and propose changes where appropriate.

Commentary on Question:
Part (i) is a straightforward calculation on estimating financing cost. Many candidates did well on part (i) and received full credit; however, some candidates incorrectly used first year premium to calculate subsidy payments.

Candidates generally struggled with part (ii). This part tested candidates' understanding of the basic information needed to estimate the financing cost for an agent financing plan. Many candidates failed to identify and comment on the key assumptions eg. Validation Schedule, Average Financing Level, Unvested Recoveries, Agent Retention Rates, Persistency Rates etc. Many candidates had recommendations for product specifications (such as "company needs to lower commissions"), a type of answer which was outside the scope for this question.

2. Continued

Part (i)
Commission Payments = Required Commission * Fraction of Agents entering quarter
Commission Payments @ 1st quarter = $2,500 * 1 = $2,500
Commission Payments @ 2nd quarter = $3,000 * 0.75 = $2,250
Commission Payments @ 3rd quarter = $3,500 *0.6 = $2,100
Commission Payments @ 4th quarter = $4,000 * 0.45 = $1,800
Total Commission Payments at Year 1 = $2,500 + $2,250 + $2,100 + $1,800 = $8,650

Subsidy Payments = Commission Payments * Subsidy Percent
Subsidy Payments @ 1st quarter = $2,500 * 150% = $3,750
Subsidy Payments @ 2nd quarter = $2,250 * 130% = $2,925
Subsidy Payments @ 3rd quarter = $2,100 *115% = $2,415
Subsidy Payments @ 4th quarter = $1,800 * 110% = $1,980
Total Subsidy Payments at Year 1 = $3,750 + $2,925 + $2,415 + $1,980 = $11,070

Total Estimated First Year Premium = $14,475

Annual financial cost per agent as a percent of premium
= Total Subsidy Payments at Year 1/ Total Estimated First Year Premium
= $11,070 / $14,475 = 76.48%

Part (ii)

- It's typical to have a monthly scale in the first year to better reflect interim terminations.
- Cost estimate should recognize agent retention rates by financing level and by age at hire.
- Only one financing level is assumed; a refinement to separate new agents into different financing levels could improve the accuracy of the cost estimate
- To determine the entire cost of plan, this would need to extend to the length of the financing plan
- Unvested recoveries from agents who terminate should be subtracted from the subsidy payments to determine the financing cost
- Last quarter of subsidy percentage is shown as 110%, typically end of year grades to 100%
- Cost estimate should recognize the validation schedule. Failure to meet minimum requirements may have a time constraint so that agents have 2-3 months to meet minimum before terminations.
- New agents have higher lapse rates with monthly/quarterly modes. Persistency of business is lower for terminators' premiums.

3. Learning Objectives:

2. The candidate will understand the relationship between product features, inherent risks, and the methods and measures to design and price products.

3. The candidate will understand actuarial requirements of product governance, implementation, operations, and management.

Learning Outcomes:

(2b) Assess and critique performance measures, risk measures, and modeling approaches. Recommend their uses in product management.

(2c) Develop and evaluate a product's performance, capital requirements, tax and regulatory requirements, and risk profile.

Sources:

Risk Based Pricing – Risk Management at Point of Sale, Product Matters, June 2009

Modelling of Policyholder Behavior for Life and Annuity Products

Level Term Lapse Rates – Lessons Learned Here and in Canada

Term Mortality and Lapses

Commentary on Question:

The questions tests understanding of how different assumptions and product feature changes will affect the pricing and assumption of the product.
Generally candidates did poorly in part A and B of the question, and did well in part C of the question.

Solution:

(a) ALX Life is considering the following discount rate options:

- Replicating asset portfolio rate
- Risk free rate

(i) List advantages and disadvantages of each discount rate.

(ii) Recommend a discount rate for use in pricing the product. Justify your answer.

(iii) Calculate the value of new business (VNB) using a 4% discount rate. Show all work.

3. Continued

Commentary on Question:
Successful candidates demonstrated understanding of the two different discount rate structures. Many candidates compared the two discount rate in terms of real-world and risk-neutral assumptions which was not the intent of the question. Most candidates also did not tie selection of the discount rate to the product described in the question.

(i)

Advantages of Replicating Asset portfolio:

- The CF of the replicating assets is an exact match to the CF liabilities, so the value of the liability CF is equivalent to the value of the replicating asset portfolio.
- The higher the discount rate, the cheaper the cost of the product, so more competitive

Disadvantages of replicating asset portfolio rate:

- It is operationally complicated to replicate an asset portfolio that matches the liability CF exactly and maintain it

Advantages of Risk-free rate:

- Operationally, it is the easiest to model
- Provides some level of conservatism

Disadvantages of risk free rate:

- There's no adjustment to credit risk or other uncertainties, so it doesn't properly reflect inherent risks in liability
- Can be used as an approximation only if there is some certainty of payout, and non-material company credit risk margin
- Since it's a relatively low rate, the pricing calculated will be higher, and could be less competitive

(ii)

The risk free rate is more appropriate
The product assumes no credit risk, and no non-hedgeable risks, therefore the risk free rate sufficiently reflects the inherent risks in the product

(iii)

VNB Formula = PV(after-tax future profits) - TimeValue(Financial Options and Guarantees) - frictional costs of RC - cost of Non-Hedgeable Risk

	Pre-Tax Profit	Post Tax Profit	Discount @4%
1	50	35	33.65
2	50	35	32.36
3	50	35	31.11
4	50	35	29.92
5	50	35	28.77
			VNB= 155.81

3. Continued

(b) ALX Life is considering a yearly renewable term (YRT) premium payment structure and a CSV equal to the future unearned premium for both products.

Compare and contrast the YRT structure to the level premium structure with respect to:

(i) Risk exposure

(ii) Lapse experience

Commentary on Question:
Candidates did poorly for this part of the question. Most candidates mistook YRT for adjustable premiums. Some candidates listed considerations for both premium structures but did not compare them to each other.

(i)
YRT: premium is increasing consistent with mortality risk of the insured at a set scheduled (or based on attained age and varied only by gender)
Level: Same premium amount for the duration of the policy

Due to the increasing premiums for YRT, the product will experience anti-selection and selective lapse at later durations as healthier policyholders will choose to lapse and find lower premiums. Therefore, the mortality risk exposure is higher than level premium structure in later durations.
Points are also awarded if the candidate indicates that the mortality risk exposure is the same at the point of pricing for the products.

Level premium structure will experience higher investment risk exposure as the company has to reinvest the premiums to ensure there is sufficient returns to cover future liabilities.

(ii)
Under YRT, we can expect lower lapses in the early duration due to lower premiums, and higher lapses in the later durations as premiums increase.
In general, aggregate lapses for YRT also tend to be higher than level premium products.
Given that the CSV is present under both premium structures, it is not expected to have a material impact on the lapse rates when comparing the two premium structures.

