1.

This question reviewed the various risk mitigation techniques in general, and what specific ones may be applicable to Zoolander's attempt to mitigate some of the risk embedded in the Eagle investment.

Learning Objective: 8.f. Describe risk mitigation techniques and practices: credit derivatives, diversification, concentration limits, and credit support agreements.

a)

- Netting – this involves having an agreement in place to offset cash amounts due between the two parties. This will not work for Zoolander / Eagle as there is no offsetting position to the debt issue to Eagle.

- Collateralization – requirement that Eagle pledge (liquid) assets to support the debt. Not likely to work given Eagle is a start up with few tangible assets.

- Mark to Market – More applicable to derivative positions and unlikely to work since in this case as there is no MV for Eagle debt.

- Termination – early termination (repayment) of the debt by Eagle upon some predefined credit event. Not likely to work as debt position is not easily valued.

- Reassignment – equivalent to a parental guarantee offered by Insuratron. Good option as Zoolander has recourse to highly rated counterparty upon failure of Eagle.

- Embedded Put – Zoolander option to put the debt upon occurance of credit event. Unlikely to work as Eagle would be unlikely to be able to redeem debt.

b)
Credit default swap
- Zoolander is buying protection from Insuratron
- Zoolander makes periodic payments of 50bp x Notional Amount of underlying bond to Insuratron
- Insuratron makes no payment to Zoolander unless the Eagle debt defaults
- If Eagle defaults within 5 years, Insuratron makes a payment to Zoolander equal to the notional amount less a prespecified recovery amount

1.

Total return swap
- Zoolander is buying protection from EZBank
- Zoolander makes periodic payments equal to the total return (coupon, principle, and appreciation/depreciation) of the Eagle debt holdings to eZBank
- eZBank makes periodic payments to Zoolander including: eZBank funding cost (LIBOR), change in debt value(depreciation), and a 200 bp spread

c) Spread should reflect the credit risk exposure Zoolander has to EZBank, inversely related to amount of collateral. Other factors include creditworthiness of Eagle, general market conditions and the term of the swap.

d) Recommend reassignment of debt to Zoolander. If they are willing to offer such a parental guarantee, it is the cheapest and simplest way to gain the protection desired by Zoolander.

2.

This is a Case Study question on Principles-Based Reserve valuation method. It covers a wide range of related topics including the valuation methodology, assumption settings and deterministic and stochastically modeling techniques. To answer this question well, it is important that students should apply the related knowledge to address Zoolander's specific situation, instead of just writing down the general concept. Therefore, familiarity with the Case Study before the Exam is also crucial.

Learning Objective: 3(a) The candidate will be able to analyze a specific company financial situation by demonstrating advanced knowledge of balance sheet and income statement structures.

a)
For principles-based valuation method,

Methodology:
- Prospective valuation method
- Gross premium valuation method
- Capture all material risks
- Utilize risk analysis and risk management techniques to quantify the risks
- Include deterministic approach and stochastic approach
- Stochastic approach may be required for product with material tail risk
- Project all liability cash flows, including benefit, expense, etc.
- Project all asset cash flows (model assets)
- Model reinvestment and disinvestment
- Take into account investment policy

Assumptions:
- Actuaries have discretion in settling assumptions
- Assumptions for all material risks
- For risks that a company has influence, assumptions reflect a blend of company experience and prescribed assumptions
- Take into account credibility of company expertise
- For risks that a company has no control, use prescribed assumptions or methods
- Use Prudent Best Estimates, incorporating appropriate margin, for deterministic assumptions
- Apply CTE level for stochastically modeled assumptions

b)
Impact on reserve level:
Company may need to hold more reserves, because:
- Reduced asset cash flow: due to expected lower investment return (low interest rate environment) in the near future

2.

- Higher expected default: due to increased allocation of investments to non-investment grade bonds and real estate result

Possible change in credit rating (downward)

Impact on operations:
- More resources are required to perform the new valuation method because:
    - More modeling work
    - Need to perform experience studies for setting valuation assumptions
    - Need more computing resources

c)
Considerations in setting Prudent Best Estimate (PBE) assumptions:

In general:
- Use of PBE should result in tVx that (in concert with all other PBE's) is consistent with the stated CTE level under moderately adverse conditions
- PBE assumptions to be developed for all material risks not stochastically modeled
- Apply a margin to best estimate to cover estimation error and uncertainty
- Margin should increase with level of uncertainty

For mortality:
- Mortality should be based on a blend of LIC specific and prescribed tables using credibility
- Consider recent experience, studies

For treasury yield curve:
- Should be developed using prescribed assumptions or methods (not LIC specific)
- Can use either of:
    a) stochastic generators/parameters prescribed by NAIC
    b) predetermined scenario sets

d)
Estimate of Deterministic Reserve

Reported tVx = max (Detr. tVx , Stoch. tVx)　　　(statement)
Detr. tVx = max (a,b) = 342.2　　　　　　　　(computed value)
A = CSV = 22.3　　　　　　　　　　　　　(comparison to CSV)

B = pv of (Ben + Exp – GP) using portfolio earned rate 4.52% = 342.2

Determining B + E – P　Any two of the three possible improvements
1. Develop and apply padded experience assumptions
2. Extend the projection period if material

2.

