CFE SDM Model Solutions
Spring 2020

1. **Learning Objectives:**

3. The candidate will understand how to apply decision making models to general managerial decisions within specified business constraints.

5. The candidate will understand the role that organizational behavior and communication play in organizational decision making and efficacy, as well as learn how to ineffective communication is a risk to organizations.

Learning Outcomes:

(3a) Apply fundamental techniques and frameworks of management science to make informed business decisions:
- Apply linear optimization models to managerial decisions
- Develop decision trees, scenario tests, and simulation models

(3b) Apply statistical and quantification methods to analyze managerial decisions with uncertain conditions:
- Apply probability distributions to business situations with random variables
- Construct optimization models utilizing probability theories

(3c) Evaluate business situations and describe how quantitative and statistical methods can improve decision making.

(5b) Evaluate the impact of human behavior factors on the effectiveness of decision making processes within organizations:
- Explain the role of cognitive biases on making suboptimal individual decisions.
- Evaluate the role of organizational behavior on organizational decision-making processes and efficacy.

(5c) Evaluate the importance of communication to the decision-making processes.
- Explain why communication is strategically important to organizations.
- Describe how information is communicated within organizations.
- Describe organizational and individual barriers to effective communication.
- Identify the risks of ineffective communication.
- Explain how to overcome communication barriers and minimize risks of ineffective communication.

1. Continued

Sources:
Ch. 7 of Data, Models, and Decisions: The fundamental of Management Science, pg. 66

SDM-187-19: 20 Cognitive Biases that Screw Up Your Decisions pg,. 1

Organizational Behavior - Ch. 10, pg. 31

Commentary on Question:
General commentary:

- *Candidates generally performed well on this straight-forward question.*
- *A through C were generally well done and most people earned high marks. Most people earned a lot of points in part C setting up the tree and calculating EMV.*
- *Part D was trying to get the candidate to recognize that as a quantitative tool, decision trees and EMV provide a mean/expected value, but does not give insight into the variance/risks. Any points on qualitative criterion was extraneous.*
- *Almost everyone was able to identify a cognitive bias for Ei) but to get full points for Eii) candidates had to identify <u>how</u> the bias led to a suboptimal decision (e.g., optimism led to overemphasized gains or underestimated losses, eagerness of management to approve projects led to less validation and therefore narrower range of scenarios explored).*

Solution:

(a) Describe how decision trees are used in decision analysis.

Commentary on Question:
Candidates did well on this question. Most were able to clearly state how decision tree can aid the decision making process.

Decision analysis is the logical and systematic way to address a wide variety of problems involving decision-making in an uncertain environment. Decision tree is an analytical model used in the decision analysis. The decision tree is a drawing composed of the various decisions and uncertainties in a chronological and systematic fashion.

(b) Describe two benefits of using a decision tree.

Commentary on Question:
Candidates did well on this question. Most were able to list out the benefits associated with a decision tree.

1. Continued

Clarity of the decision problem: By constructing the decision tree, the decision maker is able to see clearly the structure of the sequence of the decisions and the uncertain events, and to see the interplay between the decisions and the uncertain events. This allows BJT to see the sequence of decision and uncertain events and how they are all interconnected.

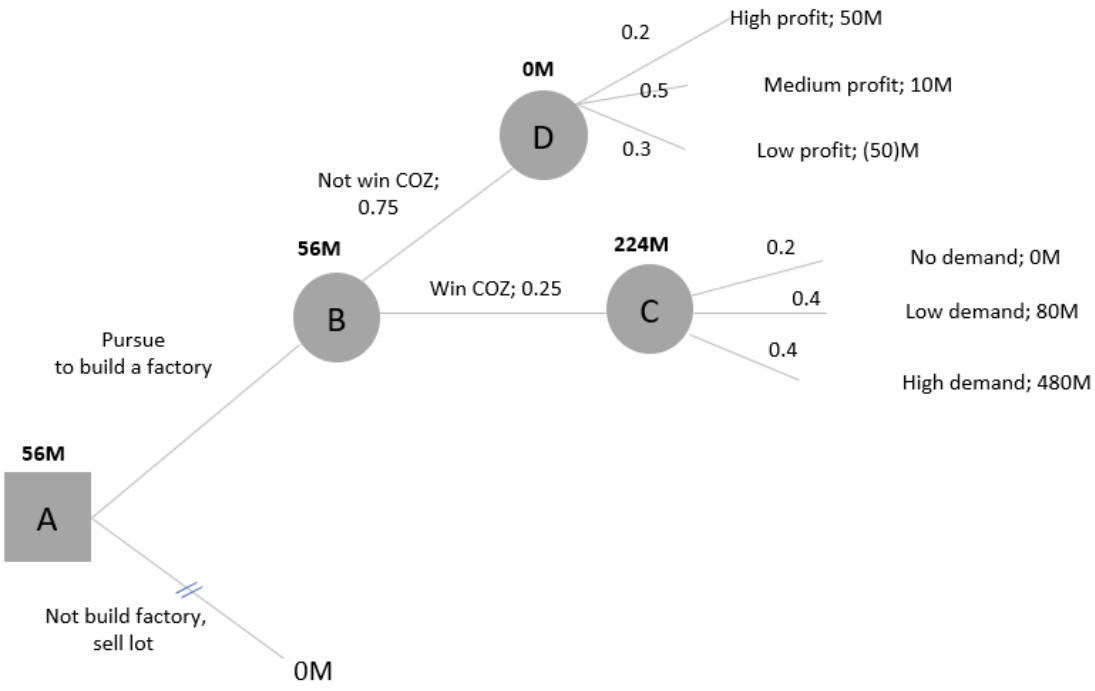
Insight into the decision process: By analyzing all possible outcomes from the decision tree, BJT management can make the optimal decision by picking the best possible decision and the factors that go before it to achieve the result.

(c)

(i) Construct a decision tree for BJT.

(ii) Calculate the EMV for each node. Show your work.

Commentary on Question:
Candidates did well drawing the decision tree and calculating the EMV. Full points were awarded for labeling the nodes, recognizing decision versus event nodes (square vs circle), and crossing out the suboptimal decision branch correctly. Most candidates also correctly identified that the 10M lobbying was a sunk cost and not factored into the EMV calculation.



1. Continued

EMV A: 56M
EMV B: $0.75 \times 0 + 0.25 \times 224 = 56$
EMV C: $0.2 \times 0 + 0.4 \times 80 + 0.4 \times 480 = 224$
EMV D: $0.2 \times 50 + 0.5 \times 10 + 0.3 \times (50) = 0$

0M is assigned to selling the lot because it is converting a land asset already carried at market value on the company's books to a cash asset, so there is no net gain. *However, $5M was also awarded full points to selling the lot as not a single candidate recognized this point.*

(d) Explain whether or not EMV should be used as the sole quantitative criterion for BJT's decision. Justify your answer.

