

# CFE SDM Model Solutions

## Fall 2018

### 1. Learning Objectives:

2. The candidate will be able to identify and assess second-order risk factors, e.g. credit risk, liquidity risk, contagion risks and parameter risks that can have a major impact if not properly measured, monitored or managed.

### Learning Outcomes:

- (2a) Explain the various types of risks that can arise from specific business activities but are not directly specific to the business itself.
- (2c) Critique the applicability and relevance of measurement and management techniques for these second-order risks.

### Sources:

SDM-108-13 Chapters 2 and 3 of Liquidity Risk – Measurement and Management, Matz and Neu

SDM-150-16 Management Solutions: Liquidity Framework and impact on management

Home Capital article (Globe and Mail article)

### Commentary on Question:

*Candidates generally did well on this question. Candidates were required to list and explain liquidity risk that can arise from specific business activities, but are not directly specific to the business itself. Candidates needed to consider second-order risks that originate from liquidity risk.*

*Candidates should also be able to critique the applicability and relevance of measurement and management techniques for liquidity risk and apply that to Big Ben's situation.*

### Solution:

- (a)
  - (i) Explain the measures Big Ben uses to monitor its liquidity risk.
  - (ii) Assess the change in Big Ben's liquidity risk from 2011 to 2015 based on the above measures. Justify your answer.

### Commentary on Question:

*Candidates did fairly well on this question. Some candidates had trouble defining and analyzing Net Liquidity measure.*

## 1. Continued

(i)

Liquidity index measures the potential losses a Financial Institution (FI) could suffer from sudden or fire-sale disposal of assets compared with the amount it would receive at a fair market value established under normal market (sale) condition.

- Liquidity Index = weighted sum of fire-sale price over fair market value

Financing Gap is the difference between a Depository Institution (DI)'s average loans and average (core) deposits.

- Financing gap = Average loans – Average deposits
- Also accepts: Financing gap = - liquid assets + Borrowed funds

Net Liquidity position measures the difference between sources of liquidity and uses of liquidity.

(ii)

Big Ben's liquidity index has improved from 2011 to 2015, thus, its liquidity risk improved.

Big Ben's financing gap was high from 2011 to 2014. In 2015, it decreased to - 850 mm, which means that the average deposit is larger than average loan. The liquidity profile has improved.

Big Ben's net liquidity was negative for 2011 and 2015, which means it used all liquidity sources and it would be a warning of potential liquidity issues.

(b)

- (i) Identify two flaws with the current liquidity measures Big Ben is using. Justify your answer.
- (ii) Recommend one solution to address each of the two flaws identified in part (i). Justify your recommendations.
- (iii) Assess whether or not the flaws identified in part (i) are material to Big Ben based on recent trends. Justify your answer.

### **Commentary on Question:**

*Candidate did poorly for this section. Marks were given to flaws not listed below only if they were well-supported.*

(i)

The measure Big Ben is using only gives information of liquidity profile at one point of time in a year. It does not provide liquidity information of Big Ben on a timely basis.

## 1. Continued

The liquidity measure does not give information of cash inflows and cash outflows. The maturity of cash flows and appropriate time frame of DI's business is not provided by current tools.

(ii)

Big Ben can monitor liquidity profile and provide liquidity measures more frequently over a specified time period.

Big Ben can use BIS Approach (Maturity ladder) to monitor the liquidity risk on a day-to-day basis or over a series of more frequent specified time periods under different scenarios.

(iii)

These two flaws are not material to Big Ben. Big Ben is currently in a good liquidity position (see part a) and had survived the financial crisis fairly well. From existing liquidity measurements, there is no long-term cashflow mismatches for Big Ben.

- (c) Assess which of the above strategies (I to III) can best address Big Ben's liquidity requirements for each of the following events. Justify each of your answers.
- (i) Mild downgrade of Big Ben's rating
  - (ii) Seasonal withdrawal of deposits
  - (iii) Run on deposits, but only at Big Ben
  - (iv) Failure of the entire financial system
  - (v) Exercise of a \$990 million loan commitment in 2015

### **Commentary on Question:**

*Candidates did fairly well in this question. For part iv), many candidates failed to consider that in a systemic financial failure, RPPC will also be affected.*

*Line of credit and capital injection from parent company are both purchased liquidity management tools. Line of credit will be more expensive and it may not always be available. Capital injection will be Big Ben's unique resource of liquidity due to the structure of the corporation. Line of credit will be more expensive and it may not always be available. Liquid assets are viewed as stored liquidity management, which decreases asset size and has the opportunity cost, but are reliable when other options are out.*

## 1. Continued

*Partial marks were given for choices that do not match the model solution, but were explained well.*

- (i) Capital injection - A downgrade of the bank's rating can also have major effects on both the asset and the liability sides. The cost of funding will increase and the bank might become not eligible for further lending from other institutions which follow lending rules based on minimum ratings. Capital injection from parent company will be preferable to the line of credit, which is more expensive. Liquid assets can also help but they will be sold at a discount price, so it's not recommended.
- (ii) Sell liquid assets - For seasonal withdrawal from depositors, Big Ben should anticipate the seasonal effects by holding larger than normal excess cash reserves. It can prepare that by selling liquidity asset for fair market value. This way, Big Ben won't need to get capital injection from parent company, nor would it need to get line of credit from credit facility.
- (iii) Capital injection – When a bank run happens to Big Ben, the best strategy will be capital injection from parent company. Line of credit from credit facility will be more expensive because of bank run happened to it. Sell liquid assets will possibly at a much discounted price, but also cause even more severe panic about Big Ben's solvency.
- (iv) Sell Liquid assets - In the event of a system-wide crisis like bank run, the unique safety cushion against market disruptions is liquid assets because they always provide a source of funding, even that means Big Ben has to sell its liquid asset at a discount price. Line of credit or capital injection may not be available when bank run started.
- (v) None - In 2015, an exercise of a huge 990 million loan commitment. From the balance sheet, Big Ben will have enough cash reserve to use as a cushion for the exercise of 990 million loan commitment. So it does not need to use any of the three for this event.

## 2. Learning Objectives:

3. The candidate will understand best practices for ERM processes and Capital Management and their use in setting a risk-return strategy in any industry.

### Learning Outcomes:

- (3a) Explain ERM and capital management concepts to evaluate and recommend corporate financial and ERM decisions.
- Apply capital allocation models to a multi-line organization.
  - Compare and contrast various ERM and Capital Management frameworks as to their ability to assess value and articulate the risk-return strategy of an organization.
  - Evaluate the value-added for an organization by jointly evaluating risk measurement and capital allocation.
  - Assess how an ERM process can improve capital efficiency and articulate the risk-return strategy.

### Sources:

SDM-141-15 Managing the Invisible: Identifying Value-Maximizing Combinations of Risk and Capital, 13 - 28

### Commentary on Question:

*The quantitative parts were answered fairly poorly while the qualitative parts were answered well. In particular, candidates did not make a clear connection between debt and credit ratings.*

### Solution:

- (a) Calculate how much initial surplus ABC should hold on January 1 to guarantee its solvency at the end of year. Show your work.

### Commentary on Question:

*Few candidates got this. Some answers were irrational e.g. negative surplus.*

ABC needs to be able to pay the full claim and have its operating loss not exceed 60% of initial surplus to ensure solvency.

$$\text{Critical loss} = (\text{Premiums} - \text{Expenses})(1+i) + \text{Surplus} * i + c * S / (1-t)$$

$$\text{Critical dollar loss} = \text{Claim} - \text{Premium} * (1+i) - \text{Initial Surplus} * i$$

$$60\% \times \text{Surplus} = 100 - 10 * 1.05 - \text{Initial Surplus} * 0.05$$

$$\text{Surplus} = 137.69$$

## 2. Continued

(b) Calculate Value Added if ABC holds the following amount of initial surplus at the beginning of the year:

(i) Amount calculated in part (a)

(ii) \$40

Show your work.