3. Develop and apply a path of discount rates for each asset segment equal to the path of Net Asset Earned Rates

e)

1. <u>Reported Reserve at CTE (80%)</u>
Stochastic reserve at CTE (80%) = (350.1 + 348.70 / 2 = 349.4
Reported reserve = max (deterministic reserve, stochastic reserve)
   = max (342.2, 349.4) = 349.4

<u>Reported reserve at CTE (60%)</u>
Stochastic reserve at CTE (60%) = (350.1 + 348.7 + 336.5 + 330) / 4 = 341.3
Reported reserve = max(deterministic reserve, stochastic reserve)
   = max(342.2, 341.3) = 342.2

2. Average of scenario reserve = 342.9
Standard deviation of scenario reserve = 18.0
Pr (Losses > 349.4) = Pr (Z > (349.4 - 329.4)/18.0) = Pr (Z > 1.36) = 8.74%

3. Pr (Losses > 342.2) = Pr (Z > (342.2 – 324.9)/18.0) = Pr (Z > 0.96) = 16.9%

4. Mean = 324.9
Std. Dev. = 18.0
Mean + Std. Dev. = 324.9 + 18.0 = 342.9 >>> closer to CTE 60%

f)
Stochastic scenarios are not recommended for determining term reserves, because:
- The distribution of net cost outcomes is believed to be stable for the block
- Term block does not contain non linear relationships or no optionality in liabilities or loss distribution has no irregularities / discontinuities
- No plausible reason that range of outcomes will be materially different if valuation performed one period later
- Term block relatively insensitive to initial conditions
- Term block is not path dependent
- Stochastic required when cost distribution is skewed (with low frequency / high severity events)
- Stochastic required dealing with volatile variables (equity returns) and this translates into volatile loss distribution

3.

This question tested the candidate's knowledge of the Enterprise Risk Management Framework and Fundamentals. Candidates were first asked to define a certain type of model risk. Part b expands on model risk and asks the candidates to focus on the reasons why the fundamental value of certain securities may not equal the market price. In part c, candidates were asked to define model risk management techniques and identify whether Zoolander had adequately employed such techniques in its Hedge Fund product initiative. Part d solicited identification of 3 failures by Zoolander in derivatives best practices, and asked for changes required by Zoolander to comply.

Learning Objectives:

> 1(b) Identify all risks, including all hidden and embedded risks, categorize and evaluate potential sources of risk in products offered by both insurance companies and other financial institutions.
>
> 6(b) Describe the fundamental concepts of financial and non-financial risk management and evaluate a given risk-management framework.
>
> 7(c) Identify potential sources, categories and consequences of risk.
>
> 7(e) Describe means for managing risks and measures for evaluating their effectiveness.

a) One potential definition:

Model Risk is the risk of occurrence of a significant difference between the mark-to-model value of a complex and/or illiquid instrument, and the price at which the same instrument is revealed to have traded in the market.

b) Pseudo-Arbitrageur and EMH (3 points)

- pseudo-arbs often take positions not with their own money, but as agents of investors of shareholders
- If the product is complex, so is the model necessary to arrive at its price, the ultimate owners of the funds at risk might lack the knowledge, expertise or inclination to assess the fair value, and will have to rely on their agent's judgment
- This trust, however, will not be extended for too long a period of time, and certainly not for many years
- Therefore, the time span over which securities are to revert to their fundamental value must be relatively short (and almost certainly will not extend beyond the next bonus date)
- The existence of institutional and regulatory constraints might force the liquidation of positions before they can be shown to be 'right'
- Poor liquidity, often compounded with the ability of the market to guess the position of a large relative-value player, also contributes to the difficulties of pseudo-arbs
- Very high info costs might act as a barrier to entry, or limit the number, of pseudo-arbs

3.

- Reliable models require teams of quants to devise them, scores of programmers to implement them, powerful computers to run them and expensive sources to validate them

c) Model Risk Management (4 points)

1. Inadequacy of Traditional Model Validation

- Model validation traditionally means the review of the assumptions and the implementation of the model used by front office for pricing deals, and by finance to mark their value
- absence of computational mistakes is clearly a requirement
- Risk management should also check computations, not just John
- A review of the model assumptions by Bill is insufficient to justify correct mark-to-market modeling
- rejecting a model for standard reasons can also be totally inappropriate from the risk manager's perspective, if the market is happy to live with the blemishes for certain products
- the risk manager's prime task in model risk management is to identify the model currently used by the market in order to arrive at the observed traded prices

2. Gathering Market Intelligence

- Is primarily the ability to 'see' the largest possible number of transactions, and the levels where they trade
- Risk manager should worry if model prices / tenders consistently beat the competition
- Bill should probably worry about the "fancy" derivative that is consistently priced below market by the model
- Contacts with brokers, traders, or other risk managers can provide an effective "early-alert system"
- Being aware of the latest market developments, and of academic papers can be very useful in guessing future market direction
- professional conferences are useful to gauge the market's reception of new ideas, and their likelihood of becoming the market standard
- another cause for managers' concern is the sudden occurrence of large-notional trades for which a customer-driven demand rationale for them is not clear

3. Reverse Engineering: Plain-Vanilla Instruments

- Once adequate market intelligence has been gathered, the next task is to reverse engineer the prices to find the best set of methodologies that explains them
- The exercise should begin with the simplest interest rate building blocks, then recovery of plain-vanilla options prices

3.

- This may be somewhat accomplished already by John's walkthrough of the interest rate swap with Bill
- the creation of a full smile surface that extends well into the wings is essential in model risk management both for the direct risk of mis-marked out-of-the-money options, and also because large portions of the smile surface typically constitute the inputs to models for more complex products.
- however, it is not always necessary or possible for a 'model' to account for the observed market prices of plain-vanilla options
- a number of surface-fitting methodologies have been proposed, but the criteria for choosing among them is not clear-cut

4. **Reverse Engineering: Complex products**
   - The price of complex products may depend on a much larger number of variables
   - As the Hedge Fund strategy relies on complex derivatives, these must be reverse engineered as well by Bill
   - as a consequence, finding a clever model-independent algorithm that can account for observed market prices over a large range of this multi-dimensional space is almost impossible, and an appropriately calibrated model must almost always be used
   - significant pricing differences can arise between traders who use the same pricing approach, but who choose different functional forms for the input functions

d) G-30 Recommendations
3 Examples

1. Market Risk Policies: The G-30 recommended that institutions should ensure that the mark-to-market process is rigorously conducted
   - Specifically, the G-30 indicated that dealers sh. Mark their derivatives to market at least daily for risk management purposes
   - Zoolander would be relying on Badger's model to mark positions to market daily for the new hedge fund, and putting on hedges on the same basis
   - Zoolander would have to risk manage the derivatives activities, including the new hedge fund
   - The risk management function would have to vet all models and in particular, appropriately deal with model risk in marking to market

2. Credit Risk policies: The G-30 stated that dealers and end-users "should have a credit risk management function with clear independence and authority, and with analytic capabilities in derivatives"
   - Badger has been given too much authority and control, and there is no independent, knowledgeable supervision of his activities

3.