Commentary on Question:
Either Yes or No were accepted if candidates supported their position. Most candidates were able to support their answer by identifying the weakness of the EMV calculation from above. Part D was really trying to get the candidate to recognize that as a quantitative tool, decision trees and EMV provides a mean/expected value and doesn't give insight into the variance/risks of outcomes. Any suggestions candidates provided on qualitative criteria was extraneous.

No, it does not provide information about risk/variance of potential outcomes. Nodes C and D have a substantial difference in possible outcomes; therefore using EMV as a sole metric does not adequately articulate this risk.

(e)

(i) Identify a cognitive bias to which BJT management may be prone. Justify your answer.

(ii) Describe how the bias identified in (i) may lead to a suboptimal decision on the use of the vacant land.

(iii) Recommend two debiasing techniques that BJT management could implement to improve on their ability to assess the analysis and recommendation from the PEC. Justify your answer.

Commentary on Question:
Candidates generally did not perform as well in this Section e compared to earlier sections. In order to receive full marks, candidates had to support their answer with specific examples from the question.

1. Continued

(i) *Below are examples of biases identified, however it is not an exhaustive list and other biases were awarded full marks as long as candidates identified a correct bias and supported their reasoning.*

a. Outcome Bias – just because the outcome is successful doesn't mean that the decisions leading up to the outcome were made appropriately. There could always be an element of luck that overrides a poor decision. In this case, the Product Expansion team is credited with the outcome but the steps they took to achieve that outcome was never critiqued. Or
b. Over confidence bias – the management team is overly confident in PEC's ability to make successful decisions and overlooked the last 2 proposals that performed poorly.

(ii) *Candidates were awarded full marks if they were able to tie the potential suboptimal result to the bias identified in (i)*

a. Since product expansion committee created the scenarios, but BJT management has responsibility to review the scenarios and approve them, the over confidence bias identified above could have compromised the following decision tree aspects:
    i. Management team may have been overly eager to approve the scenarios, without requiring deep validation, which leads to a smaller range of outcomes – the variability and spread of possible results may be more narrowly focused than they could be.
    ii. Overly optimistic - magnitude of gains overemphasized, magnitude of probability of gains over estimated, costs underestimated
    iii. Overly optimistic (under pessimistic) underestimate magnitude of losses, underestimate the probability density of loss scenarios.

(iii) *Different answers were accepted and full marks were awarded for supporting the debiasing technique. Some candidates provided general suggestions to improve decision-making for BJT that were not debiasing techniques and therefore received no marks for failing to answer the question.*

a. Dialectical inquiry – An additional group can come from inside the company and prepare a separate proposal. The two groups present their views which might come to the same conclusion but will have more robust thinking and justification. Or

1. Continued

b. Devil's Advocate – Someone that can review PEC's proposal and challenge the recommendation by PEC. This ensures there is a dissenting view out there which can lead to better discussion of the assumptions used. Or
c. Nominal Group Technique - Have Jack chair the Product Expansion Committee and remain neutral and not share any opinion until everyone else has given their thoughts. Or
d. Taking an outside view – use the Product Expansion committees view and recommendation and then hire outside consultants for their idea presentation and compare the alternatives.

2. Learning Objectives:

4. The candidate will understand how to apply decision making models to general managerial decisions within specified business constraints.

Learning Outcomes:

(4a) Apply fundamental techniques and frameworks of management science to make informed business decisions:
- Apply linear optimization models to managerial decisions.
- Develop decision trees, scenario tests, and simulation models.

(4b) Apply statistical and quantification methods to analyze managerial decisions with uncertain conditions:
- Apply probability distributions to business situations with random variables.
- Construct optimization models utilizing probability theories.

(4c) Evaluate business situations and describe how quantitative and statistical methods can improved decision making.

Sources:

Business Dynamic Book by Steman
- Chapter 4 Structure and Behavior of Dynamic Systems, pg. 114-116
- Chapter 5 Causal Loop Diagrams, pg. 169-174
- Chapter 6 Stocks and Flows, pg. 197-208

Case Study, Blue Jay Tire Co, pg. 68-80

Commentary on Question:

Commentary listed underneath question component.

Solution:

(a)

(i) Identify three risks that impact how many tires BJT supplies.

(ii) Identify one risk that impacts demand for tires produced by BJT.

Commentary on Question:

Risks must be from the case study. Candidates were expected to choose three supply and one demand risk from the list below. Some other answers were accepted if enough justification was provided. Candidates generally did well on this part.

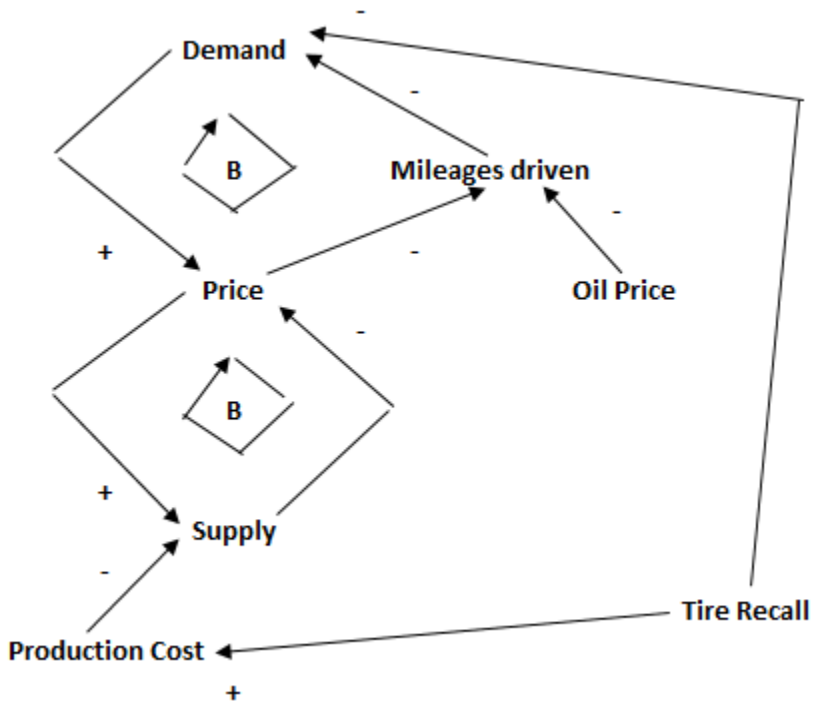
Supply: commodity risk, manufacturing risk (tire recall), labor risk (union negotiation), legal risk (minimum wage), distributor risk, insurance risk, environment risk, reputational risk, political risk, & currency risk

Demand: economic risk (oil prices)

2. Continued

(b) Sketch a causal loop diagram of the model.

