AFE Complete Illustrative Solutions

Spring 2009

1. Learning Objectives:

2 – Describe basic accounting concepts used in producing financial statements
2 – c. Describe economic measures of value and their uses in corporate decision-making

Source: Damoradan, Strategic Risk-Taking, 2006 – Ch. 9, Risk Management: The Big Picture

Grader comments: Generally no points are allocated for answers that are irrelevant or inconsistent to information provided within the case study.

Solution:

(a)(i) Describe the Value of Equity and the Value of Firm. Compare these two measures for Zoolander. (more points allocated when related to Zoolander).

- For Zoolander Value of Equity = Value of Firm
- Zoolander has no debt financing therefore Cost of Equity = Cost of Capital
- Zoolander has no debt financing therefore Cash flow to firm = Cash flow to Equity
- Value of Equity
  - Σ Cashflows to equity/(1 + Cost of Equity)^t
  - Cashflow to equity is the CF left over after debt payments and after taxes
- Value of Firm
  - Σ free Cashflows to firm/(1 + Cost of Capital)^t
  - Cashflow to firm is CF left over after taxes but before debt payments
  - The formula can be reduced by adding Terminal Value of business to finite NPV
  - The Terminal Value is approximated by CF_{N+1}/(CoC - constant growth rate)

(a)(ii) Explain how risk is typically reflected in the calculation of these measures

- Risk is reflected in discount rate
- Cost of Equity increase with exposure to market risk
- Cost of Equity is unaffected by exposure to firm-specific risk.

1. Continued

(b) Explain the four drivers of DCF value

- Cashflow to firm
  - Generated from existing assets
- Expected Growth from new investments
  - Equal Reinvestment Rate × Return on Capital
  - Return on Capital = EBIT*(1 – tax rate)/Capital Invested
- Length of the Excess Return/High Growth Period
  - The stronger the barriers to entry, the longer a firm can stretch its excess return
- Discount rate
  - Discount rate reflect riskiness of investment

(c)(i) For each of the three possible actions (I, II, III) above: Explain the impact on each of the four drivers of DCF value identified in part (b). (more points allocated when related to Zoolander)

- Zoolander has no debt, therefore Cost of Capital = Cost of Equity and distress cost does not impact the company
- For Zoolander since held by widely investors, no impact on Cost of Equity for hedging firm-specific risk

Strategy I – YRT

- Cashflow ⇒ For Zoolander reduces cashflow since paying for YRT premiums
  - However, the cashflow may be offset by tax effects from smoother earnings
- Expected Growth ⇒ For Zoolander no impact
- Length of Excess Return ⇒ For Zoolander no impact
- Discount Rate ⇒ For Zoolander can decrease discount rate since risk of company may be reduced

Strategy II – Reinsurance

- Cashflow ⇒ For Zoolander reduces cashflow since paying premiums for reinsurance
- Expected Growth ⇒ For Zoolander increases growth since more new business capacity
- Length of Excess Return ⇒ For Zoolander increases period since more capital for investing
- Discount Rate ⇒ For Zoolander can increase discount rate since more inforce creating more earnings volatility

Strategy III – 3rd party administrator expenses

- Cashflow ⇒ For Zoolander reduces cashflow since higher expense due to 3rd party administrator
- Expected Growth ⇒ For Zoolander, no impact on expected growth
- Length of Excess Return ⇒ For Zoolander, no impact on excess return
- Discount Rate ⇒ For Zoolander, since firm-specific risk no impact on discount rate

(c)(ii) For each of the three possible actions (I, II, III) above: Explain the impact on Value of Firm. (in order to get points need appropriate reasoning for answer).

1. **Continued**

Strategy I
Zoolander value generally decreases because even though the discount rate may decrease this is offset by CF ↓ and no impact on excess growth and length period.

Strategy II
Zoolander value generally increase because Growth ↑ and Length ↑, Discount does not change, therefore offsetting the ↓ CF.

Strategy III
Zoolander value generally decrease because CF ↓, Growth no impact, Length no impact, Discount no impact

(c)(iii) Explain whether the action hedge firm-specific risk or market risk, or is a general management activity.

Strategy I
- Risk Hedging – since caps death benefit claims for Zoolander for a fee
- Market Specific – For insurance company, this is a market risk because many ways to decrease risk (securitization, cat bonds)

Strategy II
- Risk Management – This activity for Zoolander is trying to optimize their strength.

Strategy III
- Risk Hedging – since cap expenses for Zoolander for a fee
- Firm Specific – because no general market solutions for expenses

Comments
General
(a) Some students mistakenly assumed that YRT reinsurance provides significant surplus/reserve relief.
(b) Some students discussed impacts of bankruptcy / distress, even though Zoolander has no debt.

1. Continued

Question Specific

1(a)(i) Only partially answered by most candidates. Only a very few candidates compared the two measures for Zoolander. Candidates could have scored many more points if they had answered in the context of Zoolander's firm value.

1(a)(ii) Generally, candidates explained adequately the impact of risk on discount rate.

1(b) Most provided a general list of drivers, but candidates would have scored more had they provided more details for each driver.

1(c)(i) Explanations are only partial. This impacts 1(c)(ii).

1(c)(ii) This proved difficult for many because it required an understanding of 1(c)(i). Only a few produced all explanations.

1(c)(iii) Most candidates identified the main components for each strategy. The question was asking for a higher form of cognitive reasoning than just memorizing a list. Many candidates had a low score on this part.

2. Learning Objectives:

3 – f. Describe how derivatives, synthetic securities, and financial contracting may be used to manage interest rate risk, including key rate risks
- Contrast modified duration and effective duration measures
- Calculate effective duration and effective key-rate durations of a portfolio
- Explain the concepts of immunization including modern refinements and practical limitations

Solution:

(a) 3 forms of interest rate risk exposure (source: FE-C128-07)

Mismatch risk – a mismatch in the timing of asset cash flows relative to GIC cash flows requiring either reinvestment or disinvestment by Zoolander
- Reinvestment risk is characterized by liability CFs that are "longer" than asset CFs
- Disinvestment is characterized by liabilities "shorter" than assets
- Zoolander has significant mismatch risk as it has "lengthened the term of its assets dramatically"

Yield Curve risk – arises when anticipated shifts, changes in the slope and shape of the YC, have adverse effects on Z's income or underlying economic value
- Zoolander only uses Macaulay duration so is definitely exposed to YC risk

Option risk – assets can contain call or prepayment options and liabilities can contain put options
- Zoolander's public bond holdings include CMO's which have prepayment options that are likely to be exercised when rates are unfavorable for the GIC products

Basis risk – arises from imperfect correlation in the adjustment of the rates earned and paid on different instruments with otherwise similar repricing characteristics

Note – Candidates only get points for the first 3 risks included in the answer since the question only asked for 3. There were numerous grading points associated with Zoolander details in the case study so candidates that included reference to Zoolander in their answer were able to score more points.