3. Continued

(c) Explain how adding a term conversion option would affect:

(i) Marketability

(ii) Policy administration

(iii) Pricing assumptions

Commentary on Question:
Candidates did well on this part of the question. Some candidates failed to identify the key pricing assumptions that would be affected by the conversion option, or listed considerations that were not related to the conversion feature.

(i) Impact of Term conversions on marketability
Term conversions should improve marketability; policyholders now have the ability to convert to a permanent policy by the end of the term period without providing evidence of insurability. This should reduce lapse/increase persistency due to cancellations since policyholders are no longer forced to re-apply for a permanent policy. In addition, because no evidence of insurability is required, the policyholder usually keeps their current risk class which would appeal to many policyholders.

(ii) Impact on administration
Many companies may struggle to distinguish converted policies. They should be distinguished as a distinct type of lapse/termination from the term policy, and also be identifiable as a permanent policy arising from conversion so that experience can be monitored on conversions. The same would apply on a ceded basis to ensure that reinsurers are also aware of converted policies for their own monitoring/experience.

(iii) Impact on pricing assumptions
Converted policies will exhibit varying degrees of antiselection, as healthy lives would be able to re-apply and get underwritten. In particular, those who convert closer to the end of the term period/conversion option expiry are more likely to exhibit very highly antiselective mortality and low post-conversion lapses.

4. Learning Objectives:

1. The candidate will understand various insurance products, markets, and regulatory regimes.

Learning Outcomes:

(1b) Evaluate insurance markets, consumer needs, distribution channels, and regulatory regimes.

Sources:

The Art and Science of Life Insurance Distribution, Actex, Ch. 3 – 7

LP-134-15: Digital Distribution in Insurance: A Quiet Revolution, Swiss Re, 2014

LP–147–17: Life Insurance: Focusing on the consumer, Signa Swiss Re, No. 6,2013

Commentary on Question:

Some candidates did not receive full credit in part (a) because they only described some of the steps, or they listed the steps without providing supporting detail. For (ii), many candidates described IMOs but struggled to explain how they are changing the customer facing function.

Solution:

(a)

(i) Describe an agent's role in the key steps of the customer facing function of distribution.

(ii) Explain how IMOs are changing the customer facing functions of insurance agents.

Commentary on Question:

Some candidates did not receive full credit in part (a) because they only described some of the steps, or they listed the steps without providing supporting detail. For (ii), many candidates described IMOs but struggled to explain how they are changing the customer facing function.

(i)

1. Prospecting for New Clients
   In this step the agent builds sources of new prospects with the goal that someday enough sales will be generated by word of mouth that they will no longer need to prospect.
2. Needs Analyis
   The agent will set up a meeting to determine the likelihood the customer will buy and to discuss their needs. The agent then determines what products best fit their needs.

4. Continued

3. Present and Closing
   The agent presents a solution to the client and closes the sale. After the client is approved, the agent can deliver the policy in person, explain product features, and answer any questions.
4. Managing the Client Relationship
   The agent can continue to answer questions from policyholders to provide service after the sale. They can also sell additional products to the customer if their needs change.

(ii) IMOs provide leads to agents, and sometimes the agents pay for those leads. With IMOs, the focus is on productivity, and the agents only have to call the leads rather than prospect. Also, IMO agents focus only on a few specific products.

(b)

(i) Determine which commission structure maximizes the net present value (NPV) of commissions. Show all work.

(ii) List the reasons why an agent might prefer a lower NPV of commissions based on a heaped structure versus a higher NPV on a levelized basis.

Commentary on Question:
In part (i), many students applied the persistency bonus in the wrong year or did not include the override. Partial credit was given if the override was applied as 200% rather than (100% + 200%), and the levelized structure was recommended.

(i)
$v = 1 \div 1.05$
P = annual premium

Find the net present value of the heaped commissions, including decrements and persistency bonus.

$NPV_{heaped} = 60\% \times (1 + 200\%) \times P + (5\% \times 94\% \times v) \times P + (5\% \times (94\%)^2 \times v^2) \times P + (5\% \times (94\%)^3 \times v^3) \times P + (5\% + 10\%) \times ((94\%)^4 \times v^4) \times P$
$= 201.7\% \times P$

Find the net present value of the levelized commissions, including decrements and persistency bonus.

$NPV_{levelized} = 45\% \times P + (45\% \times 94\% \times v) \times P + (45\% \times (94\%)^2 \times v^2) \times P + (45\% \times (94\%)^3 \times v^3) \times P + (45\% + 10\%) \times ((94\%)^4 \times v^4) \times P$
$= 189.0\% \times P$

4. Continued

$NPV_{heaped} > NPV_{levelized}$, therefore the heaped commission structure maximizes the NPV of commissions

(ii)

- It is easier for new agents to get started if they receive the commissions earlier
- Agents can get paid money faster by churning business if there is no chargeback on lapses
- Most of the work to get the sale is in the beginning which aligns with how heaped commissions are paid out
- Incentivizes agents to seek out new sales if their existing block of business is not large enough to generate adequate levelized commissions

(c) ZRT Life received the following concerns from prospective policyholders:

- *"I glanced at the contract and it's probably a good product with various options, but I'm not sure if it meets my needs."*
- *"Besides, I'm only 30. Why do I need life insurance?"*
- *"This is a very big decision, and I don't want to pay money for nothing."*

Recommend changes that can be made to address the above concerns with respect to:

(i) Product design

(ii) Communication to consumers

Commentary on Question:
Many candidates did not receive maximum credit because they only provided insufficient supporting points.

(i)
Recommended changes with respect to product design:

- Make the product designs simpler (for example, with fewer options)
- Include Return of Premium feature to address concern that they are paying money for nothing
- Design a product where the insurance coverage kicks in at different events (like birth of a child)
- Use a free look period where the customer can back out of the contract within a certain period of time

4. Continued

(ii)
Recommended changes with respect to communication to consumers

- Use less complicated language/terminology in the policy
- Put product info on social media
- Use education programs to better inform customers on the importance of life insurance
- Make product info available on web site before client meets with agent

(d) ZRT Life's senior management is worried about the disruption that technological innovation is bringing to insurance distribution and are seeking to transform ZRT Life by embracing new digital methods of distribution.

(i) Explain the role ZRT Life's agents should play in the transformed organization.

(ii) Propose five digital distribution methods ZRT Life can use to enhance the marketing of term insurance.

Commentary on Question:
Some candidates did not receive full credit for part (i) because answers focused on digital methods the agent could use rather than the agent's role. There are a variety of correct answers for part (ii). Most candidates were able to list several digital distribution methods.

(i)
Agents will still be needed in the transformed organization. Some customer will still want face-to-face meetings to get advice and guidance. Also, older clients will be less likely to buy products online. Some complicated products will not be available for online purchase. Agents can use social media to help them build a client base.

(ii)

- Use an aggregator web site
- Use social media to build brand awareness
- Agents can live chat with customers
- Use the company web site for online purchasing and product info

5. Learning Objectives:

1. The candidate will understand various insurance products, markets, and regulatory regimes.

Learning Outcomes:

(1a) Describe insurance product types, benefits, and features including reinsurance.