Commentary on Question:
Candidates were expected to correctly draw the supply-demand diagram and add nodes for Tire Recall and Oil Price to it. Marks were awarded for correct nodes, connections and loop type identifiers. Mileage driven and Production cost nodes were not necessary but they make the diagram clearer. Marks were also awarded for these and other intermediary nodes that were pertinent to the model. Most candidates were able to correctly draw the supply-demand diagram; however, fewer candidates correctly identified and drew the correct relationships of the Tier Recall and Oil Price nodes with supply and demand.



(c) Recommend a way to mitigate risk based on the dynamic model developed in part (b). Justify your answer.

Commentary on Question:
Since oil price is given (external) to BJT, tire recall is the only risk factor that the management can mitigate its impact to the business. Recommend finishing the tire recall process quickly to reduce delays and mitigate negative impact.
Alternatively, candidates could recommend improving the quality control process.

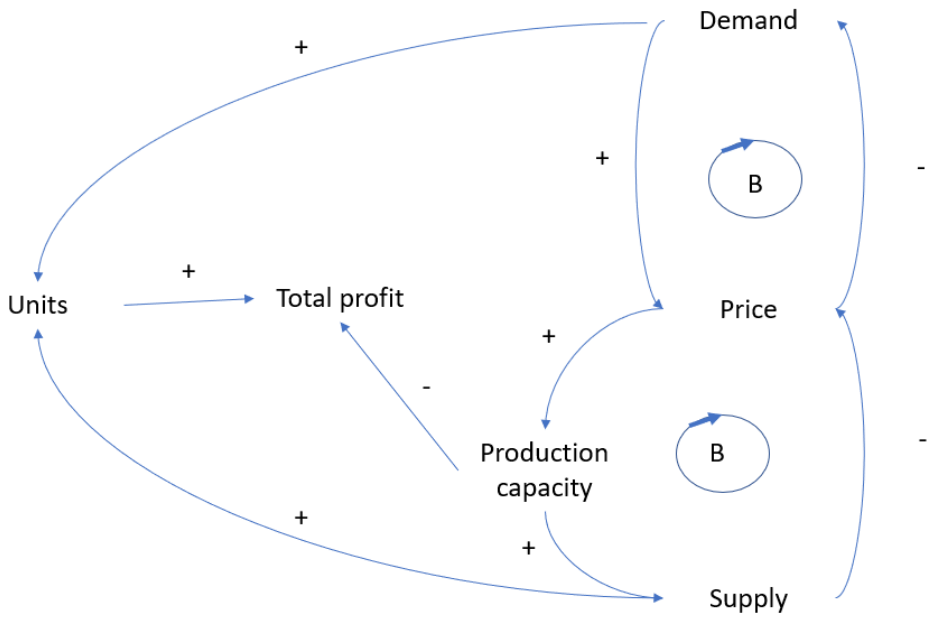
2. Continued

Partial marks were awarded for a suggestion to buy a derivative to offset the exposure to oil price fluctuations. Candidates generally did well on this part.

(d) Sketch a causal loop diagram to illustrate how adding additional capacity will impact BJT's profit, by at least including the following nodes:

- Units Sold
- Profit
- Production Capacity

Commentary on Question:
A diagram with three nodes was needed to get partial marks: units sold, profit, and production capacity along with correct connections. Additional marks were awarded for additional nodes and relationships that were relevant for the model and help explain the process. For example, the effect of units sold on price, units produced vs. units sold, effect of price on profit and negative effect of increasing the production capacity on profit due to construction costs. Most candidates were able to correctly identify and draw the relationship between production capacity, units sold, and profit; however many candidates struggled with further developing the diagram to depict other relevant nodes and relationships.



2. Continued

(e) Evaluate the impact on sustainability and stability of the model due to adding production capacity. Justify your answer using the model in part (d).

Until BJT builds new plants and/or adds extra production capacity to existing facilities, an increased demand puts an upward pressure to price. But it will take time and bring in disequilibrium in the short run. Meanwhile competition might fill up a supply gap if they have redundant capacity.

When BJT completes building additional production capacity, if demand does not change, BJT will meet demand and have large profits. The tire market will be in equilibrium.

If demand comes down, BJT will have excess production capacity. This might drive down price and introduce discrepancy between demand and supply. So, the tire market might experience disequilibrium and instability. This might cause the oscillatory behavior of the market.

Candidates generally did not explain the technical state of the diagram well, even though most candidates correctly identified that the system is not stable. This suggests a generally poor grasp of the syllabus terminology and desired learning outcomes that would expect to apply to more complex systems.

(f) Recommend a strategy to mitigate the risk of instability and improve sustainability. Justify your answer.

Recommend increasing production capacity in phases responding to the increase of tire demand. This strategy will meet demand increase in the short term without over-producing tires. Another option was to recommend using a best estimate of future demand as a target instead of current demand.

Additional marks were given for identifying that this strategy may not achieve economies of scale in the long term.

Candidates generally were able to provide a justifiable strategy to the issues raised in part (e); however some candidates did not explain how their strategy mitigates the risk of instability or provided solutions that were unrelated.

3. Learning Objectives:

2. The candidate will understand measures or corporate value and their uses in corporate decision making.

5. The candidate will understand the role that organizational behavior and communication play in organizational decision making and efficacy, as well as learn how to ineffective communication is a risk to organizations.

Learning Outcomes:

(2b) Assess how performance metrics and incentives could impact key business decisions and create value for shareholders:
- Explain how managerial accounting can impact strategic decisions.
- Explain and recommend methods a firm may use to allocate its costs and how these methods impact the perceived performance of a firm or its component lines of business.

(5b) Evaluate the impact of human behavior factors on the effectiveness of decision making processes within organizations:
- Explain the role of cognitive biases on making suboptimal individual decisions.
- Evaluate the role of organizational behavior on organizational decision-making processes and efficacy.

Sources:

Accounting for Decision Making and Control - Ch. 4, 5, 7, 9-13

Organizational Behavior - Ch. 12

Commentary on Question:

This question tested the candidate's ability to apply theories of cost allocation and power from the syllabus to a life insurance company. Successful candidates explained how cost allocation approaches impact a firm's ability to monitor and control performance, and they explained how the powers of individual stakeholders impact a firm's decisions.

Many candidates mentioned correctness or fairness of the cost allocation without discussing how it incentivizes managers to improve cost efficiency or helps senior management make better decisions. Incentives and decision-making were important concepts from the syllabus which need to be discussed in order to demonstrate a thorough understanding of this question.

Solution:

(a) Critique Anne's approach to allocating expenses for the IUL product.

Commentary on Question:

Hardly any candidates received more than half the available points for this part of the question. Critiques should include positive and negative comments.

3. Continued

This a fast way to allocate expenses, saving time so that Darwin can focus on value creation.

However, mis-allocating the expenses can lead to inaccurate pricing, which can lead to poor decisions about how much to sell.

In addition, managers should be held responsible for the expenses they impose on other divisions, such as hedging expenses for IUL.