(b) Chain of events that follows upward spike in market interest rates (source: FE-C128-07)
- Increase in rates causes asset market values to decrease
- Competitors able to increase new business crediting rates due to higher market rates
- Zoolander experiences increased surrenders at book values as policyholders want to move their money to a GIC paying a higher interest
- Zoolander must liquidate assets at losses to fund surrenders

2. Continued

(c) Limitations of Macaulay Duration (source: FE-C128-07)

- Not accurate for large changes in interest rates
- Assumes parallel shift in yield curve which is not realistic
- Does not work if the cash flows are sensitive to changes in interest rates (i.e., optionality in CFs)
- Duration matching requires rebalancing the asset portfolio frequently which can be costly

(d) Calculate effective duration (source: FE-C127-07)

- Asset effective duration $= 0.2 + 0.3 + 1.2 + 1.5 + 1.5 = 4.7$ years
- Liability effective duration $= 0.1 + 0.2 + 0.9 + 3.5 + 0 = 4.7$ years

(e)(i) Calculate change in surplus for curvature shift (Source: 8V-115-00)

$\text{Surplus} = 6.8\text{M} - 6.6\text{M} = \$200,000$

$\text{Asset Value Change} = (2\% \times -0.2) + (1\% \times -0.3) + (0\% \times -1.2) + (1\% \times -1.5)$
$+ (2\% \times -1.5) = -0.4\% - 0.3\% - 0 - 1.5\% - 3.0\% = -5.2\%$

$\text{Asset Value} = (1 - 0.052) * 6.8\text{M} = 0.948 \times 6.8\text{M} = \$6,446,400.$

$\text{Liab Value Change} = (2\% \times -0.1) + (1\% \times -0.2) + (0\% \times -0.9) + (1\% \times -3.5) + (2\% \times -0.0)$
$= -0.2\% - 0.2\% - 0 - 3.5\% - 0 = -3.9\%$

$\text{Liab Value} = (1 - 0.039) * 6.6\text{M} = 0.961 \times 6.6\text{M} = \$6,342,6003$

$\text{Surplus} = 6.4464 - 6.3426 = \$103,800$

(e)(ii) Calculate change in surplus for steepening shift (source: 8V-115-00)

$\text{Asset Value Change} = (2\% \times 0.2) + (1\% \times 0.3) + (0\% \times 1.2) + (1\% \times -1.5) + (2\% \times -1.5)$
$1.5\% - 3.0\% = -3.8\%$

$\text{Asset Value} = (1 - 0.038) * 6.8\text{M} = 0.962 \times 6.8\text{M} = \$6,541,600.$

$\text{Liab Value Change} = (2\% \times 0.1) + (1\% \times 0.2) + (0\% \times 0.9) + (1\% \times -3.5) + (2\% \times$
$-0.0) = 0.2\% + 0.2\% + 0 - 3.5\% - 0 = -3.1\%$

$\text{Liab Value} = (1 - 0.031) * 6.6\text{M} = 0.969 \times 6.6\text{M} = \$6,395,400.$

$\text{Surplus} = 6.5416 - 6.3954 = \$146,200$

(f) Zero-coupons to match liabilities (source: 8V-115-00)

$W(1) = 0.1/1 = 0.1$, Buy $(0.1 \times 6.6\text{M}) = \$0.66\text{M}$ 1-yr strips

$W(2) = 0.2/2 = 0.1$ Buy $(0.1 \times 6.6\text{M}) = \$0.66\text{M}$ 2-yr strips

$W(3) = 0.9/3 = 0.3$ Buy $(0.3 \times 6.6\text{M}) = \$1.98\text{M}$ 3-yr strips

$W(5) = 3.5/5 = 0.7$ Buy $(0.7 \times 6.6\text{M}) = \$4.62\text{M}$ 5-yr strips

$W(10) = 0/10 = 0$ Buy $\$0 \times 6.6\text{M} = \$0$ 10-yr strips

$W(0) = 1 - (0.1 + 0.1 + 0.3 + 0.7 + 0) = 1 - 1.2 = -0.2$ Cash $= -0.2 \times 6.6\text{M} = \$ - 1.32\text{M}$

$\text{Total} = (0.66\text{M} + 0.66\text{M} + 1.98\text{M} + 4.62\text{M} + 0\text{M} - 1.32\text{M}) = 6.6\text{M} = \text{Liabs}$

2. Continued

(g) Zero-coupons to match assets (source: 8V-115-00)

$W(1) = 0.2/1 = 0.2,$ Buy $(0.2 \times 6.8\text{M}) = \$1.36\text{M}$ 1-yr strips

$W(2) = 0.3/2 = 0.15$ Buy $(0.15 \times 6.8\text{M}) = \$1.02\text{M}$ 2-yr strips

$W(3) = 1.2/3 = 0.4$ Buy $(0.4 \times 6.8\text{M}) = \$2.72\text{M}$ 3-yr strips

$W(4) = 1.5/5 = 0.3$ Buy $(0.3 \times 6.8\text{M}) = \$2.04\text{M}$ 5-yr strips

$W(5) = 1.5/10 = 0.15$ Buy $\$0.15 \times 6.8\text{M} = \$1.02\text{M}$ 10-yr strips

$W(0) = 1 - (0.2 + 0.15 + 0.4 + 0.3 + 0.15) = 1 - 1.2 = -0.2$

Cash $= -0.2 \times 6.8\text{M} = -\$1.36\text{MM}$

Total $= (1.36\text{M} + 1.02\text{M} + 2.72\text{M} + 2.04\text{M} + 1.02\text{M} - 1.36\text{M}) = 6.8\text{M} = \text{Liabs}$

1 yr strips: Assets 1.36M; Liabs 0.66M	Sell 0.7M 1 yr strips
2 yr strips: Assets 1.02M; Liabs 0.66M	Sell 0.36M 2 yr strips
3 yr strips: Assets 2.72M; Liabs 1.98M	Sell 0.74M 3 yr strips
10-yr Strips: Assets 1.02M; Liabs $0M	Sell 1.02M 10-yr strips
Cash: Assets – 1.36M; Liabs – 1.32M	Buy 0.04M Cash

(h) 3 principles (source: FE-C129-07)

Have interest rate risk measurement systems that capture all material sources of interest rate risk

Establish and enforce operating limits

Measure its vulnerability to loss under stressful market conditions and consider those results when establishing policies and limits for interest rate risk

Have adequate info systems for measuring, monitoring, controlling, and reporting interest rate exposures

Notes – Candidates only get points for the first 3 principles included in the answer since the question only asked for 3.

(i) 3 KRD advantages (source: FET-119-07)

- KRDs can identify the price sensitivity of an option-embedded asset/liab to each segment of the YC
- KRDs recognize that the YC movements is driven by multiple market factors
- KRDs can be used to create a replicating portfolio of a bond with embedded options using zero-coupon bonds

2. Continued

***Qualitative Commentary**:*

- *Candidates generally did OK on Part A but could have earned more points if they would have made more references to Zoolander. In many cases the responses were generic and had no relationship to Zoolander or the case study info.*
- *Most candidates did well on Parts B, C, and D. These were relatively easier sections that could be answered with list-type responses. The calculation on Part D was quick and easy so most candidates got full credit on that part.*
- *Parts E, F, and G included numerous calculations. In general, candidates that showed their work could get more partial credit since the grader could follow their thought process and identify where they went wrong.*
- *One common mistake for Part E was to miss the negative sign when calculating the impact from the KRDs.*
- *Candidates generally either did well on Part F & G or earned no points.*
- *Candidates did not do as well on Parts H & I as would have been expected. This may have been because they were the last 2 parts of a very long question.*

3. Learning Objectives:

3 – p. Define strategic risk
3 – q. Describe methods for managing this risk, both pre-event and post-event
3 – r. Understand examples of company disasters that were the result of these types of risks – what the exposure was, what occurred, the sequence of events, what actions management took, didn't take, and could have / should have taken, what the financial impacts and general consequences were

Solution:

(a) You are reviewing the preliminary Strategic Risk Map produced by Cobalt Management Consultants (CMC) and determining how it can be applied to the VA line.

(i) Identify the three risk categories in the Strategic risk Map that are most significant for Zoolander's VA product line and describe how each of these risks is present in the VA line.