### Commentary on Question:

*Few candidates got this. Some answers were irrational e.g. negative value added.*

(i)

$$\begin{aligned} \text{Value Added} &= \text{Value\_franchise} + \text{Value\_residual} - \text{Initial Surplus} \\ \text{Value\_franchise} &= \text{Present Value of Expected Dividends} \\ \text{State 1 Dividend} &= \text{Initial Surplus} * (1+i) + \text{Premium} * (1+i) - \text{Claim} \\ &= 137.69 * 1.05 + 10 * 1.05 - 0 \\ &= 155.08 \\ \text{State 2 Dividend} &= 137.69 * 1.05 + 10 * 1.05 - 100 \\ &= 55.08 \\ \text{Value\_franchise} &= (0.95 * 155.08 + 0.05 * 55.08) / 1.05 \\ &= 142.9 \\ \text{Value\_residual} &= 0 \quad (\text{since the firm is guaranteed not to go bankrupt}) \\ \text{Value Added} &= 142.9 - 137.69 \\ &= 5.24 \end{aligned}$$

(ii)

$$\begin{aligned} \text{Value\_franchise} &= \text{Present Value of Expected Dividends} \\ \text{State 1 Dividend} &= \text{Initial Surplus} * (1+i) + \text{Premium} * (1+i) - \text{Claim} \\ &= 40 * 1.05 + 10 * 1.05 - 0 \\ &= 52.5 \\ \text{Value\_franchise} &= 0.95 * 52.5 / 1.05 \\ &= 47.5 \\ \text{Value\_residual} &= \text{Present Value of Expected Residual Value} \\ \text{Residual Value} &= \text{Initial Surplus} * (1+i) + \text{Premium} * (1+i) - \text{Claim} \\ &= 40 * 1.05 + 10 * 1.05 - 50 \\ &= 2.5 \\ \text{Value\_residual} &= 0.05 * 2.5 / 1.05 \\ &= 0.12 \\ \text{Value Added} &= 47.5 + 0.12 - 40 \\ &= 7.62 \end{aligned}$$

## 2. Continued

- (c) Explain whether it is preferable for ABC to hold the amount of initial surplus from part (b) (i) or part (b) (ii) from the point of view of:
- (i) ABC's shareholders
  - (ii) ABC's regulatory body

Justify your answers.

**Commentary on Question:**

*Most candidates got this fairly intuitive question that shareholders would want lower levels of capital than the regulator. Candidates who did not get parts (a) and (b) right could still get full marks in (c)*

- (i) ABC's shareholders would prefer to hold \$40 of initial surplus (i.e., same level as part (b) ii ) in order to maximize Value Added.
  - (ii) ABC's regulatory body would prefer for ABC to hold the level of surplus from (b) i) so that there is no solvency concerns with the policyholder / their beneficiary being fully paid.
- (d) Explain why ABC's market capitalization on a stock exchange may be lower compared to the values calculated in part (b). Justify your answer.

**Commentary on Question:**

*Most candidates got part marks on this question which was designed to be fairly easy.*

Shareholders would want to be compensated for the riskiness of the business, and would charge a risk premium reflected in ABC's market capitalization / stock price.

- (e) Explain whether or not the shareholders would support the CRO's proposal based on Value Added. Justify your answer.

**Commentary on Question:**

*Most candidates correctly argued that they would not support the proposal.*

No, as a shareholder, I would not support the proposal. ABC's Value Added is not maximized when holding a 99th percentile level of capital.

## 2. Continued

Part (a) shows that 137.69 of initial surplus needs to be held to remain solvent with a 95th percentile loss. Therefore, at least this level of capital needs to be held to withstand a 99th percentile loss. Part (b) shows that a lower level of surplus is more value maximizing for the shareholder.

- (f) Explain two reasons why the answer from part (e) might change. Justify your answer.

**Commentary on Question:**

*Many candidates got full marks here*

The business plan is no longer to run off the one existing policy. As a shareholder, I would now support the CRO's proposal in order to attain a favorable rating from XYZ.

Attaining a favorable rating from XYZ will lower the cost of issuing debt. Higher interest costs would lower potential dividends / the value of the firm. If the cost of issuance is too high, ABC may need to issue more equity which would dilute the value of current shares.



### 3. Learning Objectives:

1. The candidate will understand measures of corporate value and their uses in risk management.

#### Learning Outcomes:

- (1a) Assess accounting concepts used in the production of financial statements and recommend the appropriate measure to evaluate corporate value.
- (1c) Evaluate various financial reporting metrics for use in corporate decision-making.

#### Sources:

SDM-100-13 Managerial Accounting for CERAs and FSAs, 2013

#### Commentary on Question:

*The purpose of the question is to test the candidate's ability to apply accounting concepts in evaluating a company's financial performance and risks. The candidates are expected to propose business recommendations based on their evaluation.*

*One important consideration for receiving maximum points is whether the candidate successfully justifies the answer based on the case study materials or just relies on a general explanation.*

#### Solution:

- (a)
  - (i) Identify one income statement line item for each risk that is directly impacted by that risk.
  - (ii) Describe how each line item identified in part (i) has been impacted by the applicable risk if at all. Justify your answer.
  - (iii) Propose a solution to mitigate the most volatile of the four risks above. Justify your answer.

#### Commentary on Question:

*Most candidates successfully completed question (a). In part (a) (i), some candidates failed to identify the manufacture risk's impact on Other (5) under operation expense. This risk was indicated in the note (5) of Blue Jay Tire Corporation's Non-consolidated statement of operations (Predominantly injury claims). Also, some candidates' justifications in part (a) (ii) failed to refer to the case study materials. Only partial credits were granted in this case.*

- (i) The commodity risk impacts the cost of raw materials.  
The manufacturing risk impacts the Other (5) under operation expense.  
The labor risk impacts the production costs.  
The foreign exchange risk impacts the foreign exchange gain (loss).

### 3. Continued

- (ii) Commodity risk: The rise of natural rubber's price increases the cost of raw materials. The cost of raw materials has been increased by 1 million dollars each year since 2014. The cost of raw materials has accounted for 5% of the total sales constantly. Therefore, the impact of the commodity risk is low.

Manufacturing risk: There is no obvious evidence to prove the impact of manufacturing risk is high. However, the expenses caused by the manufacture risk (e.g. predominantly injury claims) are volatile year by year.

Labor risk: The production cost has accounted for 10% of the total sales consistently since 2014. The current union contract ends in 2016. The level of labor risk will depend on the renewal negotiation for the new contract.

Foreign exchange risk: The foreign exchange gain (loss) is the most volatile among the four line items. It is about 5% of the total Operating expense. The impact is medium since the dollar amount of the gain / loss is not significant.

- (iii) Foreign exchange risk is not significant by the amount. However, it is the most volatile risk since the loss or gain from foreign exchange has changed the most by % in the income statement among the above four risks. It is recommended to use the foreign exchange swap to hedge the foreign exchange risk. BJT can lock-in the foreign exchange rate from foreign currency to USD by paying a fix rate and receiving a floating exchange rate.

(b)

- (i) Calculate Quick Ratios for BJT from 2012 to 2015. Show your work.
- (ii) Calculate the Days Sales Outstanding for BJT from 2012 to 2015. Show your work.
- (iii) Assess the implication of the Quick Ratios and the Days Sales Outstanding from parts (i) and (ii).