Moreover, managers should be incentivized through expense allocations to cut costs, such as costs of manual administration that Darwin currently experiences, whereas IUL will require enhanced administration.

(b) Critique Anne's statement with respect to the performance of the products.

Actual profit per face amounts sold is better than expected for IUL. If this can continue, Darwin should sell more.
IUL sales may be coming at the expense of the other products. Focusing on IUL my further decrease UL and Trad Life.

Expenses may be allocated incorrectly, which would distort the results shown. The allocation method chosen was non-insulating, and this can distort product-level results when performance differs from expected.

(c) Propose a revised cost allocation method for Darwin that will improve the accuracy of the profitability for each line. Justify your answer.

Darwin could use activity-based costing (ABC) to improve the accuracy of the profitability of each product line. Activity-based costing increases the amount of expenses that can be directly traced to products, so that cost estimates are more accurate. It would also allow Darwin to have a better understanding of the key activities and drivers behind expenses for each product to focus their cost-saving efforts.

Activity-based costing would use batch-level costs and product-level costs rather than just unit costs, which would improve the issues of over- or under-stating profits when volume fluctuates.

3. Continued

(d)

(i) Define power.

(ii) Explain which individual bases of power apply to each stakeholder (A to C) listed above.

(iii) Recommend the order of prioritization, from most to least important stakeholder (A to C) for Darwin to satisfy. Justify your answer.

Commentary on Question:
Successful candidates tied part (iii) back to the bases of power of each stakeholder which the candidate discussed in part (ii). Many bases of power can be appropriate in (ii), but the model solution only has one basis for each stakeholder. Ordering of the stakeholders does not matter in (iii) if the candidate gives a good argument, consistent with (ii).

(i) Power is the ability to achieve desired outcomes.

(ii) A. Brandon has legitimate power based on his position as the CEO.
B. Sales agents have reward power, because their efforts can increase Darwin's sales volumes.
C. Current IUL customers have coercive power, because they can withdraw their account values if they are unhappy with Darwin.

(iii) I choose B > C > A
B. The company cannot continue without sales agents, so it is critical that their concerns are satisfied so that they continue to sell policies.
C. If current IUL customers lapse their policies, it would be harmful to Darwin. However, they can't easily coordinate their efforts, and the expense allocation may not impact them.
A. The CEO is very powerful, but he can be replaced if his actions lead to poor sales or high lapses, so his concerns regarding the expense assumptions are less important than those of the sales agents and current IUL customers.

4. **Learning Objectives:**

1. The candidate will understand and apply strategic management concepts and frameworks to corporate financial and ERM business problems.

3. The candidate will understand the ERM processes that consider all types of risks and their use in setting a risk return strategy in any industry.

5. The candidate will understand the role that organizational behavior and communication play in organizational decision making and efficacy, as well as learn how to ineffective communication is a risk to organizations.

Learning Outcomes:

(1a) Evaluate and apply strategic management concepts, recognizing factors that affect development and implementation of strategies:

- Analyze the firm's external environment and the internal organization.
- Describe and apply models such as Porter's five forces.
- Define types of business-level strategies and recommend an appropriate business-level strategy for a given situation.
- Explain the impact of competitive dynamics on strategic management.

(3a) Identify and assess second-order risk factors:

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

(3b) Explain ERM principles and frameworks:

- Describe the components of a risk appetite statement. Design and develop a risk appetite statement and risk-return strategy.
- Evaluate a company's ERM processes in its ability to adapt to emerging issues and identify strategic opportunities based on risk-return trade-off.
- Evaluate the sustainability of a given business enterprise based on its risk tolerances and appetite.
- Apply risk mitigation strategies in ERM decisions.

(5a) Apply best practice techniques to structure and communicate ideas logically and persuasively:

- Explain differences between good and poor communication techniques and their implications.
- Apply techniques to structure ideas logically.
- Develop clear fact-based messages that can be communicated persuasively.

4. Continued

Sources:
Data, Models, and Decisions: The fundamental of Management Science

- Chapter 1, Decision Analysis, pg. 1-31
- Chapter 7, Linear Optimization, pg. 323-410

Organizational Behavior - Ch. 13

Commentary on Question:
Overall, candidates performed well for this question. Part a) and e) were especially well done.
This question tests the candidate's ability to apply decision making models to general managerial decisions, including how to find the optimized solution given specific business constraints, and recognizing internal/external factors that affect development and implementation of strategies. The question also requires the candidate to understand how organizational behavior and communication skills play a key role when communicating such business decision.

Solution:
(a)

(i) State the objective function.

(ii) State the constraint functions.

(iii) Sketch the feasible region.

(iv) Determine the optimal price. Show your work.

Commentary on Question:
Candidates had mixed responses for this question. Some candidates did not convert the three reinsurance variables into two, which greatly increased the difficulty in the graphing part.

Let W be Dinosaur Re's share
Let X be Sloth's share
Let Y be Mammoth's share
Let C be the cost to obtain cover

(i) The objection is to minimize the cost of cover, i.e. $C = 10W + 8X + 6Y$

(ii) The constraints are:
A. Dino's share demand: $W > 30\%$
B. Weighted internal credit score: $6W + 3X + 2Y \geq 5$
C. Sloth vs Mammoth ratio: $4Y \leq X$
D. Share percentages add up to 100%: $W + X + Y = 1$

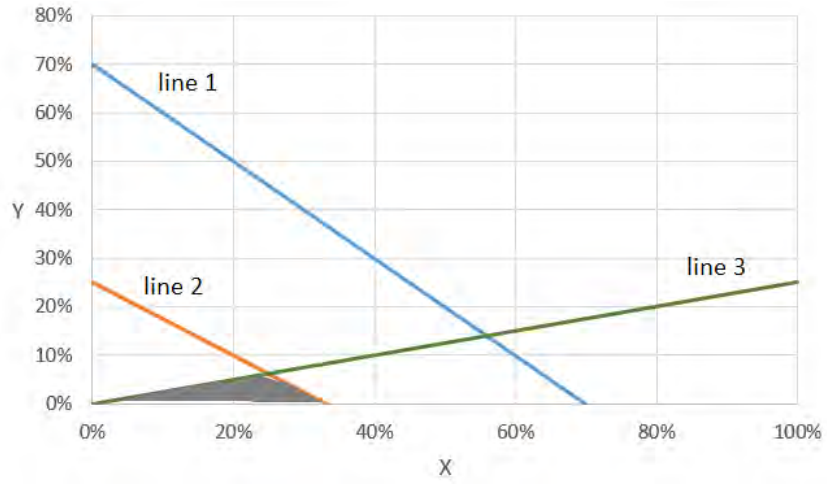
4. Continued

(iii) Combining constraints A and D, we have:
$70\% \geq 1 - X - Y$ (line 1)