- Zoolander needs to hire an expert team to independently supervise the derivatives activities, and in particular, set credit risk limits and monitor activities against them

3. Operational Risk Policies – G-30 emphasized the control of operational risk, for example, the G-30 emphasized the importance of hiring skilled professionals, and to "ensure that derivatives activities and undertaken by professionals in sufficient number and with the appropriate experience, skill levels, and degrees of specialization"
    - While Badger may be an expert derivatives trader, Badger cannot perform all the roles necessary, and Fish should not be supervising activities he does not understand
    - Zoolander should have more derivatives experts to independently administrate the back-office, experts to perform risk management, and experts to supervise derivatives activities

4.

Learning Objectives: 6.b. Describe the fundamental concepts of financial and non-financial risk management and evaluate a particular given risk-management framework.
6.g. Describe a desired risk profile and appropriate risk filters.
7.b. Describe how ERM is able to contribute to shareholder value creation.

This question tests the candidate's knowledge on the indirect effects that risk can have on shareholder income, particularly through convex tax schedules and agency costs, as applied to Zoolander's investment in Eagle. Part (a) assesses the value of the Eagle investment initially accounting for capital gains taxes, with and then without the hedge, and repeats the analysis ignoring capital gains taxes, demonstrating the impact of taxes on the hedge decision. Part (b) and (c) demonstrates the potential impact of agency decisions on risk management strategies taken that may be contrary to shareholder interests, in particular, due to compensation structures.

(a) (i) Future value of hedge assuming pay capital gains taxes.

Expected After Tax Value without Hedge

	PreTax Value	Capital Gain	Tax at 23.56%	AfterTax Value	Expected
15%	18.0	0.0	0.00	18.0	2.70
35%	52.0	2.0	0.47	51.53	18.04
35%	130.0	80.0	18.85	111.15	38.90
35%	190.7	140.7	33.15	157.55	23.63
					83.27

Expected After Tax Value with Hedge

	PreTax Value	Capital Gain	Tax at 23.56%	AfterTax Value	Expected
100%	95.0	45.0	10.60	84.40	84.00

Expected Value of Hedge $= 84.00 - 83.27 = 1.13$

4.

(a) (ii) Future value of hedge assuming no capital gains taxes.

Expected After Tax Value without Hedge

	PreTax Value	Capital Gain	Tax at 23.56%	AfterTax Value	Expected
15%	18.0	0.0	0.00	18.0	2.70
35%	52.0	2.0	0.00	52.0	18.20
35%	130.0	80.0	0.00	130.0	45.50
35%	190.7	140.7	0.00	190.7	28.61
					95.00

Expected After Tax Value with Hedge

	PreTax Value	Capital Gain	Tax at 23.56%	AfterTax Value	Expected
100%	95.0	45.0	0.00	95.00	95.00

Expected Value of Hedge = 95.00 – 95.00 = 0.00

(a) (iii) Conditions that will produce a tax benefit.

Tax convexity. Due to

> Increasing marginal rates,
> Loss carry-forwards,
> Depreciation.

(b) Incentive for consultant to recommend hedge.

Comp #1 $50,000 base + 1% * PreTax Value.

Expected Utility without Hedge

	Eagle Value	Consultant Income	Consultant Utility	Expected Utility
15%	18.0	230,000	479.58	71.94
35%	52.0	570,000	754.98	264.24
35%	130.0	1,350,000	1161.90	406.66
35%	190.7	1,957,000	1398.93	209.84
				952.68

4.

Expected Utility with Hedge

	Eagle Value	Consultant Income	Consultant Utility	Expected Utility
100%	95.0	1,000,000	1000.00	1000.00

Greater utility with hedge, so consultant incented to hedge.

Comp #2 $1,000,000 base + 1% * (PreTax Value - $100 million).

Expected Utility without Hedge

	Eagle Value	Consultant Income	Consultant Utility	Expected Utility
15%	18.0	1,000,000	1000.00	150.00
35%	52.0	1,000,000	1000.00	350.00
35%	130.0	1,300,000	1140.18	399.06
35%	190.7	1,907,000	1380.94	207.14
				1106.20

Expected Utility with Hedge

	Eagle Value	Consultant Income	Consultant Utility	Expected Utility
100%	95.0	1,000,000	1000.00	1000.00

Greater utility without hedge, so consultant incented to not hedge.

(c) Pay structure render consultant indifferent to hedge.

Flat base salary.

5.

Question on measuring value. The first half of the question focused on Fair Value reporting in contrast with US GAAP, and the second half covered Economic Value Added.

Learning Objective(s):

4a) Compare and contrast different approached to the fair value of insurance liabilities.

4c) Describe the concept of economic measures of value (e.g. EVA; embedded value) and their uses in corporate decision-making process.

a) Outline the differences between the US GAAP accounting system and a fair value approach.

(Drawn from "Fair Value of Insurance Business," 8FE-320-01)

US GAAP accounting system:
- Measures change in company value, defined as change in asset value less change in liability value.

Drawbacks of US GAAP accounting system:
- US GAAP does not hold assets or liabilities at fair value.
- US GAAP does not calculate realized or unrealized gains on liabilities.
- Focused on short-term income.
- Creates false incentives for management.
- Focus should be on total return.
- Marking assets to market won't help if liabilities are unchanged – may create even bigger distortions.