**Commentary on Question:**

*Most Candidates can recall the formula for Quick Ratio and Days Sales Outstanding. The candidates need to emphasize that as long as the quick ratio is >1, BJT is not experiencing a liquidity issue.*

### 3. Continued

- (i) Quick Ratio = (Current Asset – Inventory)/Current Liability

	2015	2014	2013	2012
<b>Current Asset</b>	206	210	198	201
<b>Inventory</b>	53	58	48	37
<b>Current Liability</b>	13	12	10	4
<b>Quick Ratio</b>	12	13	15	41

- (ii) Days Sales Outstanding = Account Receivable / Average sales per day  
(Average sales per day = Sales / 360)

	2015	2014	2013	2012
<b>Amount Receivable</b>	23	11	9	4
<b>Average Sales per day (Sales / 360)</b>	0.8	0.7	0.7	0.6
<b>Days Sales Outstanding</b>	29.9	15.3	13.4	6.3

- (iii) The quick ratio indicates BJT's short-term liquidity. For example, in 2015 a quick ratio of 12 indicates that BJT has \$12 of liquid assets available to cover every \$1 of current liabilities. Since the quick ratio is larger than 1, it doesn't indicate that BJT has a potential liquidity risk to meet its short-term obligations using the most liquid assets.

The days-sales-outstanding ratio (DSO) estimates BJT's average collection period. BJT's DSO nearly doubled in 2015. It indicates that BJT account receivables might be managed poorly in 2015. BJT might have problem to collect money back from its customers. A higher DSO indicates potential cash flow problems and heightened default risk from those customers.

- (c) Describe how the tire recall crisis was reflected in BJT's Non-Consolidated Statement of Cash Flows and Non-Consolidated Statements of Operations. Justify your answer.

**Commentary on Question:**

*Most candidates answered the question well. Line items other than the ones listed below could be accepted, if it was justified properly. In order to receive the full credit, a detailed explanation based on the case study is required.*

### 3. Continued

Tire recall activities made a change in the following three line items:

- Changes in other operating activities: Tire recall is not considered as a recurring event. It causes negative cash flows of \$60 million under other operating activities in 2015 only.
- Amortization of deferred expense: the \$60 million expense caused by recalling is amortized fully in three years using straight line method.
- Changes in inventory: The change in inventory is \$4 million in 2015. Tire recall could hurt BJT's reputation and reduce the tire sales in 2015. Therefore, BJT spent less cash for manufacturing tire (inventory).
- Non-recurring under operating expense: Tire recall could trigger an upgrade to the manufacturing process, as evidenced by an uptick in 2015 non-recurring expense.

(d)

- (i) Critique the Board's assertion that the expansion program has not helped to improve income.
- (ii) Identify the primary funding strategy for BJT's past production expansion. Justify your answer.
- (iii) Explain the risk associated with the funding strategy identified in part (ii).

**Commentary on Question:**

*The essence of (d) (i) is to realize that non-recurring expenses need to be removed from net operating income when the board evaluates the expansion strategy. Most candidates answered (d) (ii) and (iii) well.*

- (i) Expansion program increases the sells every year from 2012 to 2015. Non-recurring items are not related to expansion strategy. They are mainly associated with the tire recall activities and are not expected to re-occur as normal business expenses. Therefore, non-recurring items need to be removed from net operating income when the board evaluates the expansion strategy. The net income will increase after such a removal. Also, the yearly gain (loss) from foreign exchange is volatile. The foreign exchange gain in year 2014 and 2015 increased net income. However, the gain (loss) from foreign exchanges is not directly related to the expansion program.
- (ii) BJT has been funding by debt. This is indicated by a doubled Long Term Debt line of the Non-Consolidated Statement of Financial Position since 2009. There is no equity injection over the period.
- (iii) Increasing debit will increase potential liquidity risk identified in part b.

### 3. Continued

- (e)
- (i) Evaluate the tire warranty program with respect to the following three aspects:
- BJT's core business
  - Strategic importance to BJT
  - Profitability
- (ii) Describe the pros and cons of using insurance to mitigate the risk of the warranty program on future tire sales.

**Commentary on Question:**

*Some candidates evaluated the future profitability of the warranty program covered by insurance instead of the current warranty program in part (e) (i).*

*Most candidates did well in part (e) (ii).*

- (i) BJT is a tire manufacture company. Insurance is not its core business. The tire warranty program is important strategically because it enhances BJT's sales and brand image. The income generated from the tire warranty program has been historically strong and stable.
- (ii)
- Pro: Selling product warranty is not the core business for BJT. BJT may not have the best resource to for such an operation. However, it is necessary to offer the warranty to its clients as part of product enhancement. Therefore, buying insurance for its warranty program will allow BJT to continue offering the tire warranty to its clients. BJT can transfer the liability from its tire warranty to a third party and smooth its earning volatility. BJT will pay a fixed amount to exchange for the full coverage of potential tire liability. The high quality of its tire ascertains a low number of claims on its tire warranty program. This good experience in return will help BJT receive a better premium rate from the outsourced insurance company.
  - Cons: The income from tire warranty program has been strong and stable. Purchasing insurance for new business will substantially decrease the future net income from the warranty program while the liability of the replacement costs on the sold tires will not diminish (because the warranty program is maintained on a pay-as-you-go basis).

### 3. Continued

- (f) Describe the impact on BJT's Non-Consolidated Statement of Financial Position if BJT also insures its liability on outstanding warranties. Justify your answer.

**Commentary on Question:**

*Most candidates did poorly in this question. In order to receive full credit, the candidates need to understand that the reserves of the inforce business need to be transferred to the insurer along with its liability. In BJT's case, the warranty program is maintained on a pay-as-you-go basis. No reserve was set up initially for the inforce warranty program. Therefore, BJT needs to fund the required reserve from its cash.*

Insuring the existing liability will require BJT to provide the expected future replacement cost on the existing tires on a present value basis. This will increase the current liquidity risk exposure for BJT as it needs to come up with a one-time cash to pay for such transfer of risks.

#### 4. Learning Objectives:

4. The candidate will understand the impacts of organization cultures, competition, trends, customer experience, communication and business strategies on corporate finance and ERM decision making.
5. The candidate will explore how to evaluate new risk areas, innovations, new product designs and market disruptions in a sustainable and risk-aware manner.

#### Learning Outcomes:

- (4a) Apply human behavior factors to evaluate and recommend corporate finance and ERM decisions.
- (5a) Critique financial models, assumptions and decisions including the impact of human behavior in decision-making, problem solving and innovation.

#### Sources:

SDM-240-13 Organizational Behavior - Ch 9, 302-303, 308-314, 316-318

SDM-250-13 Improving Decisions about Health, Wealth and Happiness - Ch 1, 23-35

SDM-241-13 Organizational Behavior - Ch 10, 339-343

SDM-243-13 Organizational Behavior - Ch 12, 415-420

#### Commentary on Question:

*The question tested candidates on various concepts of communication. Candidates were generally able to identify and discuss concepts but had difficulty applying these to the written memo. Often times the candidate would acknowledge the audience (the regulator) and identify the negotiating tactic but failed to successfully communicate a consistent reply.*

#### Solution:

- (a)
  - (i) Identify two common organizational barriers to effective communication.
  - (ii) Describe one way to minimize the adverse impact from each of the two barriers identified in part (i).