Combining constraints B and D, we have:
$6(1 - X - Y) + 3X + 2Y \geq 5$
$6 - 3X - 4Y \geq 5$
$1 \geq 3X + 4Y$
$1/3 \geq X + (4/3)*Y$ (line 2)

From constraint C, we have:
$X \geq 4Y$ (line 3)

Therefore, the feasible region is the grey region:



(iv) Since $C = 10W + 8X + 6Y$
$C = 10(1-X-Y) + 8X + 6Y$
$C = 10 - 2X - 4Y$
Since we are minimizing C, we need to maximize $2X + 4Y$ or $X + 2Y$.
The negative slope of $X+2Y$ is less steep than line 2 so the optimal solution is at the point where line 2 and line 3 above intersect.
Solving for the intersection point:
Line 2: $X + 4/3Y = 1/3$
Line 3: $X - 4Y = 0$
Implies $Y = 1/16$ (6.25%) and $X = 4/16$ (25%).
Therefore $W = 1 - X - Y = 11/16$ or 68.75%.
The optimal cost is $10W + 8X + 6Y = 148/16$ approximately equals 9.25% of the amount of limit.

4. Continued

(b) Critique the program structure with respect to the Bargaining Power of Suppliers.

Commentary on Question:
Most candidates were able to list at least two critiques. Three well-explained and reasonable critiques were needed for full marks. A sample response is provided below.

Dinosaur is the only reinsurance with a credit score above 5, which means they will have a majority share and the ability to dictate price. The have large bargaining power.
Sloth and Mammoth can only compete on price unless they improve credit quality or if the constraint on credit quality is altered.
There are only 3 reinsurance companies, which creates concentration risk/limits competition, particularly if Dino's credit quality falls.

(c) Propose two changes to the linear optimization problem based on your critique in (b).

Commentary on Question:
Candidates can receive full marks only if their answer in this section is relevant to their answer in part b).

Add a constraint where there's an appropriate limit to Dinosaur Re.
Add a constraint where another large reinsurer with high credit rating is added to the optimization problem.

(d)

(i) Determine the shadow price of each constraint in the optimization problem defined in part (a). Show your work.

(ii) Describe the implications of your answer to part (i) with respect to the above scenarios (A to C).

Commentary on Question:
Candidates struggled with the calculations asked in this question

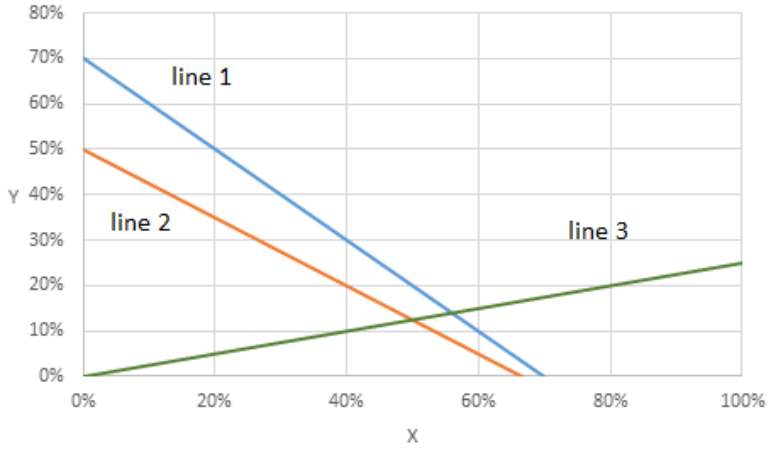
A
The new pricing for Sloth and Mammoth increase to 9% and 7% respectively. The cost function is now C = 10W + 9X + 7Y and using 1 – X - Y = W we get 10 - X - 3Y. Therefore, we need to maximize X + 3Y. The slope of this line is still less steep than the slope of the line 2, so the shares in the optimal solution do not change. Using the new cost function and X = 4/16, Y = 1/16 and W = 11/16 we have 153/16 or about 9.56%. The shadow price is thus 5/16 or 0.31%.

4. Continued

The implications are that the optimal share amounts to the three reinsurer remain unchanged. The price increases because there are more expenses baked into Sloth and Mammoth prices, thus a small increase in the total cost.

B

The weighted credit score needs to decrease by 1 to compute the shadow price. The credit constraint changes to $6W + 3X + 2Y \geq 4$. This leads to $6 (1 – X - Y) + 3X + 2Y \geq 4$ which leads to $3X + 4Y \leq 2$ which means $Y \leq -3/4*X + 1/2$. The new graph becomes:



We still need the intersection of line 2 and line 3 above to find the optimal solution. We will use the formula for line 3: $X = 4Y$. We get that the intersection is at $Y = 2/16$, $X = 8/16$, and W is therefore 6/16. The price is thus 136/16 or about 8.5%. Therefore, the shadow price is 8.5% - 9.25% which is about -0.75%. This is the shadow price for the internal credit score constraint.

Therefore, relaxing the weighted credit score constraint allows the company to assign more share to Sloth and Mammoth. This allowed for a sizeable decrease in cost.

C

Increasing the limit purchased by 1 unit will increase cost proportionally up as the linear optimization problem remains unchanged, however we are purchasing 1% more cover. Thus, the cost remains at 9.25%, so the shadow price is 9.25% on 1 million cover which is 92,500.

Increasing the limit of cover purchased does not change the shares in the optimized solution. The price goes up proportionally (i.e. the rate per limit of premium remains unchanged), which makes sense as adding more of the same risk should cost more.

4. Continued

(e) The following conversation was held between Ruth and Edward Pink, Chief Executive Officer.

Edward: Hi Ruth, what is the status of the reinsurance cover?

Ruth: Good afternoon, Mr. Pink. I am pleased to report that the results of our preliminary analysis using shadow pricing are in-line with expectations, but we have additional statistical testing to complete. We are performing sensitivity analysis with respect to each constraint vector…

Edward: Huh? Shadow pricing? Never mind. Can you can present your recommendation at tomorrow morning's Board meeting? The outcome of the program will impact all of our annual bonuses.

Ruth: Well... That is not a lot of time to prepare. I'll do my best.

Edward: Thank you Ruth. We'll speak again soon.

(i) (*2 points*) Describe two barriers to effective communication that are exhibited in the above communication.

(ii) (*3 points*) Recommend three interpersonal communication skills Ruth should rely upon when presenting at the Board meeting. Justify your answer.

Commentary on Question:
Candidates performed very well in this section. Full marks were awarded for those who could identify AND explain the barriers and communication skills, with the correct terminology from SDM 200-20 Organizational Behavior.

(i) Any two combinations of the answers below:

Status differences – Since Ed is the CEO, and Ruth speaks to him in a very formal manner, and there is added time pressure on the response, this could negatively affect the quality and honesty of responses by Ruth.

Semantic differences / Specialty area jargon – shadow pricing is not a term that is common language and the CEO doesn't understand it.

Time Pressures – The next morning is a tight deadline, and this could affect Ruth's ability to respond effectively.