(1b) Evaluate insurance markets, consumer needs, distribution channels, and regulatory regimes.

(1c) Construct, evaluate, and recommend product designs that are consistent with market needs, tax and regulatory requirements, and company business objectives.

- Evaluate the feasibility of proposed designs. Recommend designs.

Sources:

Life Insurance and Modified Endowments Under Internal Revenue Code Sections 7702 and 7702A, DesRochers, Christian J., et. al., 2nd Edition, 2015, Ch. 1-3, 6 and 7 (pp. 205-252 up to Appendix 7.1)

Canadian Insurance Taxation, Swales, et. al., 4th Edition, 2015, Ch. 10 and 11

Commentary on Question:

Part (a) tested candidate's ability to determine if a given flexible premium UL (Universal Life) policy complies with U.S and Canadian regulations/rules regarding the definition and tax treatment of life insurance.

Part (b) tested candidates' ability to evaluate the impact certain assumptions/changes may have on the given flexible premium UL policy's ability to comply with U.S. regulations regarding the definition and tax treatment of life insurance.

Solution:

(a) Determine if this policy meets the requirements for:

(i) IRC 7702 using the GPT (Guideline Premium Test), assuming the cash value corridor test requirement is met

(ii) IRC 7702A

(iii) Canadian 2017 New Exempt Policy Rules

5. Continued

Commentary on Question:

(i) Candidates consistently performed well in determining if the policy satisfies section 7702 receiving most of the available points.

(ii) The results were the same when determining compliance under 7702A.

(iii) Candidates struggled when evaluating the policy under Canadian rules. Most failed to note that the policy is compliant at issue due to passage at the current and next anniversary. Many performed the test using the cash value net of surrender charge rather than the account value -or- cash value gross of surrender charge. When the account value was used most correctly identified failure (as illustrated) in year 4. Virtually no one referenced the recognition of Automatic Adjustments.

(i)

- GLP (Guideline Level Premium) interest rate = max(4%, guaranteed interest rate) = max(4%, 5%) = 5%
- GSP (Guideline Single Premium) interest rate = max(6%, guaranteed interest rate) = max(6%, 5%) = 6%
- GLP (5%) = $5,630 (given)
- GSP (6%) = $69,411 (given)
- To pass 7702 cumulative premium paid must not exceed max(GSP, cumulative GLP) for all policy years

Pol Year	GSP	Cum. GLP	Cum. Prem. Pd.	test	Max(GSP, Cum. GLP)	Result
1	69,411	5,630	12,000	<	69,411	Pass
2	69,411	11,260	24,000	<	69,411	Pass
3	69,411	16,890	36,000	<	69,411	Pass
4	69,411	22,520	52,000	<	69,411	Pass
5	69,411	22,520	68,000	<	69,411	Pass
6+	69,411	28,150	68,000	<	69,411	Pass

- Since the premium paying period is 5 years if the policy passes through year 5 then it will pass in years 6+
- Policy meets the definition of life insurance under section 7702 of the IRC (Internal Revenue Code) and as such the death benefit is tax exempt and the inside build-up of cash value is tax deferred

(ii)

- 7702A MEC (Modified Endowment Contract) 7-Pay interest rate = max(4%, guaranteed interest rate) = max(4%, 5%) = 5%
- 7-Pay limit = $13, 036 (given)
- To pass 7702A cumulative premium paid must not exceed the cumulative 7-Pay limit for policy years 1 through 7

5. Continued

Pol Year	Cum. Prem. Pd.	test	Cum. 7-Pay Limit	Result
1	12,000	<	13,036	Pass
2	24,000	<	26,072	Pass
3	36,000	<	39,108	Pass
4	52,000	<	52,144	Pass
5	68,000	>	65,180	**Fail**
6	68,000	>	78,216	X
7	68,000	>	91,252	X

- In policy year 5 cumulative premium paid exceeds the cumulative 7-Pay limit and as such the policy is classified as a MEC under section 7702A of the IRC
- As a MEC the death benefit remains tax exempt however any distributions are taxed on a LIFO basis

(iii)

- The test compares the CSV_{Gross} (Cash Surrender Value gross of SC (Surrender Charge)) of the policy with the AF_{ETP} (Accumulating Fund of the Exempt Test Policy) at the current and next anniversary where the CSV_{Gross} is not to exceed the AF_{ETP}
  - In this case AV (Account Value) = CSV_{Gross} = CV + SC

Pol Year	AV	test	AF_{ETP}	Result
1	11,465	<	13,391	Pass
2	24,360	<	26,783	Pass
3	37,732	<	40,174	Pass
4	55,738	>	53,566	**Fail**
5	74,386	>	66,957	X
6	77,092	>	80,349	X
7	79,844	<	93,740	X
8	82,635	<	107,132	X
9	85,466	<	110,541	X
10	88,329	<	114,027	X

- At issue the policy is exempt (passes test) because the AV is less than the AF_{ETP} at the current and next anniversary
- As illustrated the policy will fail the test in year 4 because the AV exceeds the AF_{ETP} (absent any automatic adjustments) on the next (5^{th}) anniversary

5. Continued

- Because automatic adjustments are ignored for the next anniversary any adjustments must be made preemptively or (in this case) prior to the 4th anniversary for the policy to pass when tested at the 4th anniversary

(b) Evaluate the impact on the IRC 7702 and 7702A tests for the following changes:

(i) Guaranteed interest rate changed to 3%

(ii) Guaranteed expense load changed to 30%

(iii) Period planned premium for 5 years is changed to single pay which equals $70,000

(iv) Adding an Acceleration of Death Benefit Rider to the policy

Commentary on Question:

(i) Candidates performed well when evaluating the impact of a change in the guaranteed interest rate and earned the majority of available points.

(ii) Many did not perform well when evaluating the impact a change in the guaranteed expense load would have on 7702. By far the most common mistake was the notion that this change would impact/increase the GSP/GLP, failing to recognize the fact that 7702 allows for a reasonable (current) expense allowance and is not dependent on guaranteed expense charges. Almost all candidates did correctly recognize the fact that expenses do not impact the 7702A 7-Pay limit.

(iii) Collective performance was again strong when evaluating the impact of moving to a single premium assumption, recognizing the fact that funding via single premium would result in failure to comply with 7702 and 7702A.

(iv) Only a handful of candidates performed well when evaluating the impact an ADB rider might have on 7702 and 7702A. Virtually all candidates went down the path of citing whether the rider would be considered a QAB (Qualified Additional Benefit) or not and how this may or may not affect premium, guideline premium, and 7-Pay limit. The handful that performed well recognized the impact realizing accelerated death benefit payment(s) would have on the remaining death benefit and as a result the 7702 and 7702A thresholds resulting in the need to reevaluate under 7702 and 7702A.