#### Commentary on Question:

*Most candidates were able to answer this question. Some responses to minimizing the adverse impact of the barriers were too general and needed to be elaborated.*

#### Information Overload

Know your audience when presenting. Details may overwhelm them so keep the message simple

## 4. Continued

### Information Distortion

Encourage feedback of your communication to ensure that they are interpreting it correctly

### Time Pressures

Regulate information flow and timing to other areas. Reach milestones before communicating results and providing status updates.

*Candidates needed to present a reasonable argument that could minimize the identified communication barrier. The barrier and the minimization have to be consistent.*

- (b) Assess the merits of the proposed collaboration effort and its effectiveness with regulators based on each of the five identified actions (A to E). Justify your answer.

### **Commentary on Question:**

*Most candidates were able to provide a reasonable assessment. There were a handful of candidates that wrote general responses that did not relate back to the question at all. Those responses received little to no marks.*

### Know your Audience

- It is positive that XYZ is taking a proactive approach with regulators as they recognize a potential risk to their product.
- Sharing current regulations that could be applicable to the UK market allows regulators to become informed and benchmark with other jurisdictions
- High level numbers might not be sufficient to reducing regulators concerns, may need more details or at the very least give the regulators an opportunity to ask some detailed questions about potential impacts

### Select an Appropriate Communication Medium

- A written summary lacks richness in communication because it does not provide any immediate feedback opportunities for regulators. This lack of richness when attempting to launch an innovative product could hinder the speed of acceptance by the regulators. However as an initial form of communication that leads to face-to-face meetings with regulators, this could be an effective way to introduce the subject to regulators.

### Listen Actively

- There is no opportunity to actively listen with this initial proposed collaboration effort.



## 4. Continued

### Encourage Feedback

- XYZ did not reach out to the regulators on providing feedback on their plans. This would not be effective in getting the regulators to accept this innovation.

### Regulate Information Flow and Timing

- XYZ did a good job of limiting the information being initially provided to regulators. Rather than overwhelm them with numbers, they have present information at a high-level in attempt to emphasize its significance.

*Candidates needed to present a reasonable argument that is consistent with the source materials to demonstrate his/her understanding of the materials.*

(c)

- (i) Identify two cognitive biases demonstrated by the regulators. Justify your answers.
- (ii) Describe two approaches through which XYZ may overcome the cognitive biases identified in part (i).

### **Commentary on Question:**

*Candidates struggled in providing approaches to overcome cognitive biases. There were a number of candidates that identified the representativeness heuristic but failed to properly explain it.*

### Anchoring

Regulators are using taxi average premium as a reference in determining the appropriateness of the ride-sharing insurance product without considering other factors that can make the ride-sharing insurance unique.

### Ease-of-recall or Availability Bias

Average premium is a readily available measure that might not be a fair comparison between the 2 types of insurance products. Other measures such as premium per miles/kilometers driven might make for a better comparison but would require more analysis and in-depth understanding of the products.

Explain why average premium is not a good way to compare the 2 types of insurance product.

Explain why ride-sharing and taxi insurance are different in terms of coverage and risk exposure.

## 4. Continued

- (d)
- (i) Recommend a negotiation tactic that could create a Win-Win situation for XYZ and the regulators. Justify your recommendation.
  - (ii) Recommend three actions that XYZ could undertake in pursuing the negotiation tactic recommended in part (i). Justify your recommendations.

### **Commentary on Question:**

*Most candidates were able to identify the negotiation tactic but many were unable to provide actions that XYZ could undertake. Actions tended to be too general. Additional elaboration was needed in many cases.*

Only Integrative Tactics for negotiation can create a Win-Win situation for XYZ and regulators because this is the only strategy that involves a collaborative win-win approach and since developing a product that protects the users should be an attractive undertaking to both XYZ and the regulator. Also, since the other party is a regulator, it is in the best interest of XYZ to be collaborative and finds a solution that is attractive to both parties.

Example actions:

Show that the regulators' concerns and goals (ie need insurance but at right price) are important to XYZ.

Provide numbers to backup possible issues.

Provide existing research to regulators that address their anticipated concerns.

Show that launching a riding-sharing insurance is too important to compromise.

Indicate that ride-sharing is inevitable and people need protection from this activity that isn't being addressed by the current market.

Make arguments to show the benefit significantly outweigh the cost.

Setting up a face-to-face meeting with the regulators will allow XYZ to facilitate a Win-Win situation because XYZ can show the regulators the amount of due diligence they have put into this product and can immediately respond to any of their concerns.

Demonstrate that XYZ is flexible with respect to various solutions.

Provide alternatives product design for regulators consideration.

Set up a follow-up meeting to go over concerns during the first meeting.

## 4. Continued

- (e) Draft a written response to the regulators incorporating your answers to parts (c) and (d).

**Commentary on Question:**

*Candidates responses varied significantly. Candidates needed to understand that the audience was the regulator and needed to use appropriate language and consideration. Telling the regulators that they have biases is inappropriate and inconsistent with an integrative negotiating tactic.*

**Sample Response:**

Thank you regulators for your response.

As you are aware, ride-sharing as an alternative to traditional taxis has increased X% over the last decade, and the insurance market needs to acknowledge and address ride-sharing as a new viable option. We share your view that passengers should be properly protected no matter what method of transportation they elect, and are grateful for the opportunity to collaborate on a suitable product for this market.

We believe that it is in both of our interests to advance the development of this new insurance products in order to protect public interests. As a well-regarded insurance company in the market, protecting policyholders is of the utmost importance and we agree with your assessment that premiums should be priced fairly and reflective of the coverage provided. The first step for us to develop a suitable product to understand the differences in exposures between ride-sharing and traditional taxis. As we are working toward our shared goal of providing passengers with adequate protection, this is a great opportunity for us to collaborate on a product design that best reflects the nuances of the ride-sharing industry.

We would like to setup a face-to-face meeting to address your concerns as soon as possible so that we have time to adjust our product. Our Regulatory Affairs personnel will reach out to you shortly to confirm some possible meeting times.

XYZ looks forward to working with you to bring a new innovative product to the UK marketplace.

## 5. Learning Objectives:

1. The candidate will understand measures of corporate value and their uses in risk management.
3. The candidate will understand best practices for ERM processes and Capital Management and their use in setting a risk-return strategy in any industry.

### Learning Outcomes:

- (1b) Explain how economic capital and related concepts can be used as the building block of value measure in any industry.
- (3a) Explain ERM and capital management concepts to evaluate and recommend corporate financial and ERM decisions.
- Apply capital allocation models to a multi-line organization.
  - Compare and contrast various ERM and Capital Management frameworks as to their ability to assess value and articulate the risk-return strategy of an organization.
  - Evaluate the value-added for an organization by jointly evaluating risk measurement and capital allocation.
  - Assess how an ERM process can improve capital efficiency and articulate the risk-return strategy.
- (3b) Explain ERM principles and frameworks.
- Evaluate a company's ERM processes in its ability to adapt to emerging issues and identify risk opportunities.
  - Critique the direction of new regulation and industry standards in risk governance.
  - Describe the components of a risk appetite statement. Design and develop a risk appetite statement and risk return strategy.

### Sources:

SDM-168-17 Risk Management and the Rating Process for Insurance Companies

SDM-169-17 ORSA practice note

SDM-145-16 A comparison and economic analysis of international solvency regimes for life annuity markets

### Commentary on Question:

*The intent of this question is to test the candidate's understanding of A.M. Best methodology for risk management in the rating process and apply the process in a realistic context. Additionally, candidates will understand differences in statutory versus economic value measures, and recommend actions to meet strategic objectives in light of competing value measures.*

## 5. Continued

### Solution:

- (a) Describe one strong characteristic and one weak characteristic of an insurance company with respect to each key area (I-III).