(ii) Identify any countermeasures Zoolander is already taking to address these risks.

(iii) Recommend further measures Zoolander could take to counter these risks.

Source: (FE-C159-09, pp. 3-4)

(i) **(1) Industry Market Squeeze**
VA line profitability sagging
(ii) Countermeasure – Shift from competition to collaboration
Collaboration with mutual fund companies to use their offerings

(i) **(2) Customer Priority Shift**
Policyholders want more fund options
Policyholders want more guarantees
(ii) Countermeasure – continuous creation and analysis of proprietary information
Analysis of VA Writers Survey

(i) **(3) New-Project Failure**
Concerns about internal administrative and marketing challenges, as well as negotiating revenue sharing with fund companies
(ii) Countermeasure – employing the stepping stone method – creating a series of projects that leads from uncertainty
Adds on a few funds at a time, and only one family of funds at a time
(iii) Additional Countermeasure – Engage in smart sequencing.

Comment: Candidates performed best on this part of the question. When answering part (i) they didn't always elaborate more than just mentioning the risk.

3. Continued

(b) Identify and describe the next steps that Zoolander should perform to complete its Strategic Risk Management (SRM) process once the Strategic Risk Map is completed. Your response should be specific to Zoolander's situation.

Source – (FE-C159-09, p. 5)

Step 3 – Quantify your risks
- Risks should be comprehensively measured in a common currency (CF@risk; eco cap@risk; MV2risk)
- Zoolander will then be able to compare & aggregate the risks and link them to decisions regarding capital allocation, pricing, and risk transfer

Step 4 – Identify the potential upside for each risk
- What could happen if a key risk is reversed? Growth opportunity?

Step 5: Develop risk mitigation action plans
- For every major risk identified, there should be a team responsible for preparing a formal mitigation plan
- This document will outline the risk assessments made in earlier steps (nature of risk, root causes, % of MV affected, etc.) and assign responsibility for executing countermeasures
- The team will be multifunctional

Step 6: Adjust Zoolander's capital decisions accordingly
(i) Business units and certain major projects that face greater levels of risk may warrant a higher cost of capital
(ii) Zoolander may need to change its capital structure

Comment: Candidates could have done much better if they had done more than just list the major steps. A little more explanation of what the step entailed and relating it Zoolander's situation would have made a big difference.

(c) Differentiate the SRM practices relating to capital that would lead to each of the following S&P classifications in (I) through (IV). Based on Zoolander's capital management practices, determine the category in which Zoolander would likely fall. Justify your assessment.

Source: (FE-C171-07, p. 6)

I. Weak SRM
- Insurers who are concentrating their capital management activity on maintaining capital levels that are acceptable on a regulatory basis and/or to a rating agency's capital adequacy basis
- Zoolander appears to be focused on maintaining its favorable Kelly Ratings – Zoolander is at least Weak

3. Continued

II. Adequate SRM

- Insurers who have a somewhat more robust view of their risk capital through a full economic capital model or a generic risk capital model that has been significantly modified to reflect specific risk positions of the insurer that are not accurately captured by the general formulas
- Zoolander definitely is not doing Eco. Capital yet, and it currently unknown if the planned Eco. Capital initiative will be robust enough for Zoolander to be deemed Adequate

III. Strong SRM

- Insurer demonstrates, in addition to a process to ensure satisfying the constraints from regulators, rating agencies, and internal views of capital, they have a process for choosing and rejecting potential options that have higher or lower risk-adjusted returns
- The process of optimizing risk-adjusted return may be performed on a marginal basis for groupings of activities
- Zoolander would have to adopt a robust Eco. Capital system and assess activity on a risk-adjusted basis to become Strong

IV. Excellent SRM

- Insurers that have been practicing Strong SRM processes for multiple planning cycles and may be in $2^{nd}/3^{rd}$ stage of refinements to specific aspects of the process

Comment: Most candidates did poorly on this section. Capital management, particularly managing capital according to risk is the most significant determiner. Linking what Zoolander is or is not doing for each ranking would help significantly.

(d) Your Strategic Risk Analysis has identified a certain level of acceptable equity risk. Assume Kelly follows S&P's risk control process for the equity risk emanating from the VA line.

Describe how Kelly would evaluate Zoolander with respect to each element of that process

Source – (FE-C171-07, pp. 16-21)

(i) Risk identification

- Most favorable indicators – insurer is aware of equity market risks, product design risks, policyholder behavior risks, risk modeling, and financial reporting risks
- Zoolander would be viewed favorably since is at least aware of aforementioned risk, if not appropriately managing them

3. Continued

(ii) Risk monitoring

- Most favorable indicators – monitors risk indicators, such as benefits outstanding, ITM exposure, VaR, CTE, delta, gamma, vega, and rho; all on both hedged and unhedged bases
- Zoolander would be viewed between Favorable and Unfavorable, as monitors such items as CTE and ITM exposure

(iii) Risk limits and standards

- Zoolander would be viewed unfavorably, as don't have set specific quantitative limits

(iv) Risk limit enforcement

- Zoolander would be viewed unfavorably, as has ad hoc rebalancing

(v) Risk management

- Most favorable indicators – regular hedging program with complex model that measures retained risk and has disciplined trading guidelines for hedges; standards updated for emerging experience; full reinsurance for excess
- Zoolander would probably be viewed unfavorably because of ad hoc hedging program

(vi) Risk learning

- Most favorable indicators – dynamic hedging and adjust models/product for emerging experience
- Zoolander probably has a mixed review here – strongly monitors P/H behavior and adjusts models, but no real action plan

Comment: Most candidates did no more than list the major activities. If they would have mentioned how Kelly would rank Zoolander on each one, they would have performed much better.

(e)

(i) Identify elements of sound practices in New Product Risk Control identified by S&P.

(ii) Assess which, if any, of these have been demonstrated in the development of Zoolander's VA Plus Product.

(iii) Describe the pricing process Zoolander should follow for the VA Plus product in order to appeal to S&P from a strategic risk perspective, assuming Kelly agrees with S&P's approach.

Source – (FE-C171-07, pp. 30-31)

There are 4 elements in (i), and these are labeled (1) through (4)

(i) **(1) Risk identification and analysis of all risks attached to the product's primary and secondary benefits**

3. Continued

(ii) Zoolander has identified guarantees risk, but has not really performed a quantitative analysis
Zoolander has identified P/H behavior risk and is attempting to measure it via the VA Writers Survey

(i) **(2) Decide which risks to retain, depending upon risk profile and expertise**
- Define risk limits; use reinsurance or hedge strategies

(ii) Zoolander hasn't explicitly stated which risks they're going to retain,

(i) **(3) If decide to assume new risks, identify all situations where new risk control procedures would be needed**

(ii) Zoolander doesn't have risk control procedures

(i) **(4) Define investment strategy – don't deviate significantly from company's current investment profile**

(ii) investment strategy for VA's mostly revolves around guarantees using hedging
- Zoolander currently uses ad hoc approach, although plans for more robust systematic hedging

(iii) Model all identified risks using appropriate methodology for both the complexity of the risk and data available
- Probably need stochastic pricing for market risks embedded within guaranteed benefits
- Perhaps stress test mortality, expense and surrender risks

- Need to determine capital requirements of new product
  - VA RBC determined by C3 Phase 2
  - Better yet, Economic Capital at comfortable CTE/VAR
- Ongoing, post-implementation monitoring of performance
  - Compare pricing assumptions to actuals and make applicable future corrections
- Full involvement of local top management and all risk managers; designate risk manager for VA Plus
- Standardized decision making process which allows senior personnel to make informed decision whether to launch product or not
- Group risk management should give final signoff on VA Plus risk/return profile, valuation framework used in pricing (consistent),

Comment: Candidates did poorly on this part, perhaps because the answer was dispersed throughout the source. It is also important for the candidate to understand what is being asked, rather than just generally discussing the subject.