5. Continued

(i)

- GLP (Guideline Level Premium) interest rate = max(4%, guaranteed interest rate) = max(4%, 3%) = 4%
  - Changed from 5%
- GSP (Guideline Single Premium) interest rate = max(6%, guaranteed interest rate) = max(6%, 3%) = 6%
  - Unchanged
- GLP (4%) = $6,414 (given, changed from $5,630)
- GSP (6%) = $69,411 (given, unchanged)
- 7702 result is unaffected as cumulative premium paid unchanged, GLP increased, and GSP unchanged
- Policy meets definition of life insurance under 7702
  - Unchanged
- 7702A MEC (Modified Endowment Contract) 7-Pay interest rate = max(4%, guaranteed interest rate) = max(4%, 3%) = 4%
  - Changed from 5%
- 7-Pay limit = $16,163 (given)
  - Changed from $13,036
- The increased 7-Pay limit allows the policy to pass the 7-Pay test so the policy is not considered a MEC
  - Changed

(ii)

- 7702 allows for a *reasonable* (current) expense allowance when calculating guideline premiums
- Changing the guaranteed expense load will not impact 7702 since the current (*reasonable*) expense load is unchanged
- Policy meets definition of life insurance under 7702
  - Unchanged
- 7702A includes no expense allowance so the 7-Pay test is unaffected
- Policy is classified as a MEC
  - Unchanged
- As a MEC the death benefit remains tax exempt however any distributions are taxed on a LIFO basis

(iii)

- The $70,000 single premium exceeds the 7702 GSP of $69,411
- Policy immediately fails to meet the definition of life insurance under 7702
  - Changed

5. Continued

- Failure to comply with 7702 results in the taxation of the inside buildup as it is credited (year by year cost of insurance plus change in CSV less premiums)
- Net amount at risk remains tax exempt
- If performed the 7702A test would result in immediate failure since the $70,000 single premium exceeds the 7-Pay limit of $13,036
- Because the policy fails 7702 the 7702A test is moot

(iv)

- Payment of an ADB (Accelerated Death Benefit) typically results in a reduction of death benefit and cash value
- A reduction in death benefit will reduce the GSP/GLP
- A decrease in GSP/GLP may result in failure to comply with 7702
- There are two possible remedies
  - The Force Out option refunds excess premiums (60 day limitation)
  - The Partial Extinguishment option treats the ADB paid out as a payment of the life insurance benefit and the GSP/GLP are reduced proportionally
- Under 7702A a death benefit reduction may reduce the 7-Pay limit under the Material Benefits Reduction rule
- Policy even more susceptible to failure of 7702A

6. Learning Objectives:

2. The candidate will understand the relationship between product features, inherent risks, and the methods and measures to design and price products.

Learning Outcomes:

(2a) Identify, assess, and develop appropriate assumptions to reflect factors such as product characteristics, risks, policyholder behavior, and company actions.
- Describe and apply the uses of predictive modeling.

(2b) Assess and critique performance measures, risk measures, and modeling approaches. Recommend their uses in product management.

Sources:

Investment Guarantees, Hardy, Ch. 1, 2, 6, 7, 8, 12, 13

Commentary on Question:

Commentary listed underneath question component.

Solution:

(a) Calculate the total hedging error using the move-based hedging strategy. Show all work.

Commentary on Question:

Candidates generally did not do well on this question. Most candidates were able to correctly describe a move-based hedging strategy but struggled to identify the correct rebalancing times. A common mistake was to compare the stock price for the current month to the stock price for the prior month instead of the last rebalancing month. Few candidates calculated the hedging error correctly. Candidates particularly struggled with how to bring the previous hedge forward to the current time point.

Using the move-based hedging strategy, rebalancing is only required when the stock price moves more than 5% since the last rebalancing time.

At time 0, the stock price is 100. This means rebalancing is triggered when the stock price moves above $100 \times (1 + 5\%) = 105$ or below $100 \times (1 – 5\%) = 95$. This occurs at time 3 when the stock price is 105.25.

The next rebalancing is triggered when the stock price moves above $105.25 \times (1 + 5\%) = 110.5125$ or below $105.25 \times (1 – 5\%) = 99.9875$. This occurs at time 8 when the stock price is 99.

The next rebalancing is triggered when the stock price moves above $99 \times (1 + 5\%) = 103.95$ or below $99 \times (1 – 5\%) = 94.05$. This occurs at time 12 when the stock price is 110.

6. Continued

The hedging error at a given time point is the difference between the Black Scholes price of the new hedge and the previous hedge brought forward to the current time point.

$HE(t) = H(t) - H(t^-)$
$H(t)$ = Stock Part of Hedge + Bond Part of Hedge
$H(t^-)$ = Stock Part of Hedge $\times (S_t / S_{t^-})$ + Bond Part of Hedge $\times e^{3\% * (t - t^-)}$

$HE(3) = (-37.612 + 42.563) - [(-44.725 \times 105.25 / 100) + (52.476 \times e^{3\%/4})]$
$HE(3) = -0.847$

$HE(8) = (-55.870 + 62.003) - [(-37.612 \times 99 / 105.25) + (42.5633 \times e^{3\% \times 5/12})]$
$HE(8) = -1.587$

$HE(12) = (0 + 0) - [(-55.870 \times 110 / 99) + (62.003 \times e^{3\%/3})]$
$HE(12) = -0.548$

The total hedge error is calculated as either the present value or sum of the hedge errors at the 3 time points, which is -2.928 or -2.982, respectively.

(b) MSP uses the actuarial approach and deterministic assumptions based on the average mortality and average withdrawal rates to model its GMDB and GMWB.

Identify which combination of assumptions and guarantees is most likely to result in a mispricing of the cost of the guarantee. Justify you answer.

Commentary on Question:
This question tested candidates' knowledge of the relationship between actuarial assumptions of cost of guarantees and the inherent risks. Most candidates received partial credit by stating the linkage between withdrawal assumption and investment/in-the-moneyness. However, many candidates did not receive full credit because they did not state it is okay to model mortality deterministically.

Modeling mortality assumptions deterministically is reasonably safe, as long as there are a sufficient number of policyholders. Mortality is a diversifiable risk unlikely to be linked to investment experience.

Other the other hand, modeling withdrawal assumptions deterministically could be problematic since policyholder behavior can be linked closely to the investment performance and in-the-moneyness of the guarantees.

6. Continued

Hence, using deterministic assumptions for withdrawal rates to model the GMWB is most likely to result in a mispricing of the cost of the guarantee. For the two guarantees, GMWB benefits will be more directly affected as they are determined based on the combination of investment performance and withdrawals, whereas the GMDB benefits will be more indirectly impacted by withdrawals.

(c) MSP wants to use the static replication approach to hedge its GMDB.

(i) Describe the portfolio of commonly available assets that would allow MSP to most closely replicate the liability generated by the GMDB.

(ii) Identify three reasons why the static replication portfolio may not exactly offset the guaranteed payments.

Commentary on Question:
Most candidates did well on part (ii) but struggled with part (i). In part (i), candidates mistakenly described a portfolio of put options as it is a common replicating portfolio for most variable annuities. Whereas in this question the payoff of the guarantee resembled a call option. The responses listed here for part (ii) are simply examples. Candidates received credit for other answers that were relevant and well justified.