#### Commentary on Question:

*This part was answered poorly. Most candidates did not recall the list from A.M. Best rating process. Full credit was given if candidates recalled both a strong and weak characteristics from the reading.*

#### I. Culture

Strong: Tone is set from the top. Senior management establishes an environment that embeds risk awareness throughout the organization.

Weak: Risk management is reactive rather than proactive process.

#### II. Identification and Management

Strong: Identification process across 5 categories of risk (underwriting, market, Credit, operational, strategic)

Weak: Risk identification are done independently throughout different departments and in silos. Does not consider risk correlations.

#### III. Measurement

Strong: Use scorecards to assess risks

Weak: EC model is not incorporated as a decision making tool

- (b) Evaluate Darwin's abilities with respect to each key area (I-III). Justify your response.

#### Commentary on Question:

*Candidates must use examples from Darwin case study to get full credit.*

Culture: Darwin has a formal ERM Committee and objective is to integrate ERM with day-to-day business operations. However, the data used to feed the ERM systems is messy and hasn't been prioritized by SM despite stating they would do so. Overall evidence suggests Culture is fairly strong.

Identification and Management: There is an explicit mandate to identify risks across the 5 categories and risk appetite statements correspond to enterprise. However, it appears primary metric is statutory capital so risk assessment may not be purely economic or dynamic. Lastly, operational risk due to misaligned resources is not well identified. Overall evidence suggests Risk Identification is medium.

## 5. Continued

Measurement: Darwin uses statutory capital is the main metric and very little stress testing was done. There is talk to introduce EC and RAROC measures. Overall evidence suggests Measurement is weak.

- (c) Recommend one action for each key area (I-III) to improve the strength of Darwin's ERM framework. Justify your recommendation.

**Commentary on Question:**

*Overall, candidates did OK on this part. Candidates must identify actual shortcoming of Darwin's current processes as evidenced by the case study.*

Culture: Senior management can set a stronger tone at the top by making data quality a priority. Senior managers can have their compensation linked to successful delivery of ERM systems.

Identification and Management: Darwin can incorporate current market data and/or forward looking expectations as much as possible. Risk evaluation of new product should consider ERM impacts.

Measurement: Darwin can build an EC model and introduce RAROC for profitability measures.

- (d) Describe how a strong ERM framework can be reflected in internal measures of risk, such as economic capital.

**Commentary on Question:**

*Overall, candidates did well on this part. Most candidates demonstrated understanding of economic capital as a risk measure.*

Companies that demonstrate strong operational risk controls, select diversified portfolios of risk, and proactively deploy risk mitigation strategies can reduce their loss frequency/severity and thus reduce VaR or similar measures as quantified through economic capital. These idiosyncratic ERM abilities are generally not fully captured on a statutory basis.

- (e)
- (i) Explain why the Variable Annuity product line may consume less capital on an economic basis relative to a statutory basis.
  - (ii) Explain why the Term product line may consume less capital on an economic basis relative to a statutory basis.

Justify your answers.

## 5. Continued

### **Commentary on Question:**

*Overall, candidates did poorly on this part. In order for answers to get full credit, it must cite evidence from the case study.*

VA: Darwin engages in dynamic hedging strategy that is rebalanced weekly to 90% delta and 50% rho hedged. Residual risks will be mostly gamma/vega driven which have a much different risk profile than the unhedged liability. Therefore diversification benefit allocated to VA will also tend to be higher than on a statutory basis. In addition, Darwin is a US company subject to the US regulatory regime which has lowest level of focusing on economic values and reflecting risk sensitivities. This means that the statutory basis would likely not be the same of economic capital. The US RBC model uses a prescriptive formulaic approach which does not reflect individual company risk management model. Therefore, it is very likely that the statutory capital can be higher than economic capital.

Term: Redundant reserves basically serve as economic buffer and hence economic capital over statutory reserve would tend to be much lower than statutory capital. There is very little market risk exposure from term so mostly mortality driven profile will also tend to diversify with much larger exposures in VA/UL.

- (f) Roger says: “...because Statutory Capital is more punitive than Economic Capital in aggregate, Darwin can achieve its desired credit rating solely based on its RBC ratio”.

Critique Roger’s statement.

### **Commentary on Question:**

*Overall, candidates did not do well on this part. Credit was given if a candidate demonstrated the uses of economic capital.*

Statutory capital is not as reflective of the company's risk profile and certainly doesn't fully quantify the impact of risk mitigating strategies and diversification. Furthermore, EC forms a much more risk-sensitive basis for profitability measurement and deal acceptance, and is a critical input to firm-wide value maximization. Firms that receive strong ratings, particularly with respect to the ERM dimension, demonstrate that EC (or similar risk metric) is integrated into business decision making, which is not solely driven by statutory results. Lastly, statutory rules may not handle emerging risks that are not anticipated in today's environment while EC takes into consideration any new emerging risks from new product innovation.

## 5. Continued

- (g)
- (i) Recommend one strategy for the Variable Annuity product line that may create value for Darwin.
  - (ii) Recommend one strategy for the Term product line that may create value for Darwin.

Justify your answers based solely on the divergence of Statutory Capital and Economic Capital.

**Commentary on Question:**

*Candidates did well on this part. Credit was given if candidate had a justified answer with evidence based on the case study.*

VA: Can target a hedge ratio such that Stat and Econ capital are equalized. This basically means hedging less, which will save on hedge costs, but since the Stat requirements are set a specific level, the block is no more risky in terms of solvency. Alternatively, can communicate to rating agency that the residual risk is low and hence the locked in Stat Capital is economically free surplus.

Term: Darwin can pursue a redundant reserve financing strategy, which will free up the locked up reserve to calibrate overall total balance sheet requirement to the level implied by EC



## 6. Learning Objectives:

4. The candidate will understand the impacts of organization cultures, competition, trends, customer experience, communication and business strategies on corporate finance and ERM decision making.
5. The candidate will explore how to evaluate new risk areas, innovations, new product designs and market disruptions in a sustainable and risk-aware manner.

### Learning Outcomes:

- (4a) Apply human behavior factors to evaluate and recommend corporate finance and ERM decisions.
- (4b) Apply business school management concepts to evaluate and recommend corporate finance and ERM decisions.
- (5c) Evaluate innovation and market disruption opportunities.

### Sources:

<http://www.free-management-ebooks.com/dldebk-pdf/fme-five-forces-framework.pdf>

Nudge: Improving Decisions about Health, Wealth and Happiness, Thaler, Richard and Sunstein, Cass

Organizational Behavior: A Strategic Approach, Hitt, Michael, Miller, C. Chet, and Colella, Adrienne, John Wiley & Sons, 4th Edition, 2015, Ch. 9, 293-323

### Commentary on Question:

*The goal of this question is to test the candidate's understanding of Porter's five forces. The candidate should be able to apply the framework and determine a company's strengths, weaknesses, and competitive challenges. The candidate should evaluate Frenz's growth strategy within Porter's framework and determine the likely outcome of the strategy.*

*Candidates generally performed well on this question, but those who did not missed both the calculation portions and did not properly apply the biases/nudges to this particular scenario laid out in the question.*

### Solution:

- (a) Describe the Herfindahl-Hirschman Index (HHI).

## 6. Continued

HH is defined as an index that measures competitive rivalry position among the competitors within an industry. It takes into consideration both market shares and size of organizations in relation to the industry. It indicates the amount of competition amongst these organizations and gives a greater weighting to larger organizations. The index ranges from a value of zero, which indicates a very large number of small organizations, to one, which represents a monopoly. Therefore, the closer the HHI Index is to zero, the greater the level of competition within the sector.