Poor Listening Skills – Ruth is concerned with the deadline, but Edward appears to ignore her concern.

4. Continued

Consideration of self-interest – Both and Ed and Ruth are focusing on bonuses rather than giving accurate feedback.

(ii) Any three combinations of the answers below:

Know your audience – The audience will be the management team. Therefore, communication should be formal and concise, and should avoid jargon such as "shadow pricing".

Select the appropriate communication medium – Given that she will be presenting to the management team and the goal is to convince them of her recommendation, she should produce a PowerPoint presentation to highlight the key facts. She can supplement this with a formal report.

Listen Actively – Her presentation will not be a one-way communication vehicle. She will need to actively listen to the team members.

Encourage feedback – To ensure that the management team understands and agrees with her recommendation; she should solicit feedback from her audience.

Regulate information flow and timing –Although a great deal of effort has gone into determining Ruth's recommendation, she should stick to the facts, and not overload her audience with minor details. If she has any control over the timing of the meeting, she could choose a time that isn't too close to lunch, or near the end of the day before the weekend, since at these times the audience may be less engaged.

5. Learning Objectives:

1. The candidate will understand and apply strategic management concepts and frameworks to corporate financial and ERM business problems.

2. The candidate will understand measures or corporate value and their uses in corporate decision making.

5. The candidate will understand the role that organizational behavior and communication play in organizational decision making and efficacy, as well as learn how to ineffective communication is a risk to organizations.

Learning Outcomes:

(1b) Evaluate commonly used business growth strategies and their application under different economic risk and business environments:
- Critique and evaluate internal/organic and external/inorganic growth strategies.
- Assess and recommend growth strategies under different business situations and market opportunities including innovation and market disruption.

(2a) Assess various measures that firm can use to assess value and recommend appropriate measures to evaluate corporate value.

(5a) Apply best practice techniques to structure and communicate ideas logically and persuasively:
- Explain differences between good and poor communication techniques and their implications.
- Apply techniques to structure ideas logically.
- Develop clear fact-based messages that can be communicated persuasively.

Sources:

CFO Forum: Market Consistent Embedded Value Basis for Conclusions

Damordaran on Valuation Book: Chapter 7 Relative Valuation

Damordaran on Valuation Book: Chapter 9 Value Multiples

Damordaran on Valuation Book: Chapter 13 Value of Control

Damordaran on Valuation Book: Chapter 14 Value of Liquidity

The Pyramid Principle - Ch. 1-3

Strategic Management - Ch. 5

Strategic Management - Ch. 7

5. Continued

Commentary on Question:
This question tested candidates' ability to apply syllabus concepts and analyze a potential acquisition opportunity. Generally, candidates did well when answers were supported by specific references from the case study or evidence provided in the question itself, with the final part 5(i) building on answers from earlier parts.

Solution:

(a) Compare and contrast first-mover benefits versus second-mover benefits.

Commentary on Question:
Most candidates received partial credit on this question. To receive full credit, both positive and negative implications of being a first or second mover was required

Acceptable answers included:

First mover benefits:
- Gains loyalty of customers
- Difficult for others to take market share

First mover drawbacks:
- Take higher, yet reasonable levels of risk
- Continuous investment in R&D

First mover benefits:
- Gains loyalty of customers
- Difficult for others to take market share

Second mover benefits:
- Can avoid mistakes made by the first mover and improve on the product
- Lower investment required than the first mover

Second mover drawbacks:
- Requires the first mover to create a blueprint to follow

(b) Evaluate the proposed partial acquisition of Snappy by Darwin based on the following reasons for acquisition:

(i) Cost of new product development and increased speed to market.

(ii) Increased diversification.

5. Continued

Commentary on Question:
Candidates generally performed well on part (i) and struggled with part (ii). Candidates who recognized the potential for Darwin to leverage Snappy's distribution channels as a source of diversification received partial credit if well explained. No credit was awarded to candidates who justified increased product diversification as Darwin already sells the same product portfolio as Snappy.

(i) Snappy's automated system could be leveraged to increase Darwin's speed to market and help with its competitiveness with other carriers. However, Snappy sells the same products as Darwin. Therefore, there would be little benefit from a new product development perspective arising from the acquisition

(ii) Limited at best, as both companies sell the same products.

(c) Evaluate the proposed partial acquisition of Snappy by Darwin based on the following problems in achieving success:

(i) Integration difficulties.

(ii) Inability to achieve synergy.

Commentary on Question:
Candidates generally did well on part (i). Those who did not perform well listed "reasons for acquisition" rather than "problems in achieving success". Candidates that touched on diverging sales culture and approach to risk management received full credit for part (i). Responses for part (ii) were mixed; examples tied to the case study were required for full marks.

(i) Differing cultures and risk appetites would lead to high integration difficulties. Snappy focus is on increased sales (Note Veltro's statement) at the expense of prudent risk taking

(ii) Synergies would be hard and costly to achieve. Darwin already uses multiple administration systems for existing products and is focused on conservative underwriting. Snappy's highly automated system would be incompatible with Darwin's in the short term leading to limited synergies on that front. Unless major changes are made to both system on the back end, both would essentially operate independently.

5. Continued

(d)

(i) Compare and contrast the assumptions on market efficiency of each methodology (I and II).

(ii) Explain how the assumption differences identified in (i) could result in Snappy being perceived as overvalued using one methodology and undervalued using the other.

Commentary on Question:
Most candidates struggled on this question. For part (i), many candidates discussed whether assumptions were implicit or explicit under each methodology but not specifically the assumption on market efficiency. Most candidates did not refer to similarities between both methodologies, which was required for full credit. For part (ii), most candidates came to the opposite conclusion than what is correct.

(i)
Similarities:
- Both DCF and RV assume markets make mistakes, particularly at individual firm level

Differences:
- DCF – while mistakes correct over time, at any time, they can occur across entire sectors or even entire market.
- RV – while mistakes are made at individual firm level, they're correct on average for sector / market.

(ii)
- DCF– The entire life insurance sector is overvalued. As such, all stocks in sector are overvalued. Snappy would also be overvalued under DCF
- RV – Relative to its other peers in industry X, Stock A is less "overvalued". Therefore, Snappy would be considered undervalued under RV

(e) Calculate the minority discount between the two options (51% majority / 49% minority). Show your work.