(i) Expected GMDB payout = $30\% \times \max[F_t - G, 0] \times {}_{t-1|1}q_x$

The expected death benefit payout is 30% of the fund value at time t (F_t) over the policyholder's basis in the contract (G) multiplied by the probability of death at time t (${}_{t-1|1}q_x$).

This is proportional to a call option. Therefore, the most reasonable static replication portfolio would be a series of call options with various term lengths with notional amount for each call option reflecting both the 30% factor and the expected level of deaths to occur in that time period.

(ii) There are many possible reasons. Some common examples include:
a. May not be able to purchase call options with long enough term length to cover the life of the guarantee, or to match the exact right timing for death occurrence.
b. Death are unlikely to occur in exact proportion to match the assumed mortality table.
c. Other policyholder behaviors (e.g. withdrawals, lapses, etc.) are going to affect the fund amount or the overall persistency of the portfolio which will change the number of expected benefits to be paid.

7. Learning Objectives:

2. The candidate will understand the relationship between product features, inherent risks, and the methods and measures to design and price products.

3. The candidate will understand actuarial requirements of product governance, implementation, operations, and management.

Learning Outcomes:

(2a) Identify, assess, and develop appropriate assumptions to reflect factors such as product characteristics, risks, policyholder behavior, and company actions.
- Describe and apply the uses of predictive modeling.

(3a) Describe governance and implementation requirements, principles, and practices.
- Describe and evaluate compliance with illustration regulations.
- Describe operational requirements such as administration, marketing, reinsurance, and underwriting. Assess their impact on managing products.

(3b) Apply practices related to product management.
- Describe how to monitor and evaluate actual experience such as benefits, persistency, and utilization including the use of experience studies and supplementary data sources.
- Describe and assess practices related to data quality.
- Recommend changes to non-guaranteed elements such as credited rates and policyholder dividends.

(3c) Design and evaluate product management strategies. Recommend the product strategy.

Sources:

SOA Research 2010 - Automated Life Underwriting, Phase 2, Deloitte

Predictive Modeling for Life Insurance, Deloitte

The Use of Predictive Analytics in the Development of Experience Studies - The Actuary 2015 vol12-iss4 pp. 26-34

LP-XXX-16: Evolving Strategies to Improve Inforce Post-Level Term Profitability, Product Matters, Feb 2015, pp. 23-29

SOA - Society of Actuaries, Report on the Lapse and Mortality Experience of Post-Level Premium Period Term Plans, pp. 3 - 98

7. Continued

Commentary on Question:
Full credit was given to a candidate that demonstrated an understanding of T10 product development, with specific knowledge of automated underwriting and predictive modeling.

Solution:

(a) After considering various automated underwriting system (AUS) approaches, MoreLife has narrowed down their options to either using the AUS for simplified issue underwriting or for full medical underwriting.

(i) Assess the two AUS approaches.

(ii) Recommend the strategy that aligns best with the company's overall strategy. Justify your recommendation.

Commentary on Question:

(i) Maximum points were given for describing the two AUS approaches, demonstrating knowledge of the difference in both approaches, and describing pros and cons. Overall candidates provided half the model solution on this question.

For differences in approaches and pro/cons, credit was given for either but not both (for example)
- Small (or Large) Face Amount
- Fast (or Slow) decisions
- High (or Low) Completion rate
- Inexpensive (or Expensive)
- Simple (or Complex)

(ii) *Full credit was given for a well-reasoned opinion. This included making a recommendation, and, supporting the recommendation. Overall candidates did well on this question.*

(i):
AUS for Simplified issue:
- for small FA (100-250k)
- fast accept/reject decisions in majority (80%) of cases
- place applicant in standard risk class
- or can refer for additional UW
- Pros: high completion rate
- Cons: only useful for smaller policies

7. Continued

AUS for Full medical UW:
- system interprets full application
- programmed for greater app detail
- can assign debits/credits
- can assign substandard ratings
- Pros: can replace humans for certain large policies, can drive requirement ordering, provide reasons for referring to human
- Cons: low completion rate, very expensive and complex

(ii)
A recommendation for either AUS for simplified issue underwriting or full medical underwriting was acceptable along with an opinion that backed-up the recommendation. For example:

It is recommended that simplified issue AUS is implemented for the new low face (face amounts less than $250K) 10-yr term product because the Market for Term products is high commoditized so expenses associated with a full medical underwriting program might place an excessive completive disadvantage on the new product line. The company should continue with full medial underwriting for the existing high face (>$500K) product and the new high face (> $250 K) 10-year term product.

- AUS for Simplified issue underwriting would be more successful with fast accept/reject decisions and a high completion rate,

Implementing AUS for full medial underwriting would be very expensive because it requires a high level of app detail to be programed.

(b) MoreLife has decided to incorporate predictive analytics into its AUS.

(i) Describe how predictive analytics can be used in underwriting.

(ii) Describe the key steps in a predictive analytics project.

(iii) Explain why predictive modeling might be a better tool for underwriting screening versus predicting mortality.

(iv) Describe best practices that should be followed to address legal and ethical concerns when using data for predictive models.

7. Continued

Commentary on Question:

(i) Maximum credit was given for identifying model inputs, determining a score, and noting that predictive modeling is not always used to make final underwriting decisions but to aid in the overall process. Candidates just did fair on this question. It seemed they did not fully understand what was being asked.

(ii) Maximum credit was given for describing the steps in a predictive analytics project. Only partial credit was given if the steps were just listed and not described. Overall candidates did well however the steps missed most often were Project Scope and Implementation.

(iii) Maximum credit was given if the candidate demonstrated understanding that it is critical to use data correctly to produce an effective predictive model. Candidates seemed to understand predictive modelling for underwriting better than for mortality.

(iv) Maximum credit was given for describing the legal and ethical nature of using personal, third party, public, and other information. No points were given for US guidance such as ASOPs etc. A number of candidates just did fair on this question.

(i)

Predictive modeling determines a preliminary score based on the applicant's inputs. Explanatory variables such as issue age, gender, and other factors including third party data are used to predict a target variable. This score determines whether the policy is offered or is sent through additional underwriting. In other words, the predictive model is typically used not to make the underwriting decisions, but rather to triage applications and suggest whether additional requirements are needed before making an offer.

(ii)

1) Project Scope
    - What the model is used for
    - Identify target variable
    - Required resources, budget, timeline
2) Data collection
    - Collect data from application, MVR, Rx records, etc.
    - Prepare the data
    - Validate the data
    - Initial factor analysis - Determine the factors that are driving the model (analysis of correlation between predictor variables with target, distribution results, remove insignificant variables)

7. Continued

3) Model Building
   - Select the form of the model,
   - Determine factors, interactions and simplifications
   - Model Validation - Hold out samples and A/E analysis
   - Final Calibration - Refit model if necessary

4) Implementation
   - Taking model results and incorporating them into the business process

(iii)
Modeling underwriting decisions rather than mortality offers the advantage that underwriting decisions provide informative short-term feedback in high volumes.