Conceptual fair value approach:
- Develop benchmark portfolio of assets to replicate liability performance.
- Makes it easy to measure total return on both assets and liabilities

Comparison:
- US GAAP works well if interest rates are stable and market-to-book ratios are close to 1 for both assets and liabilities.
- US GAAP is misleading in short term if interest rates are not stable.
- Fair value approach allows for measuring *true* changes in company value

b) Discuss arguments for and against incorporating liquidity risk in fair valuation.

(Drawn from "Fair Value of Liabilities: Financial Economics Perspective, Babbel, Gold, Merrill)

5.

Liquidity: ability of market participant to transfer risk, possibly in the future, when the preference for holding that risk has changed.
- Liquidity can be seen as real option: the option is the ease of transferring risk to another party.
- An illiquid security requires higher yield in the marketplace.
- Insurance liabilities are usually illiquid and long-term; but this is *not* an argument for investing in illiquid/long-term securities and including liquidity premium in valuation, because:
- Insurers' comparative advantage at bearing liquidity risk is based on predictability of cash flows, not the illiquid/long-term nature of liabilities.
- Even if the insurer has capacity for liquidity risk, there may not be any available liquidity premium available in the marketplace.
- Issuing illiquid liabilities does not mean you can invest in illiquid securities (you would need *non-redeemable* liabilities in order to invest in illiquid securities).
- If liquidity is not accepted as a factor in fair valuation of liabilities, then the exit value will systematically overstate FV. But it is difficult to estimate the exit price of insurance liabilities because they are not traded in an open, transparent market. Therefore, including liquidity risk adjustment on insurance liabilities is problematic if you are using exit prices.

Decomposition: viewing liability as difference between put and call on ins company's assets, using risk-neutral valuation over interest rate risk, mortality risk, etc.
- Decomposition increases transparency; lets analysts compare liability structures across companies more easily.
- Regulators could interpret it as the defeasance value of liabilities, with the put option interpreted as the risk inherent in the company backing the liabilities.
- Can see where assumptions affect interest-rate-contingent synthetic Treasury value of liability.

c) Define EVA and describe how it can be used to increase shareholder value.

(Drawn from "The New Corporate Finance: From Theory to Practice," chapter 9)

EVA = Economic Value Added
EVA is Net Operating Profit after taxes, less a charge for capital used to produce those profits.
The *capital charge* is the required return necessary to compensate all investors for investment risk

How EVA improves shareholder value:

5.

- Increases return from assets already invested in business.
- Requires enterprise to invest additional capital and build the business if and only if the return on the new capital is greater than the cost of the new capital. Similarly, requires enterprise to stop investing in, and release capital from, projects with substandard returns.

d) Propose a new corporate compensation system that is consistent with EVA concepts.

(Drawn from "The New Corporate Finance: From Theory to Practice," chapter 9)

2 elements: *cash bonus plan* to simulate ownership, plus *leveraged stock option* (LSO) plan to make ownership real

Cash bonus:
- Tie the bonus to improvements in EVA over time.
- Bonus is presumed to be self-financing because increases in EVA should translate to increases in shareholder value.
- Do not cap the cash bonus.
- "Banked forward" - each year a fraction of the total bonus available is paid, with remainder banked into next year.
- Aligns short-term and long-term incentives.

Leveraged stock options:
- Managers buy in-the-money LSOs.
- Can create added incentives if managers buy LSOs with cash bonus.
- The options' strike price increases annually at a rate that provides a minimal acceptable return to shareholders before management's participation. Therefore, management only benefits if the company's equity value increases faster than the strike price.

6.

This question involves describing and assessing internal risk rating systems in general and applying a particular system to the practical example of assessing credit worthiness of a potential borrower in the airline industry. Describing and assessing internal risk rating systems in parts a) and b) come directly from the source in terms of a list, while applying the system in part c) involves assessing qualitative statements about the firm in general and using the provided rating point system. As part of this last exercise, knowledge of the definition of some standard financial ratios was required.

Learning Outcome Statement (LOS) – 8a. Define and evaluate credit risk as related to fixed income securities

a) Benefits and Concerns
- If accurately and consistently applied they provide :
  - common understanding of risk levels
  - initial basis for capital charges in pricing models
- Issues include
  - Unlikely to cover all business sectors
  - Horizon over which risk is to be measured

b) 9 Steps of a robust risk rating system
Obligor rating steps 1 to 5
1. Financial assessment of borrower
   - Are earnings and cash flow sufficient to cover debt
   - Financial trends
   - Asset quality
   - Liquidity
   - Leverage
   - Size
   - Access to capital markets – flexibility
   - Sets floor on obligor rating
2. Managerial Capability
   - Operations
   - Management assessment
   - Environment assessment
3. Industry and Relative Position
   - Industry assessment
   - Competitiveness
   - Trade environment
   - Regulatory environment
   - Tier Assessment – relative position of obligor within its own industry
   - Relative competitive position
   - Combine Industry and Tier assessment
4. Financial statement quality
   - Quality financials are important
   - Quality of accounting/audit firm

6.