4. Learning Objectives:

2 – e. Define risk metrics to quantify major types of risk exposure in the context of an integrated risk management process
- Describe risk aggregation techniques incorporating the use of correlation
- Describe how and why risks are correlated, and give examples of risks that are positively correlated and risks that are negatively correlated
- Assess the overall corporate risk exposure arising from financial and non-financial risks

3 – p. Define strategic risk
3 – q. Describe methods for managing this risk, both pre-event and post-event
3 – r. Understand examples of company disasters that were the result of these types of risks – what the exposure was, what occurred, the sequence of events, what actions management took, didn't take, and could have / should have taken, what the financial impacts and general consequences were

Solution:

(a)(i) Assume Exponential distribution. Find expected loss, cte95 for risk 3, VaR90 for risk 2.

Expected loss
$(100 \times 3,000) + (0.5 \times 100,000) + (0.001 \times 2,500,000) + (0.0001 \times 25,000,000) = 355,000$

For CTE, determine Cumulative Distribution Function for exponential distribution
= integral from 0 to x of pdf $f(x)$
$= 1 - \exp(-x/2,500)$

Solve for x where $= 1 - \exp(-x/2,500) = 0.95; \quad x = 7,489$

Set up integral to find $E[X \mid X > 7,489]$

$= (1/0.05) \times \int x \ f(x)\, dx$

$= 20 \times [(-x \exp(-x/u)) - (\int -\exp(-x/u) dx)]$

$= 20 \times [(-x \exp(-x/u)) - (u \exp(-x/u))]$

$= 20 \times [(7489)(\exp(-7489/2500)) + (2500 \exp(-7489/2500))]$

$= 20 \times [374.5 + 125.0]$

$= 9990$

Using CDF derived above $1 - \exp(-x/50,000) = 0.90; \quad x = 115,129$

Grader notes: Many students mistakenly used Normal distribution from Part B to attempt Part A.

4. Continued

(b) Assume Normal distribution. Rank using COSO and actuarial approach based on CTE 95.

COSO rank based on expected loss

Risk	Expected Loss	Rank (worst is lowest)
1	300,000	1
2	50,000	2
3	2,500	3
4	2,500	3

The ranking is based on expected loss as calculated in Part A.i.

Actuarial approach based on CTE 95

Risk	1	2	3	4
Mu	300,000	50,000	2,500	2,500
Alpha	0.95	0.95	0.95	0.95
Sigma	25,000	50,000	75,000	100,000
z-95	1.645	1.645	1.645	1.645
Q-alpha	341,125	132,250	125,875	167,000
Phi(z)	0.1031	0.1031	0.1031	0.1031
CTE 95	351,555	153,111	157,166	208,722

Risk	CTE 95	Rank (worst is lowest)
1	351,555	1
2	153,111	4
3	157,166	3
4	208,722	2

(c) Recommend an approach, identify strengths and weaknesses of each.

I recommend actuarial approach.

- Starting point of COSO is interviews from business managers (don't know about risk)
- Business manager expected to know relative probability of each risk event (often major difference between perception and reality)
- COSO usually results in huge catalog of risks, very difficult to prioritize
- Worst case outcome is usually low probability, high impact (COSO not adept at identifying such risks)
- COSO produces both false positives and false negatives/student provides example of this
- COSO tries to determine a finite number of risks, when actually a distribution of results can occur. The full set of losses should be considered as per actuarial approach.

4. Continued

- COSO considers likelihood impact approach (mean aggregate loss) whereas the real measure of risk is the unexpected aggregate loss which is better reflected in CTE measure/actuarial approach.
- Implementing COSO takes a huge effort, produces spurious and misleading results
- May focus attention on phantom risks rather than real risks
- Highly conceivable COSO approach could lead to too many controls where fewer needed, and ignore a weakness
- Distribution (actuarial approach) is better as it looks at expected and unexpected losses

Grader notes: Don't forget to recommend an approach.

(d)(i) Assess zero tolerance approach, propose alternative.

Zero tolerance is unachievable (and cost prohibitive).
I do not recommend the zero tolerance approach.
I would recommend approaching it from a cost benefit analysis.
Look to optimize the risk control relationship in the context of a cost benefit analysis.
The company has to be realistic in establishing a level of risk and loss tolerance.

(e)(i) Explain the difference between expected and unexpected/how to manage

COSO looks at total expected loss, and ignores unexpected.
The expected loss is the total amount of money one expects to lose in a year on average, and the unexpected loss is the total amount of money one could lose in a very bad year (or a specified confidence interval) in excess of the average.
You should be more concerned about the unexpected.

(e)(ii) Ways to manage for unexpected risks/how to best manage:

Risk managers must provide business managers with objective info to determine where risks are
Help managers understand how well these risks are currently being managed
Determine what level of controls is appropriate after looking at costs and benefits of each mitigation strategy.
Institute a comprehensive and transparent monitoring and reporting process with built in incentives to encourage the right behaviors.

4. Continued

(f) Advise BU managers on using historical data.

History not always a good predictor of future
Should consider/allow for things that have never occurred before (Black Swans)
Should not take your models as being "perfect" or comprehensive
The potential impact from such events can be catastrophic
Such events often have retrospective predictability.

Grader notes (Overall comments): Students did fairly well for the most part. Many seemed to focus more on the calculations, while others skipped to Part C. Students more commonly finished the exponential distribution, but few complete the normal distribution calculations.

5. Learning Objectives:

5 – e. Describe how ERM is able to contribute to shareholder value creation. Describe how the performance of a given firm or venture may be evaluated against its objectives including total returns.

Solution:

(a)(i) Calculate the market value of BCC using the cross-sectional approach.

Total market value of assets = 1,050
Total market value of liabilities = 850
Cross-sectional value of equity = Total Market value of assets – Total market value of liabilities – 200

(a)(ii) Calculate the market value of BCC using the longitudinal approach.

Discount factor = D = (1 – annual probability of reorganization)/(1 + risk-free rate)
$D = (1-5\%)/(1+5\%)$
$D = 0.904762$
g = annual growth rate = 7%
After-tax value of firm = (After-tax net income) $\times(D/[1-(1+g)\times D])$
After-tax value of firm $= 9.08\times 0.904762/[1-(1.07)\times 0.904762]$
After-tax value of firm = 257.49

(b) Compare the values obtained in (a) and explain any differences.

The longitudinal value is greater.
Longitudinal value is greater because it implicitly includes franchise value (the value of future business/renewals).
Cross-sectional value is understated and an inappropriate way to measure the value of the firm as a going-concern.
Expect stock price to trade above the value directly suggested by publicly available financial statements, assuming a positive franchise value

(c) Critique the use of a risk-free rate in a longitudinal valuation model.

Used the risk-free rate in part B because this is what the Panning model uses.
Risk-free rate is only appropriate if there is no probability of default/reorganization (i.e. if the company is risk-free).
Risk-free rate is generally inappropriate.
Risk must be accounted for somewhere:
Either adjust the survival probability to a risk-neutral measure or use a risk-adjusted discount rate.
Use of a risk-free rate with real-world probability will result in overstatement of the firm's market value.

6. Learning Objectives:

4 – f. Understand the perspectives of regulators, rating agencies, stock analysts, and company stakeholders and describe how they evaluate the risks and the risk management of an organization).