- (b) Rank the three geographic markets with respect to HHI. Justify your answers.

**Commentary on Question:**

*The goal was to have Europe be the highest HHI, but it was possible to argue that NA had that highest HHI. Where justification was provided, this answer was also given credit.*

Europe has the highest HH index among the three geographic regions because Frenz has a dominant market share position of 40% in Europe, indicating a nearly monopoly position in this geography with fragmented and weak competitive pressure for Frenz. North America (NA) will have a higher HH index than Latin America (LA) but lower than Europe because there are 3 major operators with similar market shares. The three companies equally share over 60% of the market. LA will have the lowest HH index because of the highly fragmented market, with no company having a dominant position in the market share.

- (c)
- (i) Identify the social nudge that Frenz is utilizing in its smartphone app strategy.
  - (ii) Describe how the social nudge identified in part (i) may contribute to Frenz's digital strategy. Justify your answer.

For this digital app strategy, Frenz is attempting to utilize the social tendency to "Follow the Herd" (Peer Pressure). By having users alerts their friends that they are at a nearby coffee house, Frenz is attempting to encourage friends to meet at the coffee house, increasing foot traffic, duration of visits, and ultimately sales. This social nudge aligns with Frenz's digital strategy goals of "building the brand's digital presence, enhancing customer experience with technology & reaffirming Frenz's origins as the "specialty coffee for the worker on the move". It could also allow more customer data to be collected by Frenz for predictive modeling and thus, also enhance the last of Frenz's digital goal of "using analytics to understand customer preferences".

## 6. Continued

- (d) Identify one barrier of communication for each of Groups B and C coffee consumers that may have resulted in the smartphone app not appealing to them. Justify your answers.

Group B: Time Pressure. Working professionals are constantly under multiple deadlines, which creates constraints and pressure in an individual's ability to communicate and receive the message. Other possible explanations include Information Overload, in today's world; consumers are bombarded with emails, mass marketing phone calls/letters and instant messaging. For working professionals, they are always burdened with more information than they can process.

Group C, Specialty Area Jargon, so the retirees were used to thinking and communicating in a very specialized way with their own language and has very limited understanding of other areas. Other possible explanation include Semantic Differences. Same words may have different meanings to different people and semantic differences can create communication problems. The retired have a lot of experiences and might have differing frame of references and understand the same word/concepts differently.

- (e)
- (i) Recommend a communication medium that best addresses the barriers identified in part (d) for each of Groups B and C. Justify your answers.
- (ii) Describe an example for each of Groups B and C of how Frenz can use the communication media identified in part (i). Justify your answers.

**Commentary on Question:** *Some candidates suggested tactics that completely contradicted the barriers identified in part (d) (e.g., suggesting that Frenz should teach seniors how to use the app after stating that generation does not use apps at all). Consistency was considered during marking.*

Group B: Written display such as billboard. Working professionals have a busy schedule and the only down time for this group is when they are commuting from one place to next or waiting in line to check out. Frenz should take advantage of their idle time to market its coffee via billboard on the street or notice board in store. The information overload issue could be minimized as the billboard information is usually short and precise due to limited space.

Group C: Face to Face communication to promote the coffee sales. The retired are not working and have the luxury of time. To remove any specialty area jargon or semantic difference or information overload barriers, we should rely on the richest communication media where we can better market the different types of coffee or explain the better coffee offer to this group. They would be happy with the human interface.

## 6. Continued

- (f) Recommend a social nudge that Frenz can use effectively to increase coffee sales for each of the selected communication media identified in part (e). Justify your answers with an example for each nudge.

For the billboard, one social nudge that could be used is "socializing nondrinking". By emphasizing certain statistics that support the "social norm" of drinking coffee (such as about 83% of adults drink coffee in the US ; Average consumption is 3.2 cups of coffee per day). This could encourage causal coffee drinkers to increase the frequency and amount of drinking coffee each day and encourage non-coffee drinkers to try out drinking coffee. Frenz could also highlight facts that "most (for example, 80%) of the consumers are enjoying our food along with coffee " and encourage consumers in trying Frenz's food as most other consumers do so, will want to conform and try their food too. To make this even more effective, Frenz can add a smiley face at the end of this sentence on the billboard. This will help encourage food sale as well because when informational message is combined with emotional nudge, it's the most effective. Encouraging food sale will generally help to increase coffee sale as most people take food with a drink.

For the face-to face communication, one recommended social nudge is "priming". When customers check out at the counter, Frenz's barista can ask them whether they intend to try out the different brand of specialty coffees that Frenz has or whether they have tried Frenz's new food recipe today and later. When people are asked about their intentions, they are more likely to act in accordance with their intentions and try Frenz's other specialty coffee and food, as explained by the "mere-measurement effect".

## 7. Learning Objectives:

4. The candidate will understand the impacts of organization cultures, competition, trends, customer experience, communication and business strategies on corporate finance and ERM decision making.
5. The candidate will explore how to evaluate new risk areas, innovations, new product designs and market disruptions in a sustainable and risk-aware manner.

### Learning Outcomes:

- (4a) Apply human behavior factors to evaluate and recommend corporate finance and ERM decisions.
- (4b) Apply business school management concepts to evaluate and recommend corporate finance and ERM decisions.
- (5c) Evaluate innovation and market disruption opportunities.

### Sources:

SDM-216-17 Five Forces framework by Porter

SDM-209-17 The Undoing Project Ch 6

SDM-210-17 The Undoing Project Ch 7

### Commentary on Question:

*The purpose of this question was to test candidates' ability to understand how new technology can impact an organization and to think critically about a company's strategy for dealing with potential disruptive technologies. Candidates needed to provide an assessment from a senior management perspective.*

### Solution:

- (a)
  - (i) Evaluate how the disruptive technologies (I-IV) may impact BJA under each of Porter's five forces of competition. Justify your answer.
  - (ii) Describe three reasons why the disruptive technologies represent a threat to BJA.
  - (iii) Rank the four disruptive technologies (I-IV) in the order of greatest to least threat to BJA. Justify your answer.

## 7. Continued

### **Commentary on Question:**

*Candidates needed to evaluate the impact of the disruptive technologies as a whole on **each** of Porter's five forces of competition. Some candidates instead evaluated the impact of a few of Porter's forces of competition on each of the disruptive technologies. To receive full credit for the first part, all 5 of Porter's five forces of competition needed to be evaluated along with sufficient justification. For part (ii), many candidates re-listed items they already provided for part (i). To receive full credit, candidates needed to provide new responses and be more specific in their descriptions. For part (iii), many candidates focused only on information provided in the stem – such as speed, passenger capacity, etc for each of the disruptive technologies. For effective decision-making, candidates should recognize there are also other factors to consider – such as the infrastructure required to implement the new technology. Below is the suggested ranking, but other rankings were given credit if sufficient justification was given.*

- (i) The disruptive technologies impact BJA under each of Porter's five forces of competition – competitive rivalry, threat of new entrants, threat of substitutes, bargaining power of suppliers, and bargaining power of customers.