5. Country risk
   - Relates to cross border restrictions
   - Currency convertibility
   - Political risk
   - Economic risk

Facility rating Steps 6 to 9
6. Third party support
   - Quality and magnitude of support
   - Non – 100% guarantees not considered
7. Term
   - Longer term => higher risk
8. Structure
   - Effect of covenants and debt seniority
   - Lending purposes
9. Collateral
   - Reduces the severity of loss
   - Quality and depth of collateral
   - Use liquidation scenario
   - Market risk

c) Applying Risk Rating system steps to WTA
1. Financial assessment
   - Cash interest coverage: EBITDA/Int exp = 250/150 = 1.66 = rating 5
   - Debt to Assets: Total liabilities/Total assets = 2780/3640 = 0.76 = rating 3
   - EBITDA/total assets = 250/3640 = 0.068 = rating 5
   - Total Debt/EBITDA = 2780/250 = 11.1 = rating 5
   - Equal weighted average score = 18/4 = 4.5
   - Obligor will not be rated higher than 4 (BBB)
2. Managerial
   - New management with limited experience possible down grade
3. Industry and relative position
   - Airline industry is struggling
   - WTA is a lower tier airline
   - Combining industry and tier will cause a downgrade
4. Financial Quality
   - Quality audit firm will cause an upgrade
5. Country Risk
   - Expansion into Mexico adds small country risk – neutral or small downgrade

Obligor rating is about 5 – below investment grade

6. Third party support
   - There is none, so no upgrade or possible downgrade

6.

7. Term
   - Long term will cause a downgrade
8. Structure
   - Senior status with strong covenants will cause an upgrade
9. Collateral
   - Loan will be strongly collateralized will cause an upgrade

At best WTA is just below investment grade and the facility rating provides a slight improvement

CFB should not extend loan to WTA

7.

This question is small. The first part of it tests the student's understanding of the concept of franchise value and the relationship between various financial quantities used in its calculation. The second part of the question is essentially a list recall directly from the source, and tests the effects on franchise value of a variety of business characteristics.

Learning Objective – 7b) Describe how ERM is able to contribute to shareholder value creation.

a).
1. Franchise Value = Market Capitalization – Statutory Net Asset

       Market Capitalization = share value x shares
           = 100 x 300,000
           = 30,000,000

       Statutory Net Asset = statutory asset – statutory liability
           = 100,000,000 – 80,000,000
           = 20,000,000

       so, Franchise Value = 30,000,000 – 20,000,000 = 10,000,000

2. ROE = Total shareholder return + (franchise value/equity) x (total shareholder return – franchise growth rate)
        = 12% + (10,000,000/20,000,000) x (12% - 10%)
        = 13%

3. Statutory asset = market capitalization – franchise value – dividend + statutory liability
        = 30,000,000 x (1+ 12%) – 10,000,000 x (1+10%) – 5,000,000 + 80,000,000
        = 97,600,000

b)
- Reduction in asset expense:
    - Franchise value will increase both before and after the share buyback.
    - The increase would have more impact before share buyback as the shareholder benefit from the expense reduction longer due to less debt servicing strain.

- Increase growth rate:
    - Franchise value will increase both before and after the share buyback.
    - The increase would have more impact after share buyback. At high leverage position, the effect is insignificant because of a high ruin probability. The firm doesn't survive long enough to benefit from the growth. At low leverage position, the impact is little as the capital costs offset profits from the core business.

7.

- Lower taxes:
    - Franchise value will increase both before and after the share buyback.
    - The increase would have more impact before the share buyback as double taxation of the return on net asset is the key deterrents to holding excess capital. With that deterrent removed, firms optimally increase their level of free assets.

- Lower agency costs:
    - Franchise value will increase both before and after the share buyback.
    - The increase would have more impact before the share buyback. Agency costs have a dramatic effect in reducing the level of free assets which a firm optimally holds. This is because agency costs operate as a form of tax on free assets.

- Lower economic capital:
    - Franchise value will increase both before and after the share buyback.
    - The increase would have more impact after the share buyback. The increase depends on the amount of share buyback. At the two extreme ends of leverage position, the increase in franchise value is insignificant. At the high leverage position, amount of capital is irrelevant. Here, the reason is that actual capital is so large relative to economic capital that the calculated level of economic capital becomes irrelevant. However, the optimal level of capital has fallen as economic capital fell. This is because, with a lower level of risk, we can afford to hold less actual capital.

8.

This question has two parts, the first of which requires a calculation. The first part requires the pricing of a credit default swap using the Reduced-Form Approach. The fee is the discounted expected future credit losses, whose calculation requires calculating the default probabilities and discount factor and applying them to the loss given in the problem of 40%. The second part is directly from the source, and requires a listing of the issues involved in validating such a pricing model.

Learning Objective: 8c. Describe best practices in credit risk measurement, modeling and management.

a)

Maturity t (years)	U.S. Treasury Forwards (%)	Mega Mfg. Co. Forwards (%)	1 Year Forward Credit Spreads UST Forwards – Hunley Forwards (%)
1	4.95	5.3	0.35
2	4.55	4.95	0.4
3	4.45	4.9	0.45

$\lambda t = FSt / LGD, \ LGD = 40\%$

Maturity	Forward Default Probabilities
1	.35% / 40% = .00875
2	.4 / 40% = .01
3	.45% / 40% = .01125

$P_t = P_{t-1} + \left(1 - P_{t-1}\right) \lambda t$

Maturity	Cumulative Default Probability
1	= .00875
2	$.00875 + \left(1 - .00875\right) \times .01 = .018663$
3	$.018663 + \left(1 - .018663\right) \times .01125 = .029703$

$p_t = \left(1 - P_{t-1}\right) \lambda t$

Maturity	Cumulative Default Probability
1	= .00875
2	$\left(1 - .00875\right) \times .01 = .009913$
3	$\left(1 - .018663\right) \times .01125 = .011040$

DF = Discount Factor = 1/((1 + Treas Spot Rate t)^t)

Maturity	Discount Factor
1	(1/1.0495) = .952835
2	(1/(1.0475^2)) = .911364
3	(1/(1.0465^3)) = .872534
Sum	= 2.736733

8.