5. Continued

Commentary on Question:
Both a $ and % figure for the minority discount was accepted. Many candidates struggled with this question. Some common mistakes were the following:

- *Failure to utilize the 51% majority or 49% minority figures listed as the two options*
- *Misunderstanding the definition of Book Value, and instead using Total Assets rather than Total Equity/Surplus. Note that if minority discount was expressed aa percentage, the Book Value was not required as it would be in both numerator and denominator and thus cancel out*
- *Flipping the numerator and denominator and expressing the discount as a premium*

Book Value (BV) = $2,275,769 (available from the Case Study)
Optimal Value = 1.5 * Book Value
Status Quo Value = 1.2 * Book Value

Dollar Amount
Minority Discount = Value of Majority Stake – Value of Minority Stake
Value of Majority Stake = 51% of Optimal Value = $1.74mm
Value of Minority Stake = 49% of Status Quo Value = $1.34mm
Minority Discount = $0.4mm

Percentage
Minority Discount = 1 - Value of Minority Stake / Value of Majority Stake
Value of Minority Stake = 49% of Status Quo Value = 49% * 1.2 * BV
Value of Majority Stake = 51% of Optimal Value = 51% * 1.5 * BV

Minority Discount = 1 - (49% * 1.2) / (51% * 1.5) = 1- 0.588/ 0.765
Minority Discount = 1- 0.768627451 = 23.1372549%

(f)

(i) Define “control premium”.

(ii) Critique Brandon’s statement.

Commentary on Question:
Many candidates provided a vague definition of control premium (e.g., A control premium is the amount paid to obtain control). Answers received full credit if the definition included how the value of a firm may be increased with better (optimal) management did not receive credit.

5. Continued

When critiquing Brandon's statement, candidates received some credit for discussing voting vs non-voting shares, or the idea of not needing 50%+ ownership to effect management change when there is widely distributed ownership. However, a fair number of candidates mistakenly stated or implied that Brandon was partially correct and that there were situations where control premium did not exist, rather than the fact that it still exists but may just be very small and immaterial.

(i) "Control premium" is the difference between the status quo value of a firm and its optimal value.

(ii) Brandon's statement is false. The stock price for a publicly traded firm still includes the probability of change in management and the value of changing management. Even if the control premium is small due to widely distributed ownership, it still exists.

(g)

(i) Explain how to account for illiquidity premiums in valuations using Discounted Cash Flow.

(ii) Explain why an illiquidity premium is needed for the valuation of Snappy.

Commentary on Question:
Candidates generally did well on part (i) of this question, but struggled to explain adequately why an illiquidity premium was needed for part (ii).

(i) *Many candidates did well here, with some providing multiple possible approaches to accounting for illiquidity premium in a Discounted Cash Flow valuation. One possible answer is shown below.*

An illiquidity premium can be added to the discount rate used to discount cash flows.

(ii) *Candidates needed to elaborate and explain their reasoning. One possible answer is shown below.*

An illiquidity premium is required for Snappy because:

- As an insurance company, Snappy's liabilities are illiquid by nature
- Snappy is a private company and was unable to sell any shares in a prior private offering

5. Continued

(h) Critique your colleague's statement with respect to the valuation of Snappy.

Commentary on Question:
Candidates needed to provide two distinct points in order to receive full marks. Some candidates discussed how it is difficult to calculate MCEV because of the information required, rather than the appropriateness of MCEV for valuing Snappy. No credit was given for that reason as it could be argued that valuation using the Discounted Cash Flow or Relative Valuation methodologies is also hard.

Full credit to any two of the four below:

- MCEV is not a widely understood metric, and is not immediately comparable to non-insurance companies.
- MCEV is not appropriate since it only accounts for inforce business and does not include the value of future new business, which is a key part of appraisals. Snappy is a fast-growing company.
- Model volatility can make it hard to track and understand changes over time. For example, assumption changes could be a big driver of year-over-year change in MCEV.
- MCEV does not account for intrinsic value or intangible assets. For example, Snappy's level of systems automation is not considered.

(i)

(i) Recommend the best of the three options (A to C) for Darwin. Justify your answer.

(ii) Sketch a top-down three-level pyramid structure to communicate your recommendation to Brandon with the following criteria:

- Limit the second-level of the pyramid to three key-line arguments
- Limit the third-level of the pyramid to three support points

Commentary on Question:
Candidates generally did well on this question and provided compelling reasons for the choice they selected. However, the point allocation to this question necessitated sufficient elaboration and explanation, not just high-level bullet points.

5. Continued

(i) *For part (i), candidates were awarded full marks only if they justified the option selected using arguments from earlier parts of the question.*

Option A – Acquire 51% of Snappy: *Candidates received partial marks if they selected this option and justified it by discussing potential benefits identified in early question parts.*

Option B – Acquire 49% of Snappy: *Candidates received no marks for recommending this option. From the case study and earlier parts of the question, there are significant cultural differences that make integration difficult without majority control.*

Option C – No investment in Snappy: *This is the best answer. Full marks were only awarded if this recommendation was justified. An answer receiving full marks described three distinct reasons not to invest in Snappy. Possible reasons include cultural differences, the small cap insurance sector being overvalued, unclear synergies and suboptimal diversification.*

(ii) *For part (ii), candidates were awarded points for using the pyramid principle as described in the text and having a top-down pyramid structure and relevant boxes:*

- *A clear Subject/Question and Answer at the top*
- *Relevant and justifiable arguments in the second-level of the pyramid*
- *Clear and well-described support points for the third-level of the pyramid*

Pyramids were mostly well-drawn, though many still stumbled on the Subject, Question, Answer, Situation, Complication model. A small number of candidates did not draw a pyramid or misunderstood what should be in the second and third levels.

One possible solution is shown below.

Subject (what the writer is discussing): Potential acquisition of Snappy
Question (what the reader wants to know): Which of the three options is recommended?
Answer: I recommend no investment in Snappy.
Situation (non-controversial context that the reader will accept as fact): Darwin is considering three possible courses of action for choosing Snappy.
Complication (arises from the situation): Based on what we know, one of the options is clearly the best.

6. Learning Objectives:

1. The candidate will understand and apply strategic management concepts and frameworks to corporate financial and ERM business problems.

4. The candidate will understand how to apply decision making models to general managerial decisions within specified business constraints.

5. The candidate will understand the role that organizational behavior and communication play in organizational decision making and efficacy, as well as learn how to ineffective communication is a risk to organizations.

Learning Outcomes:

(1b) Evaluate commonly used business growth strategies and their application under different economic risk and business environments:
- Critique and evaluate internal/organic and external/inorganic growth strategies.
- Assess and recommend growth strategies under different business situations and market opportunities including innovation and market disruption.

(4a) Apply fundamental techniques and frameworks of management science to make informed business decisions:
- Apply linear optimization models to managerial decisions.
- Develop decision trees, scenario tests, and simulation models.

(5b) Evaluate the impact of human behavior factors on the effectiveness of decision making processes within organizations:
- Explain the role of cognitive biases on making suboptimal individual decisions.
- Evaluate the role of organizational behavior on organizational decision-making processes and efficacy.