(iv)
1) Collecting data about individuals is a sensitive subject.
2) Even though third-party data may be legal to use, it may raise ethical concerns.
3) Threats to public relations or company values must be considered when including data into predictive models
4) Company's legal and compliance area should be consulted with use of consumer data.

(c) MoreLife wants the T10 product to be priced with initial level term rates lower than the competition and renewal rates high enough to maintain the overall profitability of the product.

(i) Critique this suggested product design.

(ii) Describe four strategies to improve post-level term profitability.

(iii) Recommend one of the above strategies to improve post-level term profitability. Justify your answer.

7. Continued

Commentary on Question:

(i) Maximum credit was given for describing the correlation between premium jump and increased lapses/increased mortality, including the impact on profits. Most candidates did well on this question.

(ii) Maximum credit was given for identifying and describing the four strategies. Partial credit was given if the strategy was only listed without a description. Most candidates did well, however the strategy missed most often was the Traditional Approach.

(iii) Full credit was given for recommending one of the pricing strategies (1 to 4), including reasonable justification. This included making a recommendation, and, supporting the recommendation with why they made the recommendations, and/or why another option was not selected, and credit was given if the option connected to MoreLife products or the AUS recommendation in part (a). Most candidates did well on this question.

Partial credit was given for making a recommendation, even if the strategy recommended wasn't one of the 4 listed strategies.

(i)

- Lapse rates will increase with the premium jump since healthy lives will lapse and get re-underwritten.
- Mortality deterioration will increase with premium increases because of anti-selection
- Lower initial premiums will decrease revenue/profitability and increasing renewal premiums will increase income later, but only from persisting policies, which will be lower
- Any additional renewal premiums will also be offset by higher claims paid from worse mortality

(ii)

Pricing Strategies:

1. The Traditional Approach
   - Assume shock lapses and develop a single YRT ceiling
   - Advantage: simplest to administer (less expenses)
   - Disadvantage: worst risks remain in force, claims volatility, negative publicity
2. Simplified Re-Underwriting Approach
   - Optional questionnaire determines PLT risk class
   - Advantage: fairness to policyholder and regulator, lower selective lapsation, better rates for both
   - Disadvantage: may increase lapse or conversions, must solve implementation problems

7. Continued

3. Graded Approach
   - PLT premiums increase at a smaller increment initially before reaching original YRT scale
   - Advantage: lower lapses initially, avoids UW, low admin cost, early experience suggests it works as expected
   - Disadvantage: best risks can still lapse, no reliable experience for post-graded experience, only experience is in Canada
4. Class Continuation Approach
   - Maintain level term structure into PLT, develop separate YRT scales by class with all converging to ultimate scale
   - Advantage: may be fairest approach since using original UW, YRT scale encourages/discourages lapses based on class, perm experience could be used for classes
   - Disadvantage: lack of experience, preferred will have lowest initial/steepest slope, selective lapse risk from preferred who have become impaired

(iii)
It is recommended that the Class Continuation approach is used. This is a fair approach for the insured since it uses the insureds original underwriting. Also, since the YRT scale is based on class, this will help improve the lapse rate.

This is better than the Graded approach since under that approach the best risks can still lapse. Also, the lapse rates under the Class Continuation approach will be better than using the Simplified Re-Underwriting approach as it may increase lapses.

8. Learning Objectives:

1. The candidate will understand various insurance products, markets, and regulatory regimes.

Learning Outcomes:

(1a) Describe insurance product types, benefits, and features including reinsurance.

(1b) Evaluate insurance markets, consumer needs, distribution channels, and regulatory regimes.

Sources:

Life Insurance and Modified Endowments Under IRC §7702 and §7702A, Second Edition, Chapters, 1-3,6 and 7(pp205-252 up to appendix 7.1)

Life Insurance Acceleration Riders, Filmore - Reinsurance Section, July 2013, pp. 35 - 38

Commentary on Question:

Commentary listed underneath question component.

Solution:

(a) Compare and contrast the following three riders:

- Terminal illness rider
- Chronic illness rider
- Critical illness rider

Commentary on Question:

Candidates overall did very well on part (a). Most candidates were able to articulate similarities and differences between three riders. Some candidates only focused on differences and did not articulate similarities.

Similarities:

- All three riders have given policyholders the option to accelerate a portion of their death benefit in the case of terminal illness, chronic illness, and critical illness.

Differences:

The benefit triggers are different:

- Terminal illness rider – Allows policyholders to accelerate their face amount when they have a life expectancy of less than X months. X is typically 2, but 24 in some states.

8. Continued

- Chronic illness rider– Allows policyholder to accelerate their face amount when they are unable to perform two or more activities of daily living (ADLs) without assistance from another person. Activities of daily living are bathing, continence, dressing, eating, toileting and transferring.

- Critical illness rider – Allows policyholders to accelerate their face amount when meeting the criteria of one or more specific critical illness. An example of a critical illness is a heart attack or stroke.

(b) You are given the following for the chronic illness rider:

- The chronic illness rider uses the same underwriting guidelines as the base life insurance products.
- The rider uses the same issue ages and risk classes as the base life insurance product.
- The rider benefit type uses an actuarial discount method.
- 100% of the death benefit can be accelerated upon temporary or permanent loss of 2 out of 6 listed activities of daily living (ADL).
- The rider excludes suicide and intentional self-afflicted injuries.

Propose changes to the rider design that will help the company mitigate its risk. Justify your answer.

Commentary on Question:
Candidates did reasonably well on part (b). The most common mistake was candidates only provided changes without going into details. For instance, "underwriting guideline should be different" or "Rider should use different issue ages and risk classes" is not sufficient to receive full credit, given the candidates were asked to "Justify your answer".

Some candidates recommended changing actuarial discounting method to lien method. In this case only partial credit was rewarded since lien method design is primary utilized when the base policy is a whole life policy.

1. The current design of relying on the base policy's underwriting guideline is insufficient. The company should use supplemental underwriting application. Supplemental underwriting will focus on conditions that may result in morbidity associated with ADL loss that may not be included in the term insurance application.

8. Continued

2. Instead of using the same issue ages and risk classes guideline as the term policy, risk will be reduced by limiting issue ages at which the chronic illness rider can be added and/or incorporation of cognitive testing at particular issue ages and the rider should be only available on policies that are issued up to some maximum rating (such as Standard of Table D).

3. Risk can be reduced by limiting the maximum benefit to be less than 100% of the death benefit on the term insurance policy.

4. Eliminating temporary loss of ADLs can be an important risk control. Temporary loss of ADLs claims are not consistent with the reduced life expectancy that is assumed in the discounted face amount of chronic illness acceleration riders.