Discounted Expected Loss = Expected Loss x Discount Factor

Discounted Expected Loss = $p_t \times LGD \times DFt$

Maturity	Discounted Expected Loss
1	$.00875 \times .4 \times .952835 = .00333492$
2	$.009913 \times .4 \times .911364 = .0036137$
3	$.011040 \times .4 \times .872534 = .0038531$
Sum	$= .010801$

Annual Fee x 2.736733 = .010801

Annual Fee = .0039

Thus the annual fee would be 39 basis points

b)

Credit Models are hard to validate because default is a rare event

Reduced-Form Models can be validated in the same way as market VaR models

i.e., they should explain the term structure of credit spreads that are directly observable from the market data

Models can be validated against cumulative credit profit and loss

This requires recording profit and loss separately for market and credit risks which can be difficult

It might be better to test a credit default model with a stress test or sensitivity analysis, these tests can help identify those areas where the model may be more apt to give inappropriate results

9.

This question was designed to test the following learning objectives:

7c) Identify potential sources, categories, and consequences of risk.

7d) Define risk metrics to quantify major types of risk exposure, and explain how each can be incorporated into the risk monitoring function as part of an ERM framework.

7g) Describe enterprise-wide risk aggregation techniques incorporating the use of correlation

a)

1. The product assumption risks associated with the SPVA product with the GMWB rider center around the risk that the accumulated fund value is insufficient to pay the guaranteed withdrawal benefits. The policyholders may not elect the benefit in accordance with the assumptions in the pricing, in effect requiring Mills to pay out more benefits than are available from the fund.

2. Insurance related risks include
    *   Mortality: If mortality is less than expected, more benefits will be paid and losses will result.
    *   Lapse/Surrender: if withdrawals/surrenders are greater than expected,
    *   Expenses: expenses must not exceed expectations
    *   Investment return: if returns are less than expected

3. Diversification will benefit the company through
    *   Access of new markets (other than WL and SPIA)
    *   WL is less sensitive than SPVA to interest rate risk, so adding SPVA can stabilize the risk.
    *   Mortality diversification: mortality impact on immediate annuities and WL are opposite.
    *   Separate account market risk is not correlated with other risks.

b)
Credit and market risks are positively correlated; insurance risk is not correlated with other risks. To calculate economic capital,

$$
\begin{vmatrix} 23 & 15 & 16 & 21 \end{vmatrix}
\begin{array}{cccc} CR & MR & IR & OR \\ \end{array}
\begin{vmatrix} 1 & 1 & 0 & 1 \\ 1 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 \\ 1 & 1 & 1 & 1 \end{vmatrix}
\begin{vmatrix} 23 \\ 15 \\ 16 \\ 21 \end{vmatrix} = 66.4
$$

CR = Credit Risk
MR = Market Risk
IR = Insurance Risk
OR = Operational Risk   It is additive to all other risks.

9.

The coefficients themselves were not as critical as setting up the correlation matrix equation.

Sum of the risks = 23 + 15 + 16 + 21 = 75
Diversification effect = 75 – 66.4 = 8.6

c)
Copula technique addresses the joint probability of extreme quantile adverse events, i.e., tail dependence, and a linear relationship is not assumed.

- Capital requirements in ascending order:
    US RBC < Gaussian < T-Copula < MCCSR
- MCCSR has no correlation benefits, so has maximum capital requirements.
- RBC is least because it overstates the correlations.
- Matrix using simplified correlations must fall between these extremes (credit will be given for any reasonable explanation).

d)
VAR is a point estimate.
CTE is the average of the tail distribution.

Coherence requires the following properties:

1. Bounded above by maximum loss		1. Translation invariance
2. Bounded below by the mean loss	OR	2. Subadditivity
3. Scalar additive and multiplicative		3. Positive homogeneity
4. Subadditive		4. Monotonicity

CTE meets all these properties and is coherent.
VAR fails subadditivity and is not coherent.

e)

A = Normal((1+Beta)/2) * Square Root (N * alpha (1-alpha))
Normal Inverse of ((1+.8)/2)= Normal Inverse of 90% = 1.28
Square Root (N*alpha (1-alpha)) = sqrt (2000*.05*.95) =9.746
A = 1.28 x (.7468) = 12.48
round(A)=12
alpha quantile = 1900
upper bound of CI = 1912
Due to zero variance for scenario 1911-1920,
Upper bound = -9

10.

Describe how rating agencies affect the choice of capital structure.

The first part of this question tests the understanding of the FPC model and the second part involves an actual calculation of the Gamma risk given a simple investment portfolio. Part a) is basically a list question directly out of the source, while the part b) answer can be obtained by following the illustrated example in the source and using this question's specific information. Part c) asks for asset strategies that would decrease the Gamma risk charge, which requires the student to understand how portfolio changes affect the Gamma risk charge.

a)
Financial Market Risk -
   exposure to changes in market prices or rates that may adversely affect returns or earnings

   a. Interest rate delta (mismatch) risk charge
      1. Definition - mismatch risk relating to net exposure to changes in interest rates at points along the yield curves where the magnitude or timing of cash flows do not exactly match or offset
      2. determine DV01 values for specific points on the yield curve
      3. determine the interest rate volatility by calculating the annualized standard deviation of historical interest-rate movements experienced at each relevant point along the curve
      4. the Gross Incremental Capital Charge (GICC) is calculated by aggregating the absolute value of the exposure for each risk bucket along the curve
      5. determine Net Risk Exposure (NRE) by adjusting GICC for covariance among risk buckets
      6. the total capital charge for mismatch risk is equal to GICC minus (between 50% to 75%) of the difference between GICC and net capital charge
   b. Interest rate gamma (convexity) risk charge
      1. Definition - measurement of the nonlinear relationship between market values and changes in yield
      2. compare the net change in market value for the entire portfolio derived from DV01 with the actual modeled changes in value for each incremental parallel shift
      3. the capital charge for convexity risk is the sum of the absolute values of these losses in the worst case directional rate scenario
   c. Liability option risk charge
      1. Definition - risk related to options embedded in liabilities

Credit risk charge
   a. Non-financial market related credit risk charge

10.