Sources:

Business Dynamics Steman: Chapter 9 s-Shaped Growth: Epidemics, Innovation Diffusion, and the Growth of New Products, pg. 300-344

Strategic Management - Ch. 4, pg. 27

Leaders as Decision Architects, pg. 19

Commentary on Question:

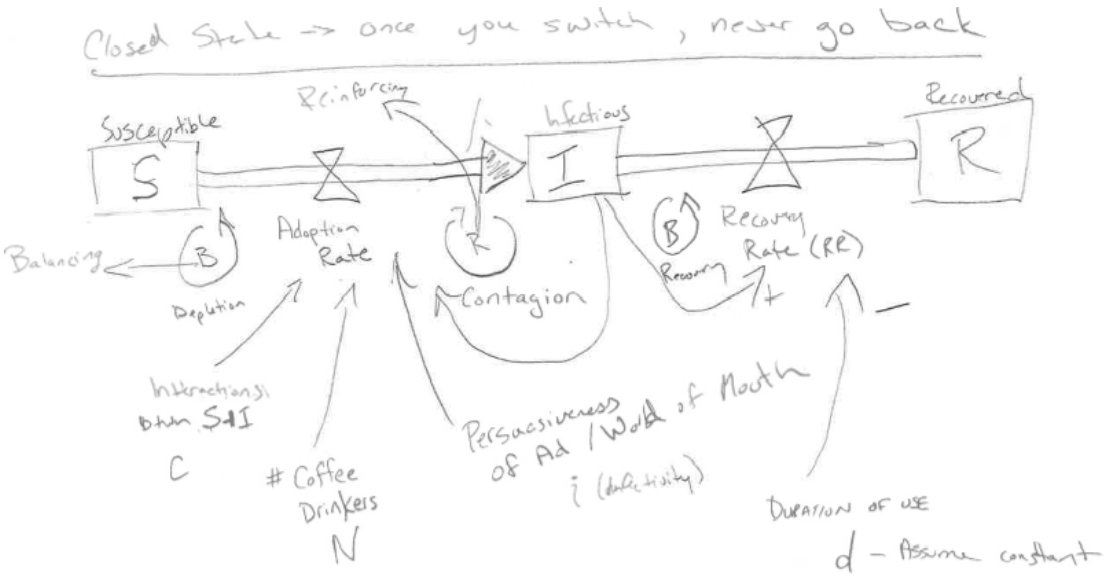
Commentary listed underneath question component.

6. Continued

Solution:

(a) Sketch this system with an SIR epidemic model diagram. Label all stocks, flows, balancing and reinforcing loops, and causal variable inputs with polarities labelled.

Commentary on Question:
Part (a) was well done by most candidates. The most common errors were including an arrow from the recovered stock to the susceptible stock, and not having the correct balancing and reinforcing loops.



(b) Determine how many people will have purchased a machine before the number of people using the machine begins to decline. Show your work.

Commentary on Question:
Many people tried to do a manual simulation which was unsuccessful. People who used the tipping point calculation from the study material typically received full credit. Many people who did the calculation correctly answered 8333 people rather than 8334 which was incorrect but given credit.

This is the tipping point calculation:
purchased = 10,000 [1 – (S/N)]

Where

cid (S/N) >1

10 x 0.10 x 6 (S/N) >1

6. Continued

⇨ (S/N) > 1/6

⇨ 1- (S/N) = 5/6

⇨ 5/6 x 10,000 = 8333.3

8334 people (has to be more than 8333.3, at 8333 people the number has not yet started to decline).

Therefore, once 8334 people purchase a machine, the number of people using the machine will begin to decline.

(c) Frenz is the only coffee shop in town. Because of the rise in popularity of the GranBaristo, sales have declined significantly.

Frenz will not be able to meet sales targets at this location of 8,000 people in town purchase a machine and the store will be forced to close.

Corporate office gives the location $10,000 to try and remedy the situation.

There are two possible actions for the location:

I. Spend $10,000 on a campaign that will decrease the chance that someone purchases a machine after sampling a cup of coffee to 8%.

II. Spend $10,000 on a campaign that will decrease the duration of ownership form 6 weeks to 5.5 weeks.

Determine the best option for Frenz. Show your work.

Commentary on Question:
Part C was testing the candidates understanding of the different variables in the system and how changes to those variables impact the system.

Some candidates did not do the full calculation to check whether the number came in lower than 8,000 people but arrived at the correct conclusion that option 1 was better since it decreased the number using the machine more quickly. Credit was given for this approach, but the more correct answer is shown below.

I. c changes from 0.10 to 0.08

10 x 0.08 x 6 x (S/N) >1 → 79.166% purchase (7917 people)

6. Continued

II. d changes from 6 to 5.5

10 x 0.10 x 5.5 x (S/N) >1 →81.818% purchase (8182 people)

The best option is I. as less people will purchase and the total number of people purchasing is less than 8000 (so Frenz will not be forced to close the store).

(d) Describe the impacts this would have on the system illustrated in part (a).

Commentary on Question:
Most people simply did not write enough things to be given full marks. Many people stated that people who stop using the machine may now start using it again and did not explain further. That was only enough to receive minimal partial credit.

People who stop using the machine will be added back to the pool of potential users.

The diagram would have two sets of potential adopters, one who have never used the machine and one who have previously used the machine.

They may have different infection rates and duration of use. For example, someone who starts using the machine again may be less likely to invite their friends over to try it so their infection rate may be lower. They also may have a different duration of use.

(e) Critique how a strategic alliance with GranBaristo affects Frenz's differentiation strategy.

Commentary on Question:
A critique should examine pros and cons. Many candidates received partial credit due to only looking at either the pros OR cons of the strategic alliance.

The GranBaristo integration helps Frenz achieve its goals in the following ways:

- Frenz is looking to "Further enhance the company's ability to quickly develop and roll out new and innovative products"
- The GranBaristo is an innovative machine; partnering will allow Frenz to be included in this innovative product, further increasing their respected premier coffee brand
- They can target new consumer markets which they are receiving pressure to do.

6. Continued

A strategic alliance could be a detriment to Frenz's business strategy in the following ways:

- This partnership will not allow Frenz to build on their differentiation as a high level coffee house.
- Not being able to make coffee for their customers, they will have to rely on their superior beans to differentiate from other competitors in this new customer space; quality control is much more difficult when have less control over how their coffee is made

(f) Propose three ways that Frenz can trigger system 1 thinking to increase sales of the "machine coffee packs" to the machine owners, at the store.

Commentary on Question:
There were many acceptable answers and a sample are shown below. Many candidates failed to say how their answer triggered system 1 thinking – for example they may have said "increase advertising in store" but did not explain why that would trigger system 1 thinking.

- Arouse emotions – increase advertising in the store. Survey GranBaristo owners what they love most about brewing their own Frenz Coffee packs.
- Harness Biases – sunk cost fallacy – Clients have already invested in the GranBaristo machine, therefore customers can be persuaded it would be a waste to not continue purchasing coffee packs for it
- Simplify the process – Provide subscription service to GranBaristo owners for regular delivery of Frenz coffee packs.