The following answers with well explanation will also receive credit:

- Exclusion clause can be expanded
- Limiting both annual and maximum acceleration amounts
- Requiring an approved licensed health care practitioner certifies that the policyholder is unable to perform the ADLs
- Reinsurance

(c) Evaluate the appropriateness of each of the following statements with respect to IRC Sections 7702B and 101(g) for the chronic illness rider:

A. Both tax sections require the same benefit trigger of at least 2 out of 6 ADLs or cognitive impairment and certified as chronically ill by a certified health care practitioner.
B. Both tax sections require nonforfeiture benefits.
C. Section 101(g) offers favorable treatment for the chronic illness rider because section 101(g) treats the benefit as a tax-free life insurance death benefit, while section 7702B treats it as a taxable accident and health benefit.
D. Under section 7702B, a chronic illness rider benefit is not included in the guideline premium calculation, whereas under section 101(g) it is included.

Justify your answer.

Commentary on Question:
More than half of candidates were able to correctly evaluate the appropriateness of at least 3 out of 4 statements. Partial credit was awarded if candidates only provided True/False without justification. Some candidates stated 7702B or 101(g) requires licensed health care practitioner but not physicians or vice versa. However, licensed health care practitioner includes any physicians.

8. Continued

Statement A:

True, the benefit trigger that must be met as a condition to receive beneficially taxed chronic illness benefits is the same as for qualified LTCI. The insured must be certified as chronically ill by a licensed health care practitioner.

Statement B:

False, only 7702B requires nonforfeiture benefits and 101(g) does not.

Statement C:

False, both 7702B and 101(g) provide tax-free benefits of the product after onset of the insured chronic illness.

Statement D:

False, chronic illness rider benefit fits under 7702B and 101(g) are considered as non-QABs. The definitional limitations apply to the life insurance contract only. Therefore, non-QAB has no effect on guideline premium or 7-pay premium calculation.

9. Learning Objectives:

1. The candidate will understand various insurance products, markets, and regulatory regimes.

2. The candidate will understand the relationship between product features, inherent risks, and the methods and measures to design and price products.

Learning Outcomes:

(1a) Describe insurance product types, benefits, and features including reinsurance.

(1c) Construct, evaluate and recommend product designs that are consistent with market needs, tax and regulatory requirements, and company business objectives.
- Evaluate the feasibility of proposed designs. Recommend designs.

(2a) Identify, assess, and develop appropriate assumptions to reflect factors such as product characteristics, risks, policyholder behavior, and company actions.
- Describe and apply the uses of predictive modeling.

(2c) Develop and evaluate a product's performance, capital requirements, tax and regulatory requirements, and risk profile.

Sources:

Atkinson & Dallas, Life Insurance Products and Finance, Chapters 10, 11, 13

LP-132-15, Lapse Based Insurance, Gootlieb & Smetters, Apr 2014, pp. 1 - 24 plus Appendix A (pp. 29 - 30)

LP-107-07: Experience Assumptions for Individual Life Insurance and Annuities

LP-114-09: CIA Research Paper, Life Insurance Costing and Risk Analysis, June 2008

The Use of Predictive Analytics in the Development of Experience Studies - The Actuary 2015 vol12-iss4 pp. 26-34

CIA 2015 - Lapse Experience under UL Level COI Policies, Sep 2015, pp. 4 – 8

Commentary on Question:

Commentary listed underneath question component.

9. Continued

Solution:

(a)

(i) Calculate the profit margin. Show all work.

(ii) Calculate the value of new business. Show all work.

(iii) Assess the profitability of the UL product. Justify your answer.

Commentary on Question:

(i) Most candidates correctly identified that the investment earned rate should be used for the calculation of profit margin (PM). The most common error candidates made was using distributable earnings when solvency earnings should have been used to calculate the profit margin.

(ii) Generally candidates performed better on this part than (a)(i).

(iii) Candidates generally performed better at commenting on VNB than PM. Many candidates only mentioned that positive/negative metric indicated profitable/non-profitable. To receive full credit, the candidate needed to comment that the PM metric does not consider the cost of capital and that a negative VNB means that the product reduces shareholder value.

(i)

PV Premium @ 5% = 126*10.5 = 1323

Solvency Earnings
= Premium - Ben & Exp – Change in Solvency Reserve + Investment Income – taxes
= 1323-1230-330+340 = 103

PM
= Solvency Earnings / PV of Premiums at earned rate
= 103 / 1323
= 8%

(ii)

PV Premium @ 12% = 126*6.8=856.8

VNB
= PV of Distributable Earnings @ hurdle rate
= Solvency earnings – Change in Required Capital + Investment Income on required Capital
= 856.8-400-340+180-350+30
= -23.2

9. Continued

(iii)
The profit margin is positive and indicates that the expected premium inflows and investment income are greater than the expected costs over the life of the product when discounted at the expected return on assets. This indicates the product will contribute positive profits over the life of the product, ignoring any capital costs.

VNB result is negative. Product does not provide an IRR sufficient to meet the company's hurdle rate. This indicates that selling this product would decrease the value of the company.

(b) With regard to lapse assumptions:

(i) Explain why this product is lapse supported. Justify your answer.

(ii) Recommend changes to the lapse assumption for this product. Justify your answer.

Commentary on Question:
For part (i), the most common error was that instead of answering why this product is lapse-supported as instructed in the question, candidates provided only a definition of lapse-supported product. Most candidates who answered the question discussed the level COI charges in relation to increasing mortality. To receive full credit, the candidate needed to also mention other possible drivers that could make the product lapse-supported.

For part (ii), candidates generally performed better than part (i). Most candidates listed multiple ways to improve the lapse assumption, but many did not justify their recommendations as the question specifically asked.

Part (i):

- Most policies have premiums that are level over the life of the policy, while mortality risk is increasing. Therefore, policyholders "overpay" relative to their mortality risk early into the life of the policy in exchange for receiving a discount later. This creates front-loaded profits.
- Upon surrendering these contracts prior to death, the cash value paid to the policyholder is smaller than the reserve release.
- The commissions of insurance brokers typically last between 3 and 10 years, with the bulk of the payment made in the first year. Insurance brokers, therefore, are relatively more incentivized to find clients that will make payments for at least a couple years but do not necessarily persist too long.

9. Continued

Part (ii):

- Lapse rate is too high; recommend lowering the lapse rate. The industry experience suggests 4% is too high of a lapse rate. Ultimate experience is in the 1-2% range.
- Lapse rate should vary by duration. Recommend decreasing lapse rates over the policy years.
- Experience shows lapse rates vary by policy size. Small policies tend to have high early duration lapses. Large policies tend to have higher late duration lapses. Recommend varying lapse rates by policy size given the considerable range this product allows.
- Experience shows lapse rates tend to decrease with issue age. Recommend varying lapse rates by age, given the considerable range the product covers
- Recommend varying lapse rates by gender as males tend to lapse more than females.
- Recommend varying lapse rates by risk class as smokers tend to lapse more than nonsmokers
- Other acceptable answers include: funding level, level of guarantees, surrender charge period, level of crediting rates vs. market

(c) Describe the advantages of using predictive models to set experience assumptions.