      1. the capital charge is the sum of (Notional amount * discounted gross cumulative default factor -Salvage value or recovery) for each security
  b. OTC-derivative counterparty credit risk charge
      1. the capital charge is the sum of (Net Exposure * discounted average gross cumulative default factor -Salvage value or recovery) for each counterparty
  c. Credit concentration risk charge

Operational risk charge
  a. Financial intermediation operational risk charge - multiply the notional or principal value of funding liabilities by factors
  b. OTC derivative operational risk charge - multiply the notional or principal value of OTC derivatives by factor

b.

Table 1

Market Value Change ($)	Downward Shifts (basis points)				Upward Shifts (basis points)		
	Down 200	Down 150	Down 100	DV01	Up 100	Up 150	Up 200
Corporate Bond	550,000	403,125	262,500	(2,499)	(237,500)	(346,875)	(450,000)
MBS	600,000	412,500	250,000	(1,995)	(150,000)	(187,500)	(200,000)
GIC	(1,200,000)	(787,500)	(450,000)	2,985	150,000	112,500	-
Total	(50,000)	28,125	62,500	(1,509)	(237,500)	(421,875)	(650,000)

Table 2

Market Value Change in Portfolio ($)	Downward Shifts (basis points)			Upward Shifts (basis points)		
	Down 200	Down 150	Down 100	Up 100	Up 150	Up 200
Expected incremental change in market value	75,438	75,438	150,875	(150,875)	(75,438)	(75,438)
Modeled incremental change in market value	(78,125)	(34,375)	62,500	(237,500)	(184,375)	(228,125)
Unexpected gain or loss related to gamma	(153,563)	(109,813)	(88,375)	(86,625)	(108,938)	(152,688)
Summation of losses in directional scenario	(351,750)			(348,250)		
Total MR-2 incremental capital charge	351,750					

Expected incremental change in market value

Down 100	Total DV01 x (-1) x 100
Down 150	Total DV01 x (-1) x (150-100)
Down 200	Total DV01 x (-1) x (200-150)
Up 100	Total DV01 x 100
Up 150	Total DV01 x (150-100)
Up 200	Total DV01 x (200-150)

10.

Modeled incremental change in market value

Down 100	Total Down 100
Down 150	Total Down 150 - Total Down 100
Down 200	Total Down 200 - Total Down 150
Up 100	Total Up 100
Up 150	Total Up 150 - Total Up 100
Up 200	Total Up 200 - Total Up 150

Unexpected gain or loss related to gamma

    Modeled incremental change in market value - Expected incremental change in market value

Summation of losses in directional scenario

Total MR-2 incremental capital charge - maximum absolute value from up and down scenarios

c.
swaps, re-weighting existing portfolio, purchase new assets

- duration change alone won't work

- need convexity increase

11.

This question was designed to test the following learning objectives:

> 2g) Describe the process, methods and uses of financial reinsurance (surplus relief) and recommend a structure that is appropriate for a given set of circumstances.
>
> 2h) Describe the process, methods and uses of insurance securitizations and recommend a structure that is appropriate for a given set of circumstances.
>
> 5a) Identify and describe means for transferring risk to a third party, and to identify the costs and benefits of doing so.

a) Let x be the percentage to reinsure, then each of the values can be solved for:

Net Premium	1000(1-x)
Net Investment Income	10
ModCo Adjustment	500x
Commissions	700(1-x)
Allowance	-160x
Expense	200(1-x)
Death Benefit	35(1-x)
Change in Reserve	500
DAC Tax	73.15
Tax	35% of Taxable Income

Either set up the equation and solve for x or more easily realize it is linear and solve for 0% and 100% reinsured. 0 % reinsurance produces 30.19% strain, 100% has a negative strain of 8.49%. Then to have a 20% strain, you interpolate (30.19-20)/(30.19-(-8.49)) = 26.34%.

b)
Post reinsurance strain =YRT Premium –Reserve Relief –Benefit Relief +/– Investment inc adj for cash flow and reserves

> Pre Reinsurance Strain = –301,850
> YRT Premium 0
> Reserve Relief =(0.5)(0.9)(100,000– 500)(0.014)(1.05^-.5)
> Benefit Relief: .9 * 35,000 = 31,500
> Investment Income Adjustment is Negligible = 0
> Post Reinsurance Strain = -269,738
> Post YRT transaction strain = 27% which exceeds Simple Life target

c)
ModCo advantages: can be used for all products, invested assets stay with insurer, ceding retains control over dividends or interest rate determinations, insurer is not exposed to reinsurer insolvency risk, reinsurer- reserves are tax deductible.

11.

Disadvantages more administratively complex, insurer realizes capital gain/losses if reinsurer terminates contract.

YRT Advantages: Ceding company retains investment and lapse risk. May have lower ongoing cost than any form of coinsurance since risks limited to mortality

YRT Disadvantages: low cost limits the amount of initial allowance or bonus that the reinsurer can provide, relatively difficult to administer

Mod-co is an effective solution while YRT is not
Mod-co mitigates the strain generated by FY expenses, reserves, and taxes
YRT offers limited reserve relief for simple UL and proportional relief for benefits
Post YRT transaction strain = 27% which exceeds Simple Life target

d)
Securitization takes the cash flows promised to Citadel in the future and sells them for immediate proceeds. Decreases surplus strain. Insurer (Originator) administers the policies pays premiums and policy cash flows to reinsurer/SPV.

SPV provides cash to the incurer, pays interest and principle to investors; pays premium to third party.

Investors provide fund to SPV. External party or third party in relation with investors; provide guarantees.

Assumption reinsurance is a complete sale of obligations to assumption reinsurer. It is suitable for a small firm. Issue costs are not prohibitive. Allows risk diversification, transfer liquid assets off balance sheet, can improve market efficiency and transparency and provides new sources of capital. It increases efficiency of insurance and financial markets.

12.

The following learning objectives were tested.