**Competitive rivalry** - many industries have seen changes in the dominance of the market leaders as new entrants and technology alter the dynamics of a market

**Threat of new entrants** - new technology can be offered through new players in the industry

**Threat of substitutes** - new technology provides an innovative, improved way of providing similar benefits to the consumer

**Bargaining power of suppliers** - materials demanded through the disruptive technology are likely similar to those used by airlines and increases the number of buyers; potentially increases bargaining power of suppliers

**Bargaining power of customers** - even business customer is price sensitive and switching costs among some of these technologies and airlines is low; potentially increases bargaining power of customers

## 7. Continued

- (ii) The disruptive technologies represent a threat to BJA because they:
- potentially destroy value of aircraft technology through transportation options that could save time and money
  - serve the same geographic markets and potentially the business community
  - include flying vehicles that are not limited to airport to airport / station to station
- (iii) The rank of the four disruptive technologies in order of greatest to least threat to BJA is as follows:
1. High Speed Bullet Train - For regional airline industry with the North America domain such as Blue Jay Air, this segment of the airline industry is already in competition with the traditional rail industries. With the advance of the High Speed Bullet Train, the competition would intensify as the rail industry already has the proprietary knowledge in this area.
  2. Hyperloop - This new technology can easily adopted by the traditional rail industry to further improve its railroad system and further intensify its competition with regional airline industry. However, the adoption of this new technology will come at a cost to the rail industry as they need to retrofit all their railroad tracks to adopt the new technology. This significant cost investment may hinder the competitiveness of the rail industry against the regional airline industry.
  3. Autonomous Flying Vehicle - Speed and distance coverage would limit its competitiveness against the regional airline industry. However, this would be a viable option for short distance flights. Helicopters are not in direct competition with regional airline companies currently.
  4. Transit Elevated Bus - Speed and infrastructure development would significantly limit the competitiveness of this technology against regional airline industry that Blue Jay Air specializes in.
- (b)
- (i) Identify one heuristic used by Rebecca in her argument. Justify your response.
  - (ii) Identify one cognitive bias demonstrated by Rebecca. Justify your response.

## 7. Continued

### **Commentary on Question:**

*Candidates generally were able to provide a heuristic and cognitive bias that fit with Rebecca's statement. Some candidates; however, did not have a clear understanding of the difference between a heuristic and cognitive bias and provided a cognitive bias for both (i) and (ii) instead. Below are example responses, other answers were accepted if justifications were reasonable.*

- (i) The heuristic used by Rebecca is **availability / ease of recall**. Predictions of future technology from the past is very vivid to Rebecca and is recalled with ease (remembers the term "urbmobiles"). Rebecca disproportionately weighs these memories in this judgment and as a result, deems the Transit Elevated Bus and flying cars to be very unlikely.
- (ii) The cognitive bias demonstrated by Rebecca was **hindsight bias**. She believed the event to be far more predictable once the outcome was known as evidenced by her statement, "All of this was predictable. People just wanted to sell magazines".
- (c) Describe three reasons why the Autonomous Flying Vehicle represents the best strategic opportunity for BJA to pursue among the four disruptive technologies (I-IV) based on the definition of strategy provided above.

### **Commentary on Question:**

*The candidate's answer needed to consider BJA's competency, resources, and the elements embedded within the strategy. Generic responses that did not consider Blue Jay Air specifically did not receive full credit. No credit was given to responses that did not align with BJA's strategy. Below is a sample response.*

Blue Jay Air's strategic vision is to become the most customer-oriented airline company, focusing on services, punctuality, safety and comfort. Also, it has strong desire to maintain a credit rating of at least BBB- rating. Even though the company implements cost control, it also wants to foster a strong relationship with its non-unionized labor force. Its clientele are mostly business travelers who demands services, punctuality, safety and comfort. Its main competency is flight services and has no experience in other form of transportation. It has a Tire subsidiary, which means that the company has some manufacturing expertise. The Autonomous Flying Vehicle represents the best strategic opportunity for BJA for many reasons. Below are a few examples:

- Autonomous Flying Vehicle (AFV) aligns better with BJA's strategic direction and scope as it enhances BJA's customer services such as door-to-door service to business traveler, expand services to include intra-city transportation, etc.
- BJA can use its existing resources and competency in operating these vehicles with less costs than other 3 technologies.



## 7. Continued

- Entering into AFV will enhance competitive advantage as BJA can maintain its current target market base as opposed to entering into a totally new customer base that BJA has no expertise in.
  - High-speed Bullet Train and Hyperloop are directly competing with BJA's current market share and thus self-cannibalization would occur through routes offered by these rail and Hyperloop.
  - Transit Elevated Bus is not a threat or commodity to the business market as it is more aligned with public transportation. Thus there is no enhancement to BJA's current strategic direction.
  - AFV allows easy transfer of technology internationally.
- (d) Recommend two tactics that BJA can use with the Autonomous Flying Vehicle to successfully overcome rivals from other disruptive technologies. Justify your recommendation.

### **Commentary on Question:**

*Many candidates provided generic responses, and did not provide sufficient details/justification on how to achieve the tactic. Candidates needed to think critically, exercise some creativity in their responses, and provide an adequate description of the tactic and how to achieve it. No credit was given to tactics that were not practical or were impossible to implement.*

Some tactics BJA can use with the Autonomous Flying Vehicle to successfully overcome rivals from other disruptive technologies include:

- BJA can offer door-to-door pickup service for its business clientele to improve its product differentiation. BJA can also expand into intra-city transport option for those business clientele that likes faster transport.
- For creative channel distribution, BJA can also synchronize its booking system to allow the AFV usage or airline usage, i.e., offer "one brand, one booking system, one booking" to enhance its channel distribution.
- BJA can partner with the AFV developer in the manufacturing process in order to enhance supplier relationship. With improved relationship, BJA can have its own brand of AFV that also helps to enhance product differentiation.
- BJA can increase service levels through its increased interface with its business clienteles and specialization in faster intra-city transport.

## 8. Learning Objectives:

2. The candidate will be able to identify and assess second-order risk factors, e.g. credit risk, liquidity risk, contagion risks and parameter risks that can have a major impact if not properly measured, monitored or managed.

### Learning Outcomes:

- (2a) Explain the various types of risks that can arise from specific business activities but are not directly specific to the business itself.
- (2c) Critique the applicability and relevance of measurement and management techniques for these second-order risks.

### Sources:

SDM-106-13 Ch 5-6 of Credit Risk Measurement In and Out of the Financial Crisis, 3rd Edition by Saunders and Allen, pages 98-114

SDM-108-13 Chapters 2 and 3 of Liquidity Risk – Measurement and Management, Matz and Neu

SDM -223-17 How to measure anything for cybersecurity Ch 7, pages 138-140,145

### Commentary on Question:

*The goal of this question was to test the candidate's understanding liquidity risk, credit risk, and commonly used credit risk models. Candidates generally did well on this question.*

### Solution:

- (a)
  - (i) Explain how a liquidity event may impact credit risk. Justify your answer by providing an illustrative example.
  - (ii) Explain how a credit event may impact liquidity risk. Justify your answer by providing an illustrative example.
- (i) A liquidity event can cause a default which is a credit event. An entity might not be able to liquidate its assets nor borrow in time to meet its obligations due to an underlying liquidity event, and this may cause it to default.

For example, consider a retail bank which uses customer deposits to earn money (spread/interest) for itself. If this bank gets hit with reputational risk (in the form of a bad news headline etc.) it could cause its customers to want to withdraw their money out of fear (to put it elsewhere). If this money is invested and not readily available to be withdrawn, then the bank will default. This is a standard example of a run-on-the-bank event.

## 8. Continued

Further, at the time when the bank suffers this kind of liquidity event, it will be unlikely that the bank will be able to get a credit facility. In fact, it may even be the case that bond creditors begin calling on their bonds in fear that they may not get their money back at a later date.