This question required candidates to understand the AM best Rating methodology specifically BCAR. In order to score well, the candidate needs to be able to interpret the chart and understand the risk assessment for any effective ERM program.

Solution:

(a) Describe the BCAR tool and identify its strengths and weaknesses

Notes: Candidates did not describe the BCAR tool in detail. Also most of the candidates did not clearly state the strength and weakness of the BCAR tool

Quantitative tool allowing Best to differentiate between companies
Indicates whether capital is appropriate for rating
Best's allows lower capital levels (for better ERM) or requires higher capital levels (for worse ERM) relative to risk management profiles
Shows Strong vs. Weak risk management based on position of graph

Strengths
Measures if capital is appropriate for rating level
Assesses balance sheet strength
Analyzes risk management to link balance sheet strength, operating performance, and business profile

Weakness
Credit is given for a strong EC model, but it takes time to gain confidence and earn meaningful credit
Doesn't currently incorporate stochastic modeling
Not a sole measure of ERM
BCAR itself provides only one view of capitalization, public financial statements

(b) Indicate the conclusions you can draw based on graph

Notes: Half of the candidates did not interpret the graph correctly. Candidates assumed that a higher position on the graph indicated a better ERM strategy, not understanding that a higher BCAR meant that the company was required to hold more capital, indicating worse ERM.

ABC has weaker risk management; XYZ has stronger risk management
ABC has higher relative exposure to volatility; XYZ has lower relative exposure to volatility
ABC has a lower rating from A.M. Best; XYZ has a higher rating

6. Continued

ABC must maintain a higher level of required capital (BCAR) than XYZ, even when volatility exposure is low
ABC's capital requirement increases at a faster rate than XYZ's as volatility exposure increases

(c) Key risks assessed through an effective ERM program

Notes: Candidates scored well on this part.

Credit Risk: default, downgrade, disputes, settlement lag, concentration, regulatory
Market Risk: currency, concentration, reinvestment, liquidity, ALM, interest rate sensitivity
Underwriting Risk: process, pricing, severity, lapse, mortality, morbidity, environment
Operational Risk: reporting, legal/monetary controls, distribution, IT systems, training, turnover, data capture
Strategic Risk: competition, demographic change, negative publicity, downgrade, regulatory/political, tech

(d) Identify five future events/trends that could affect a company's ERM strategy

Notes: Most candidates did not demonstrate any knowledge for this section. Most candidates did not list out five events.

Regulation change, i.e. Principles-based solvency
Catastrophic losses: terrorism, bird flu, hurricane
Equity and credit market declines with record-low interest rates
Policyholder-based risks
Emerging Risks (not known)

7. Learning Objectives:

3 – s. Define operational risk
3 – t. Describe methods for managing this risk, both pre-event and post-event
3 – u. Understand examples of company disasters that were the result of these types of risks – what the exposure was, what occurred, the sequence of events, what actions management took, didn't take, and could have / should have taken, what the financial impacts and general consequences were

Solution:

Writer Notes: Students with top scores on this section were able to identify the first 4 items on the grading outline.

(A) FV reporting differences from GAAP

- FV reporting is fully prospective/GAAP is retrospective
- There is no DAC, capitalization of expenses or amortization with FV
- FV assumptions are dynamic/can change upon each valuation date
- GAAP assumptions are locked in (SFAS60)/unlocked periodically (SFAS97)
- GAAP is concerned with emergence of earnings
- GAAP matches expenses to revenues (through amortization)
- FV is concerned with asset and liability statement (less so with emergence of earnings)
- FV earnings emerge as risk is released
- FV liability values highly sensitive to assumptions
- FV allows discount for interest on future P&C claims/GAAP does not (no points, not a Marlin Life product)

Writer Notes: Students with top scores on this section were able to identify the 3 main points: disclosure, consistency and guidance. Please note the question was to answer motivation and impact of FAS157 and not fair value accounting

(B) Motivation and impact of SFAS 157

- SFAS 157 does not require any new FV measurements
- (Motivation) SFAS 157 was issued to:
  - Bring consistency to previous FV statements which differed
  - Provide more guidance in area of FV reporting/limited guidance before
  - Requires expanded disclosure about FV measurements
- Impact of SFAS 157 to current practice:

(a) Definition of fair value

- Retain exchange price notice of FV
- Exchange price clarified to mean price at which reporting entity would transact in orderly market
- Price received (not sale price)

7. Continued

(b) Methods of valuation

- FV is defined as a market based measurement hence use market assumptions
- Discussion on when to use market data and what to do when such data is unavailable
- FV should be risk calibrated
- FV should include reporting entity credit risk consideration

Writer Notes: Many students were able to list the 3 levels in the JWG hierarchy; but many students did not describe the levels.

(C) Discuss three main decisions/steps

Determine Fair Value Method (3 Approaches/Methods)

1. Market Value (2when available)
2. Market Value of Similar Instruments
3. Present Value of Cash Flows (if no market data exists)
    - Very Flexible approach
    - Can be adapted to reflect value of risk and uncertainty
    - Determine what rate to discount Cash Flows
        i) Risk Free Rate
            – Risk Free, Risk-Free Spot Rate Curve
            – This would be the Default Free Rate
            – Risk Free Rate does not truly exist (may be inflation and opportunity risk)
            – Alternative – use as a dividing line (alternate scenario)
        ii) Include Risk Adjustment in market price of risk
            – Discount rate below RF, leads to positive risk adjustment (ins. Contracts)
            – Discount rate above RF, leads to negative risk adjustment (bond market)
            – Use Option Pricing Techniques; discounted PV's under a larger number of scenarios for future int. rates (weighted probabilities)
            – Adjust actual cash flows being discounted
            – Use cash flows other than the average cash flows

Determine the Risk Adjustment, Calibration of Risk Adjustments

1. The Cost of Capital Approach
    - Treats all risks at once
    - Insurers require a return on capital to compensate for risk
    - Relationship between return of capital and level of risk can be used to determine risk adjusted value of liability
2. The Option Pricing Approach
    - Applied to individual Risks
    - PV of cash flows is determined under many future alternative scenarios
    - Weights are applied to each scenario for outcome

7. Continued

Writer Notes: Many Students were able to list the 3 levels in the JWG hierarchy; but many students did not describe the levels.

Determine Credit Risk

Credit Risk (Pros)

- Fair value of assets is reduced because the asset provider may default on asset
- If no credit risk, company could buy back debt and issue more at market value (without credit risk)
- Fair value will reflect price that owner can walk away, thus credit risk is needed.
- Bonds are the larger liabilities on insurers books
- There is no compelling reason why ins. Liabilities should be treated differently than other

Credit Risk (Cons)

- Firms earnings go up, when credit ratings go down (liabilities go down)
- Asset valuations do not reflect credit standing
- Insurance liabilities are different than other liabilities insurers can't sell right away
- Not adjusted liabilities reflect the company better, purchaser would have own credit standing
- Guarantees make credit rating insignificant

Writer Notes: Many students were able to identify the key advantages and disadvantages. Few students made a recommendation and supported the recommendation with reasons.

(D) Computation of FV of Liability and NOG

Writer Notes: Many students were able to identify the formula and calculate the rate. Top marks were received for calculating the cash flow, liabilities and net gains. Very few students calculated values past t = 1. No student calculated the Capital or net income.