> 2j) Describe potential uses of excess capital including reinvestment in new business, shareholder dividends, debt retirement and share repurchase and recommend a course of action for a given set of circumstances.

> 2k) Describe the process, methods and effects of a potential acquisition or reinsurance of a business including its effect on capital structure, return on equity, price/earnings multiples, and share price.

a) The sale of Knox is being handled through a public auction. Describe two other sales methods and the advantages and disadvantage of each compared to public auctions.

1) **Privately negotiated Transactions:**
   - Discussion with one buyer in a non competitive environment, deal could be driven by personal relationship
   - Advantages from Public Auction:
     - Existing business is protected from damage due to increased confidentiality
     - Works well for smaller that may not generate enough interest for public auction
   - Disadvantages from Public Auction:
     - Board may be charges to breach of fiduciary responsibility
     - Few bidders, no chance fir bidding-war to drive the price up

2) **Modified Public Auctions:**
   - Targeted marketing aimed at the most like candidates
   - Advantages from Public Auction:
     - More flexible timeline
     - Allows advisors to sift through buyers before revealing name of seller
   - Disadvantages from Public Auction:
     - Potential bidders may remain noncommittal until the name of seller is identified.
     - Does not eliminated window-shopping by bidders interested in gaining competitive advantage.

b) Identify five reasonable methods of selecting a discount rate for valuing acquisition and describe the circumstances under which each would be appropriate

1) **Weighted Average Cost of Capital using CAPM**
   - Uses a singe discount rate uncertainties captured in the underlying cashflows
   - Appropriate if project/acquisition has same riskiness as company
2) **Weighted Average Cost of Capital using Arbitrage Pricing Theory**
   - Useful with complex or asymmetric cash flows.

12.

3) Hurdle Rate
- May vary by line of business or market conditions

Source of Funds
- Based on funds used in acquisition
- Possible temporary advantage to a company with lots of excess funds earning low rate of return

4) Stochastic Analysis
- An appropriate time-related discount rate is derived.
- Large number of runs of a computerized simulation model.

<u>Given the data provided above, calculate an appropriate discount rate to use in valuing this acquisition</u>

Use CAPM

$B = \text{Cov} (r_{market}, r_{portfolio})/ \text{Var}(r_{market}) = 0.375/0.25 = 1.5$

$R = r_f + B *(r_m - r_f)$

$R = 4\% + 1.5 \text{ x } (11\% - 4\%)$

$R = 14.5\%$

Solve for WACC

$R = (10 *2\% + 14{,}497 * 5\% + 24{,}493 * 14.5\%)/35{,}000$

$WACC = 11.65\%$

<u>Calculate the value of the Knox business ignoring distributable earnings beyond the fifth year.</u>

WACC = 11.65%, using NPV

Value = $50/1.1165\% + 50/1.1165^2 + 50/1.1165^3 + 50/1.1165^4 + 50/1.1165^5$

= 181.81

<u>Give the formula for "adjusted book value"</u>

ABV = Capital + surplus + AVR + discount IMR– deferred tax asset – non-admitted assets + surplus notes and other debt + mark-to-market assets allocated to ABV

<u>Outline components of synergy.</u>

1) Cost Savings:
- Economies of Scale
- High level of uncertainty

2) Revenue Enhancement:
- May gain access to superior or complementary products

3) Process Improvement:
- Transfer best practices/core competencies from one company to another

12.

    4) Financial Engineering:
- May be able to re-finance target's debt lowering service costs

    5) Tax Benefits:
- place shared services and central purchasing in tax-advantaged location
- Transfer brands and other intellectual property to low-tax subsidiary.

13.

This is a short question on the topic of corporate debt. Part a) is a straight list question asking for the types and descriptions of the four types of corporate debt. Part b) asks for the most appropriate type of corporate debt given Cooper Re's needs and characteristics, which is basically a 5 year loan for a quickly growing company. Part c) is a list type question on the effects of initiating debt financing (i.e., increasing leverage) given Cooper Re's current position. Part d) is the same as Part c), except that Cooper Re's financial and business characteristics have changed such that it is basically a cash cow.

Learning Outcome Statement - 2j)   Describe potential uses of excess capital including reinvestment in new business, shareholder dividends, debt retirement and share repurchase and recommend a course of action for a given set of circumstances.

a) There are 4 sources of corporate debt that Cooper Re might consider. They are:
> Commercial Paper
> Bank Debt
> Non-Bank Private Debt
> Public Debt

Commercial Paper.
> Has an average maturity of less than 3 months and a maximum maturity of 9 months. Affirmative covenants are rare, negative covenants are limited. Issue costs are large.

Bank Debt.
> Has an average maturity of 3 to 7 years. Affirmative covenants and negative covenants are common. Issue costs are small.

Non-Bank Private Debt.
> Has an average maturity of 10 to 17 years. Affirmative covenants and negative covenants are common. Issue costs are small.

Public Debt
> Has an average maturity of more than 15 years. Affirmative covenants are rare, negative covenants are common. Issue costs are large.

b) An appropriate source of debt for Cooper Re may be bank debt. The issue costs are small, which is very helpful. The average maturity of bank debt is in line with Cooper Re's needs. The increased covenants may prove restrictive for a quickly growing firm though.

c) Debt financing will likely be very costly due to lack of collateral for a high growth company like Cooper Re, higher variability of cash flows, and steep "term structure". Also, debt servicing strain can cause future lost investment opportunities. If Cooper Re does decide on debt, they should use a shorter maturity debt. Equity may be expensive since investors know that part of investment will be used to shore up values of bonds.

13.

    d) Maintaining debt financing in 5 years will have the following effects on Cooper Re:

- it will help control the "free cash flow" problem
- income tax shields are of greater value for a mature firm like Cooper Re generating significant taxable income
- low costs of financial distress makes debt cheaper
- better collateral makes debt cheaper
- flat "term structure"