Commentary on Question:
Most candidates performed fairly well on this part. The most common error was focusing on listing operational differences of predictive modelling (e.g., run time) rather than commenting on the advantages of the actual analysis and data being generated. Candidates who also listed disadvantages of predictive modeling did not receive credit for the disadvantages, because that was not what the question asked.

- Provides better insight into the interaction of various factors and allows for better use of available data.
- Isolates the true effect of each factor, standardizing the effect of all other factors in the model.
- Allows one to introduce new factors and evaluate their impact without having to rely on traditional A/E results for increasingly smaller blocks of business, which would not be credible.
- Allows use of statistical tests to back up decisions made in the modelling process.

9. Continued

(d) You are asked to analyze two pricing cells:

Cell A: Male, Smoker, Issue Age 40
Cell B: Female, Non-Smoker, Issue Age 65

Assess the profitability of each cell using the predictive lapse assumption relative to the original lapse assumption. Justify your answer.

Commentary on Question:
For the calculation part of this question, the most common error was omitting the duration factor in the formula.

For the assessment part of this question, some candidates compared lapse rates of cell A to B or compared the calculations to the 3% base lapse rate, rather than the 4% original assumption as the question specified.

Cell A:
Duration 1-10 = 3% * 150%*120%*110% = 5.94%
Duration 11-20 = 3% * 150%*120%*90% = 4.86%
Duration 21+ = 3% * 150%*120%*90% = 4.86%

Overall, predictive model produces lapse rates >4% flat originally assumed.
Product is lapse supported, so the profitability will look slightly more favorable with the predictive model.

Cell B:
Duration 1-10 = 3% * 90%*90%*110% =2.67%
Duration 11-20 = 3% * 90%*90%*90% =2.19%
Duration 21+ = 3% * 90%*90%*90% =2.19%

Overall, predictive model produces lapse rates far below 4% flat originally assumed.
Product is lapse supported, so the profitability will look much less favorable with the predictive model.

10. Learning Objectives:

1. The candidate will understand various insurance products, markets, and regulatory regimes.

2. The candidate will understand the relationship between product features, inherent risks, and the methods and measures to design and price products.

3. The candidate will understand actuarial requirements of product governance, implementation, operations, and management.

Learning Outcomes:

(1a) Describe insurance product types, benefits, and features including reinsurance.

(2b) Assess and critique performance measures, risk measures, and modeling approaches. Recommend their uses in product management.

(2c) Develop and evaluate a product's performance, capital requirements, tax and regulatory requirements, and risk profile.

(3b) Apply practices related to product management.

- Describe how to monitor and evaluate actual experience such as benefits, persistency, and utilization including the use of experience studies and supplementary data sources.
- Describe and assess practices related to data quality.
- Recommend changes to non-guaranteed elements such as credited rates and policyholder dividends.

(3c) Design and evaluate product management strategies. Recommend the product strategy.

Sources:

LP-144 – Capital Cash Shareholder Value and Active In-Force Management

Life Insurance Products and Finance Chapter 11

LP-143 – PwC, Breaking the Ice – Using Transparency to Thaw the Securitization Market

LP-138 – International Association of Insurance Advisors Global Insurance Market Report

Commentary on Question:

Overall, candidates performed well on this question. However, some candidates appeared to run out of time to complete the entire question and left parts of the question blank.

10. Continued

Solution:

(a) For the following:

- Return on Investment
- Embedded Value
- Return on Equity
- Profit Margin

Identify the two metrics that are the most useful in optimizing shareholder value. Justify your answer.

Commentary on Question:
Most candidates were able to identify one of the two metrics. Stronger candidates were able to earn full credit by identifying both metrics and providing justifications of why these two are useful in optimizing shareholder value.

Return on equity – capital is considered which helps to show how effectively capital is utilized. Good for all types of products (including annuities and investment products)

Embedded value – present value of future profits discounted at a hurdle rate which reflects a rate of return expected by company owners and which should be in line with the company's weighted average cost of capital. Embedded value helps to identify poor value blocks of business that need to be addressed.

(b) Rank the treaties in the order of shareholder value. Show all work.

Commentary on Question:
Some candidates provided profit margin and its calculations as part of their response. Partial credit was given to candidates who successfully calculated the profit margin. Most candidates received full credit by providing the correct ranking with justification. Alternative rankings with reasonable justification were also given credit.

ROE = Current period after-tax stockholder earnings ÷ equity

A = 5 ÷ 350 = 1.4%
B = 2 ÷ 250 = 0.8%
C = 20 ÷ 400 = 5%
D = -5 ÷ 600 =-0.8%

10. Continued

Recommended ranking (based on ROE): C, A, B, D

EV (as shown in the question)

A = 30
B = 0
C = 50
D = -30

Recommended ranking (based on embedded value): C, A, B, D

Justification:
C has the strongest overall metrics
A has positive EV and the second highest ROE
D destroys value (has negative EV) and has a negative ROE
B fits between A and D

(c) The mortgage securitization market grew rapidly from 1980 to 2000 but the 2008 financial crisis caused the value of these securities to drop.

You are given the following statements regarding the securitization crisis:

A. Lenders were reluctant to securitize large numbers of subprime mortgages as the lenders often retained much of the risk after the mortgages were securitized.
B. Investors commonly performed detailed independent analysis to evaluate the risk and performance of structured securitization products.
C. Securitization structures became more complex over time and were untested under economic stress conditions.
D. In response to the crisis, U.S. regulators did very little to increase retention, capital, or disclosure requirements for issuers of securitized products.

Critique the accuracy of each statement.

Commentary on Question:
In general, candidates performed well on this section. Most candidates received full credit.

A. This statement is false. Lenders had minimal risk once the mortgages were securitized, so lenders securitized a large portion of the subprime loans they originated.

10. Continued

B. This statement is false. In many cases, investors could not or did not independently evaluate the risk or performance of their structured products.

C. This statement is true.

D. This statement is false. Various regulations were put into place, such as Dodd-Frank which imposed new requirements on securities and required additional disclosures.

(d) Compare and contrast a catastrophe bond and a mortgage backed security.

Commentary on Question:
Most candidates did not perform well for this part of the question. Some candidates simply defined each security and received partial credit. Other candidates were able to compare one or two features to earn additional credit.

Differences:

- Catastrophe bonds are less aligned with market movements than mortgage-backed securities
- Mortgage-backed securities have consumer prepayment risk unlike catastrophe bonds, which may include a variable reset structure providing the cedent with an option to adjust some of the key risk variables of the coverage
- Mortgage-backed securities generally carry a higher risk of default compared to catastrophe bonds
- The average risk period for catastrophe bonds has been increasing, but remains generally shorter than that of mortgage-backed securities

Similarities:

- Both are securitizations (examples of packaging risk and selling it away)
- Both securities provide investors a higher-yielding alternative to government/corporate bonds
- Both securities provide diversification as an alternate asset class
- Both securities are generally riskier assets compared to bonds