Liability Cash Flows				
Premium (Given in Question)	250.00	–	–	–
Expense (Given in Question)	70.00	5.00	5.00	5.00
Claims (Given in Question)	–	60.00	60.00	60.00
Net Cash Flow	180.00	(65.00)	(65.00)	(65.00)

From question				
R_a	5%			
e	7%			
R_e	12%			
t	0%			

7. Continued

$rl = rA - (e \times (rE/(1-t) - rA))$			Rl	4.51%
(i) FV Liability	178.65	121.71	62.20	–
Capital (FV times equity rate)	12.51	8.52	4.35	–
Compute total assets				
Total Assets (FV plus Capital)	191.15	130.23	66.55	–
Chg ${}_tV_x$ (Change in FV)	178.65	(56.94)	(59.51)	(62.20)
Chg in Equity (Change in Capital)	12.51	(3.99)	(4.17)	(4.35)
Investment Inc (R_a times Assets)	0	9.56	6.51	3.33
PreTax Gain (Net CF-FV Liability + Investment Income)	1.35	1.50	1.02	0.52
Taxes	–	–	–	–
(ii) Net Op Gain (Pre-Tax less Taxes)	1.35	1.50	1.02	0.52

(E) EV versus GAAP and FV

Advantages of EV/FV approaches

- EV links (statutory) pricing and valuation areas using same set of assumptions>> provides insight to company's fin. Mgt.
- EV – uses realistic assumptions. ROE equal to discount rate
- EV can be incorporated into companies' Short/Long term plans – Using New Business (VNB) to measure growth
- EV/(FV) – includes/(excludes) New Business provide insight on company's viability
- EV is a key metric used to analyze mergers/acquisitions (Appraisal Value = ANAV + VIF + Value of Future Sales + Intangibles)
- EV – Analysis of EV and drivers (NB, Assumption Changes, Model, Expected Return, Dividends) helps understand business
- FV – considers restricted assets (if cannot be sold)
- FV – single definition of FV, FAS 157, should result in increased consistency

7. Continued

Disadvantages of EV/FV Approaches

- EV – More work is needed to develop and utilize stochastic and stress testing (embedded options/guarantees)
- EV – More detail is needed when showing results
- EV – Show varying risk provisions based on product (annuities riskier than term) – requires additional work
- FV – based on market participant data – may be lack of data in the marketplace
- FV – include as assessment of risk, credit, non performance risk, volatility (additional work, subjective)
- FV – Additional disclosures are required
- FV – May be costly to implement
- FV - ;limited observable inputs
- FV – effective in 2008, new issues still arising
- FV – GAAP recognized in US; not recognized internationally
- FV – May not be a large impact as other financial instruments are fair valued using FAS133

Timing of Earnings

- GAAP – realistic plus margins, FAS60 has margins, earning spread as prescribed in FASB's, loss at inception
- GAAP – defers recognition of excess earnings │ DE recognized to offset initial costs
- EV – variance in assumptions is recognized at current time, (larges swings due to assumption. Changes)
- GAAP – variance in assumptions; impact spread over life of policy

Recommended Approaches for Management Performance Based Compensation

(Key items suggested below; points credited for accurate statements supporting student's argument)

New Business Assumption

EV - contains assumption for new business; management could be over optimistic in this assumption to increase current year compensation; NB could work if compensation is spread out over many years, but this is an atypical compensation plan. GAAP does not include NB.

Use of Assumptions

FV requires more assumptions for credit risk, non performance risk and volatility, which once again may lead management to use assumptions to increase compensation. Some inputs have limited observations which could lead management to choose assumptions to favor comp plan, not market consistent

7. Continued

Time Period
EV – includes PV of stat earnings, this is a lifetime measure vs. calendar year period for GAAP, comp time horizon is 1 year

Change in Assumptions
EV – reflected immediately in current period. Management should not be compensated (or lack of comp) due to assumption changes. Change in assumptions (GAAP) some impact due to unlocking, impact is reflected in earnings in later years. FV – change is assumptions realized immediately

Intangibles
Difficult to quantity; included for EV but not GAAP; changes in intangible value should not be included in mgt. Comp

Ease of Modeling
As companies move to using an EV model, this would simplify processes by having one method for both comp and EV.

8. Learning Objectives:

3 – j. Describe best practices in credit risk measurement, modeling, and management
3 – k. Define credit risk as related to derivatives, define credit risk as related to reinsurance ceded, define counter-party risk and describe the use of comprehensive due diligence and aggregate counter-party exposure limits
3 – l. Describe risk mitigation techniques and practices: credit derivatives, diversification, concentration limits, and credit support agreements

Solution:

(a) Calculate the potential benefit to ALB of having enforceable netting arrangements in its derivatives holdings. Show your work.

Notes: This section was a simple calculation showing the benefits of netting. The formulas to use are very straightforward. Several candidates mistook this calculation as a full blown BIS calculation. However, reading parts E and F should have indicated the full calculation would come later.

Without netting $= 1.1 + 2.1 + 1.7 = 4.9$
With netting: $\text{JPO}[\max(0, -2.0 + 1.1)] + \text{MN}[\max(0, 2.1 - 1.5)] + \text{GT}(1.7) = 0 + 0.6 + 1.7 = 2.3$
Potential benefit $= 4.9 - 2.3 = 2.6$

(b) Other than netting arrangements, identify other counterparty credit risk mitigants that ALB could employ to manage its derivatives exposure.

Notes: Candidates tended to approach this section by writing a list of risk-mitigants, many of which were not relevant to the answer, rather than identifying specific mitigants and how they reduce risk. No credit is given for irrelevant items.

Collateral agreements
Exposures marked to market periodically
Thresholds are established for counterparties dependent on credit ratings
Liquidity puts – right to terminate trades on pre-specified dates
Credit triggers – settle a position because of a credit rating downgrade

(c) Describe the G-30 best-practice risk management recommendations for end-users of derivatives with respect to each of the following:

Notes: Candidates performed fairly well on part (ii) but missed some of the more important points on (i) and (iii). This should have been fairly straightforward; candidates need more detail on main points.

(i) Mark-to-Market process
Perform MtM daily for all derivative positions
MtM based on mid market prices less an adjustment
Mid market prices should reflect future costs

8. Continued

(ii) Credit Exposure and Aggregation
Measure current exposures and potential future exposure
Positions should be aggregated by counterparty; take into account any enforceable netting agreement
Compare exposures to credit limits regularly

(iii) Credit Enhancement
Analyze the benefits and costs of obtaining credit enhancement
If credit downgrades trigger early termination or collateral requirements, must carefully consider own capacity and their counterparties' capacities to meet funding needs that might result.

(d) Assess the suitability or the shortcomings of ALB's simulation model as compared to other possible models for determining the PFE for each of ALB's derivative positions.

Notes: Overall, candidates performed poorly here, with too much discussion of different models and evaluation of strengths/weaknesses. The intent of the question was to evaluate each individual transaction (T1-T5) and determine whether it was suitable or not based on ALB's current model.

ALB uses a **lognormal** diffusion process for modeling exposure for all its derivatives.
Normal diffusion process is better for interest rates in developed economies, so **not** suitable for T1, T5.
Current lognormal diffusion model is OK for equity index, so **is** suitable for T2.
Major FX rates are usually modeled as lognormal diffusions, so **is** suitable for T3.
Emerging market FX rates: modeled best via **jump-diffusion process**, so **not** suitable for T4.

(e) Detail the steps involved in calculating the original BIS (Bank for International Settlements) risk-weighted amounts for derivatives, which ignores netting.

Notes: Candidates generally did well in this section. The goal was to outline the calculation w/o netting, using these formulas for section F.