- (ii) A credit event would make it difficult for an entity to borrow because investor trust would erode. If an entity relies on short term borrowing to meet its liquidity needs, a credit event could impair those sources of borrowing, which would in turn put the solvency of its balance sheet further at risk (this is the cyclical nature of credit/liquidity risk characteristics).

For example, during the 2008 financial crisis, which was triggered by a credit event (mass defaulting of mortgages), which led to a broad loss in investor confidence resulting in general financing for the financial sector almost entirely drying up.

- (b)
  - (i) Determine a constant annual spread used for discounting ABC Inc.'s assets using the Reduced Form model. Show your work.
  - (ii) Explain the spread determined in part (i).
  - (iii) Describe three determinants of a bond spread not explicitly quantified by the Reduced Form model.

- (i) 
$$\text{Market Value} = \text{Face Amount} / (1 + \text{Discount Rate})^{(\text{Term of Asset})}$$

$$\text{Spread} = \text{Discount Rate} - \text{Risk-Free Rate}$$

$$\text{Discount Rate} = (100/72)^{(1/15)} - 1 = 0.02214$$

$$\text{Therefore, the constant annual spread is } 2.214\% - 1\% = 1.214\%$$

- (ii) Under the Reduced Form model the spread represents the risk-neutral probability of default multiplied by the loss given default. The spread is the credit risk premium above the risk-free rate. The higher the default risk, the higher the spread.

## 8. Continued

- (iii) The Reduced Form model does not differentiate between all the components that make up a bond spread, these components include:

Credit Risk – risk of counterparty default

Liquidity Spread – premium for illiquidity of an asset compared against a US treasury

Value of Embedded Options – optionality such as debt refinancing will come at a cost to the issuer/lender in terms of higher/lower spreads, respectively

Carrying Costs/Tax Treatment – there is cost to carrying risky debt

Error Term – perhaps the most important in that credit is not an arbitrage-free market, therefore no perfect way to capture it

- (c) Critique the assumption made by ABC Inc. Justify your answer.

The most significant risk here is the underlying liquidity risk due to asset and liability mismatching. In 14 years, the liabilities will mature and ABC will need to be funded through sale of their assets because the length of their liabilities and assets are not equal.

Further, ABC has argued that the spread earned on their assets is largely due to these assets being illiquid, which implies that attempting to sell these assets will not be easy and will likely require substantial price haircuts at the expense of ABC. Therefore, ABC is setting itself up for a liquidity crisis in 14 years' time.

- (d) Describe one advantage and one disadvantage for each of the three techniques (I-III).

Z-Scoring is relatively simple to use, but it assumes that credit risk is a linear function of various factors. Another problem is that most of the factors/inputs into the Z-score are accounting ratios which are based on historical data and book values. As such, they may not reflect the current environment and may not be good predictors for future performance.

Neural networks are able to model complicated non-linear relationships. They are better predictors than scoring models, and can adapt to changing input/output variable conditions and relationships. Further, there is no need to program or translate any underlying logic to the process algorithms. However, there are some downsides which include longer runtimes, complicated initial setups, and results that can be quite difficult to analyze. Results can often be difficult to analyze, and there can be a generally difficulty in understand the significance and relationships between input/output variables.

## 8. Continued

Experts are well versed in the subject matter. They can be easily accessed, and they have the advantage of being able to combine analytical and holistic methods. They may rely on quantitative methods but can also provide valuable qualitative judgement when needed. The drawback to this is that with this ability comes the risk of human biases, and exposure to subjective confidence.

- (e) Describe how ABC can design a process to minimize bias of the selected group of experts.
- 1) Select a rated bond from ABC's asset portfolio and ask the group of experts to pick the probability of default from a list of 4 multiple choice answers. The experts will be given the fundamentals of the issuing company for the bond to help in their decision-making.
  - 2) Make sure to include duplicate bonds or bonds which are financially the same in order to see if the experts provide different answers. If this does occur, then provide the experts with the correct answer so that they can determine if they were right or wrong.
  - 3) Continue with the exercise by selecting new rated assets until a pre-set threshold of the engaged experts pick the correct answer.
  - 4) Pick the subset of experts who consistently picked the correct answer to determine the credit spread for unrated assets.

## 9. Learning Objectives:

5. The candidate will explore how to evaluate new risk areas, innovations, new product designs and market disruptions in a sustainable and risk-aware manner.

### Learning Outcomes:

- (5c) Evaluate innovation and market disruption opportunities.

### Sources:

How to measure anything for cyber security Ch 4

How to measure anything for cyber security Ch 9

How to measure anything for cyber security Ch 10

How to measure anything for cyber security p.57, p.175, p.201, p.204

### Commentary on Question:

*This question was direct and primarily calculation in nature. While part marks were awarded for the calculation the most common issues were incorrect calculations, selection of invalid biases, and suggesting remedies that have no connection to the previously identified biases.*

### Solution:

- (a)
- (i) Identify a bias that your team may have. Justify your answer.
  - (ii) Recommend a way to reduce the bias identified in part (i).

### Commentary on Question:

*Most candidates did not identify the correct bias for part (a). Many candidates stated overconfidence perhaps due to the question stating the team was confident; this is not sufficient evidence. In fact, based on the skill of an individual (or group of individuals) confidence is entirely appropriate.*

One possible bias is Analysis Placebo because the team feels that engaging in training, information gathering and collaboration has improved decisions and estimates even when these actions have not improved decisions.

The team could use math and logic to derive new statements from previously confirmed statements based on large random samples, and unbiased historical data. The data should be assessed with proper mathematical methods to make inferences.

- (b) Determine which payment method (A or B) is more secure based on a beta distribution mean, using uninformative prior probabilities. Show your work.

## 9. Continued

### **Commentary on Question:**

*Many people received full marks for part (b) as the calculation was done correctly and work was shown. There were instances where marks were deducted for not adequately showing work.*

- (i) A cryptocurrency payment method  
Sample size:  $140 = 70 \times 2$   
Hits: 3 breaches  
Misses:  $137 = 140 - 3$   
Since the prior probability distribution is uniform, the prior Alpha = 1 and the prior Beta = 1.  
Alpha: prior + hits =  $1 + 3 = 4$   
Beta: prior + misses =  $1 + 137 = 138$   
Mean (Beta distribution) =  $\text{Alpha} / (\text{Alpha} + \text{Beta}) = 4 / (4+138) = 0.0282$
- (ii) An internet-based payment method  
Sample size:  $300 = 150 \times 2$   
Hits: 7 breaches  
Misses:  $293 = 300 - 7$   
Since the prior probability distribution is uniform, the prior Alpha = 1 and the prior Beta = 1.  
Alpha: prior + hits =  $1 + 7 = 8$   
Beta: prior + misses =  $1 + 293 = 294$   
Mean (Beta distribution) =  $\text{Alpha} / (\text{Alpha} + \text{Beta}) = 8 / (8+294) = 0.0265$

An internet-based payment method is more secure than a cryptocurrency method due to a lower mean of the Beta distribution of risk frequency.

- (c) Identify a security metrics model which is most appropriate for this cybersecurity program. Justify your answer.

### **Commentary on Question:**

*Part (c) was done correctly by a large number of candidates.*

Use Sparse Data Analytics because the data are scarce, that is, only 3 breaches are incurred in 140 occasions for 2 years.

- (d) Recommend the most appropriate way to improve the security metrics model identified in part (c). Justify your answer.

### **Commentary on Question:**

*The majority of candidates that did well on part (c) also correctly identified the security metrics model in part (d).*

## **9. Continued**

Functional security metrics which seek to optimize the effectiveness of key operational security areas is the only feasible improvement that could be done in a short horizon timeframe.