Current exposure = max (0, market value)
Add on factor = Notional $\times$ BIS add on factor
Credit equivalent amount = current exposure + Add on factor
Risk weighted amount = Credit Equivalent $\times$ Risk Weight by counterparty

(f) Calculate the original BIS risk-weighted amount for ALB's derivative book, ignoring netting. Show your work.

8. Continued

Notes: The purpose of this section was to perform the full BIS calculation beyond what was asked in section A. If a candidate knew the formulas from section E, they typically performed very well in this section because it applies the same formulas to the ALB transactions.

T1: WCE $= (0 + 50 \times 0.005) \times 20\% = 0.05$
T2: WCE $= (1.1 + 20 \times 0.06) \times 20\% = 0.46$
T3: WCE $= (2.1 + 20 \times 0.05) \times 20\% = 0.62$
T4: WCE $= (0 + 10 \times 0.01) \times 20\% = 0.02$
T5: WCE $= (1.7 + 20 \times 0\%) \times 50\% = 0.85$
Total BIs RWA $= 0.05 + 0.46 + 0.62 + 0.02 + 0.85 = 2.00$
RWA $= [\max(0, RC) + Aamt] \times Wt$

(g) Assess whether the proposed transaction with JPO will fall within ALB's stated counterparty risk limits. Show your work.

Notes: The idea is very simple, calculate the n^{th} scenario and compare its value in the provided PFE's to the company limit. After comparing, you should need to make a recommendation to accept or deny the trade. Several students attempted to calculate values for JPO alone based on their prior transactions but this was not the intent of the question.

ALB's limit is 10M at 99% PFE to a single counterparty
1000 scenarios, 99^{th} percentile = 990, or 10^{th} biggest PFE observation
10^{th} PFE = 10.4 mil > 10.0 limit

(h) Identify and explain 4 major components in the G-12 Recommendations that should be incorporated in ALB's derivative risk management practices.

Notes: Candidates performed very poorly, writing lists and regurgitating information from previous sections. Most responses didn't relate to the question and didn't connect to the G-12 recommendations.

1. Share enhanced information between counterparties – both before engaging in dealings likely to generate significant credit exposure, and on an ongoing basis.
2. Ensure quality of information delivered to senior management and Board. Senior management should convey overall risk tolerance, including loss potential in adverse markets, approved by Board.
3. Develop an integrated framework to measure leverage effect on market risk, liquidity risk, and funding agreements; should consider interplay between these factors, including under stress conditions.
4. Voluntary disclosure of statistical information to regulatory authorities as well as market participants.
5. Liquidation-based measures of potential counterparty credit exposures integrating market, liquidity, and credit risk factors.
6. Strengthen internal credit practices: factor potential liquidation costs into limit-setting and collateral standards.
7. Improvements/harmonization of standard industry documents, better internal controls for documentation.

9. Learning Objectives:

3. Risk Management
b. Identify and describe means for transferring risk to a third party, and identify the costs and benefits of doing so.
c. Identify and describe means for reducing risk without transferring it (internal hedges)
e. Describe risk management techniques that can be used to deal with financial and non-financial risks
g. Describe how derivatives, synthetic securities, and financial contracting may be used to manage equity risk, in particular, equity market guarantees found in variable annuities.

Question Focus

Question 9 was an integrated question that focused on the evaluation, application, and calculation of risk management approaches for GMABs and GMDBs.

Grader Commentary

Part A. Students struggled to describe each risk management approach. Answers focused on pro and con lists. Typical performance from best to worst: Dynamic Hedging, YRT, Coinsurance, Actuarial Method.

Part B. High scoring answers described the voluntary reset feature, focused on the key reason for including the feature (eliminate lapse and re-entry), and discussed specific increased risks (liquidity, concentration, tail).

Low scoring answers tended to be vague (ex. Key argument = improves marketability and impact on risk profile = increases risk profile).

Part C. Students who correctly incorporated the MER in d_1 generally did well when calculating $\text{BSP}_0(3)$. Few students knew the correct formulas and concepts to successfully calculate the margin offset.

Solution:

Part A.

Actuarial Method

Project liability scenarios. Form a distribution. Set up enough capital to meet obligations with high probability (use CTE or percentile approach). Invest the assets in risk free investments.

Pros Straightforward. Limited transaction costs.

Cons Large amount of up front capital. Increased tail risk. May need additional capital if original funding level is too low.

Dynamic Hedging

Use capital to create a replicating portfolio that will be able to satisfy the guarantee when due.

Pros High effectiveness. Lower capital requirement and less tail risk than actuarial method.

Cons Complex to implement, frequent rebalancing, high transaction costs, hedging/tracking error.

9. Continued

YRT Reinsurance

Hedge mortality risk.

Pros Simple to understand and administer. Lower ongoing cost than coinsurance.

Cons Limits transfer of investment risk. Loss of profits if favorable mortality experience. Counterparty risk. Not applicable to GMAB risks.

50% Quota Share Coinsurance

Quota share percentage can be applied to all premiums, claims, surrenders, and reserves and ceded to reinsurer.

Pros Ceding company receives allowance. Rating agencies view favorably. Clean form of risk transfer.

Cons Exposure to risk is reduced not mitigated. Need to transfer assets. Counterparty risk. Loss of profits on business reinsured.

Part B.

Voluntary Reset

Arguments to include this feature.

Option allows policyholder to opt at certain times to reset the guarantee to current fund value (or some % of it). Discourages lapse after a period of strong equity performance. Eliminates lapse and re-entry problem. Improves product marketability.

Risk Profile Considerations

Need to model voluntary reset option. Increased liquidity risk (benefit payment dates vary). Increased concentration risk (lose diversification across issue years). Increased tail risk. Modeling policyholder behavior is difficult, policyholders rarely elect option optimally.

Part C.

Calculate *d*1, *d*2, and $\text{BSP}_0(3)$.

$d1$	$\approx d1$	$\Phi(d1)$	$\Phi(-d1)$
1.5162613	1.50	0.933	0.067

$d2$	$\approx d2$	$\Phi(d2)$	$\Phi(-d2)$
1.3430563	1.35	0.911	0.089

$\text{BSP}_0(3) =$	0.002386

$$d1 = \frac{\ln(S_0(1-m)^t / G) + (r + \sigma^2/2)t}{\sigma \times (t)^{0.5}}$$

Note: As a subtle trick, $\text{BSP}_0(t)$ ***values given in the table (t = 1, 2, 4) were calculated using m = 0 instead of correctly using m = 0.0125.***

9. Continued

B = Cost of Hedge Portfolio (arbitrage free valuation of the embedded options)

	(1)	(2)	(3)	
t	$\text{BSP}_0(t)$	$Q_{x,1}$	${}_{t-1}p_x$	(1)*(2)*(3)
1	0.001882	0.10	1.00	0.000188
2	0.002976	0.20	0.90	0.000536
3	0.002386	0.30	0.72	0.000515
4	0.002871	1.00	0.50	0.001447
				0.002686

Fund Deductions (arbitrage free valuation of the fund deductions)

	(1)	(2)	
t	${}_{t-1}p_x$	$(1-m)^t$	(1)*(2)
1	1.00	0.9875	0.987500
2	0.90	0.9752	0.877641
3	0.72	0.9630	0.693336
4	0.50	0.9509	0.479269
			3.037745

Margin Offset = arbitrage free valuation of the embedded options / arbitrage free valuation of the fund deductions

0.088%

10. Learning Objectives:

4 – d. Describe elements of risk governance, and how these issues are resolved through organizational structure.

Solution:

(a) Identify common governance strengths that are typically observable among U.S. insurance companies

Focus on credit rating
Good committee structures
Sufficient number of independent directors
Strong oversight of financial, actuarial, and investment risks
Strong risk management practices

(b) Identify the advantages, from a ratings standpoint, of demutualizing.

Factors leading to a rating upgrade: Disclosure

Governance disclosure is required for stock companies, including several specific elements: executive pay, performance metrics, director profiles, board committee structure, meeting frequency
Financial disclosure is required for stock companies
Mutual companies voluntarily disclose some information, but generally less than stock companies

Factors leading to a rating upgrade: Compliance

Stock companies are required to comply with SOX and with SEC regarding governance
Direct-line reporting of internal auditor to the audit committee
Appointment of lead directors
Executive sessions of outside directors

Stock companies are required to comply with SOX and with SEC regarding financial control & reporting
SOX section 302: CEO & CFO sign-off on integrity of financial reports.
SOX section 404: requires robust evaluation of internal controls for financial reporting

Additional benefits from rating agency's perspective

Mutuals may have additional challenges within holding structure – may own more than 50% of subs.
Mutual BoD and management may be slow to take action from financial missteps
Lack of performance culture at mutual companies

10. Continued

(c) Outline and explain the key characteristics that should be considered when building a strong Board of Directors.

Independent directors
Good committee structures
    Key committees include audit, compensation, nominations, investment, and finance
Staffed by knowledgeable board members
Should not be too large
    Large boards inhibit active discussion and prevent detailed review of key issues
Directors should not be compensated with stock options
    Inappropriately aligns the board's interests too closely with management.
    Encourages a short term perspective
    Puts focus on vesting schedules rather than long term goals

(d) Provide arguments for and against including each of these individuals on the Board of Directors:

A policyholder representative
    pro: interested in financial health of company
    pro: insurance knowledge
    con: incentives not necessarily aligned with shareholders
A retired, former senior executive of SLC
    pro: knowledge
    con: not independent
A senior executive of another life insurance company
    pro: knowledge
    pro: independent
    con: may have conflict of interest
An agent representative with an equity stake in the company
    pro: brings a different perspective
    pro: knowledgeable
    con: not independent
An agent representative without an equity stake in the company
    pro: brings a different perspective
    con: Incentives not aligned with shareholders

(e) Identify the positive and negative consequences of using significant amount of stock-based compensation to attract and retain senior management for a demutualized SLC.

Positive:
Can effectively align management and shareholder interests
Pay should fall when management underperforms

10. Continued

Negative:

Executive pay becomes highly leveraged (especially when compared to pre-demutualization)

Bond holder interests not protected

Management should not be penalized for events outside of their control

Life insurance liabilities often outlast the executive's tenure

Current management should not be punished for mistakes of past management

11. Learning Objectives:

2d For companies with capital requirements, define and describe how to calculate required capital on an EC basis

- Define the basic elements and explain the uses of economic capital
- Explain the challenges and limits of economic capital calculations and explain how it may differ from external requirements of rating agencies and regulators.

Grader Comments: This question required candidates to understand the 2 approaches to calculating EC and evaluate Gator's situation and make a recommendation on how Gator should proceed to implement EC.

To score well, candidates needed to understand:
1) how to approach the modeling of the risks in detail, not just answering "stochastic,"
2) how the modeling of these risks applies to the implementation of an EC framework, and
3) pros and cons of the 2 popular EC methodologies.

Solution:

(a)(i) Explain the nature of the risk;
(ii) Explain how each risk could be modeled with an EC framework

Notes: Some candidates discussed management of the risks which was not part of the question; many candidates answered from the study note without relating the risks to Gator specifically; few candidates provided detail about the modeling approach to the various risks.

Equity Risk

(i) Nature of the risk

associated with investments supporting general acct liabilities and surplus
significant for variable products with guarantees and revenue streams in the separate account

(ii) Modeling approach

Stochastic approach: use an Economic Scenario Generator (ESG)
parameters are usually set in ESG before the projection – may be implicit or explicit
Stress testing approach; single-scenario stress test of falling equity values may be sufficient

Mortality Risk

(i) Nature of the risk

Catastrophe risk
Volatility risk – variation in the # of deaths and size of claims
Mis-estimation (parameter) risk
Trend risk – how future experience may evolve, e.g. medical advances, etc.
Gator needs to be concerned with increases in mortality (for insurance) and decreases (for annuities)

11. Continued

(ii) Modeling approach

For EC purposes, a stress test approach is typically applied (not stochastic modeling).
Catastrophe risk – need to model both probability of event and severity of claims
Mis-estimating (parameter) risk – past random fluctuations can be modeled similar to volatility risk
Mis-estimating (parameter) risk – can group the heterogeneous data
Gator should stress-test mortality assumptions and consider business as a whole, not separate product lines

Credit Risk

(i) Nature of the risk

Possibility of adverse change in Gator's financial situation if 3rd-parties do not fulfill contractual obligations
spread risk: change in spread on financial instruments, resulting in change in market value of the assets.
Default risk; concentration risk.
Concentration risk

(ii) Modeling approach

modeled using stress testing or stochastic modeling
Stochastic: existing EV/CF based projection models may allow for interaction with liabilities.
stress test – most commonly used with a one-year MTM

(b)(i) Define and compare the two approaches;
(ii) Recommend one approach for Gator and justify your recommendation

Notes: In (i), most candidates did well defining and comparing the 2 approaches, but did not relate pros & cons to Gator's situation. In (ii), a handful forgot to make a recommendation; some made a recommendation but their justification was general, not related to Gator's situation.

The liability runoff approach (LR)

current market value of assets required to pay all future benefits, expenses at the chosen security level, less the current value of liability

The one-year mark to market approach (MTM)

current value of assets required to ensure that the market consistent value of liabilities can be covered in 1 year's time at the chosen level, less the current market-consistent value of liabilities

PROS and CONS

Risk Management Considerations

MTM allows control of risk through asset/liability trading.
MTM relies on deterministic adverse scenarios to examine longer term risks and their management

11. Continued

Risk-Based Performance Measurement

MTM assesses risk over 1-year period, allowing consistent assessment of risk, capital and performance.

LR can result in a timing mismatch, comparing short-term performance with long-term risk.

Ease of Communication and Understanding

MTM is easier to understand and explain

MTM is consistent with similar measures

Implementation Considerations

MTM includes projected new business over the 1-year time period

LR requires a wide range of management decisions to be modeled

Calibration

Under MTM approach, it is easier to calibrate EC to a target security level.

Calibration of LR approach to EC to an external data source is more difficult

Aggregation

MTM approach ensures that risks are aggregated consistently

LR approach aggregates short term risks with long term benefits

RECOMMENDATION

Because Gator is selling life insurance, mortality risk plays key role in risk management. MTM does a poor job of modeling this risk, so liability run-off approach is a better choice for Gator.

Alternatively: Gator is a small insurance firm, MTM is more appropriate considering the computation capacity.

(c) Identify 5 potential uses for EC in Gator's operations and briefly describe the requirements for implementing EC in each case

Notes: Candidates correctly identified the uses of EC, but did not describe the implementation requirement specific to the particular use of EC which they had listed.

Capital Adequacy

It is the core use of EC for most insurers

Risk Monitoring and Control

A key measure of risk for a policyholder perspective

Need to update EC frequently to reflect changes in risk profile

Risk-Based Decision Making

EC is frequently incorporated in key Risk-based decision process such as asset allocation, ALM and reinsurance strategy.

Business and Strategic Planning

If EC is adopted the measure of capital that the business needs to hold, it should be included within strategic and business planning process.

Effect on shareholder value

Enable the company to attract more risk averse policyholders, thus increasing franchise value.