CURATED PAST EXAM ITEMS
- Solutions -

CP 311 – Strategic Management

Important Information:

- These curated past exam items are intended to allow candidates to focus on past SOA fellowship assessments. These items are organized by topic and learning objective with relevant learning outcomes, source materials, and candidate commentary identified. We have included items that are relevant in the new course structure, and where feasible we have made updates to questions to make them relevant.
- Where an item applies to multiple learning objectives, it has been placed under each applicable learning objective.
- Candidate solutions other than those presented in this material, if appropriate for the context, could receive full marks. For interpretation items, solutions presented in these documents are not necessarily the only valid solutions.
- Learning Outcome Statements and supporting syllabus materials may have changed since each exam was administered. New assessment items are developed from the current Learning Outcome Statements and syllabus materials. The inclusion in these curated past exam questions of material that is no longer current does not bring such material into scope for current assessments.
- Thus, while we have made our best effort and conducted multiple reviews, alignment with the current system or choice of classification may not be perfect. Candidates with questions or ideas for improvement may reach out to education@soa.org. We expect to make updates annually.

CP 311 Strategic Management Course
Curated Past Exam Solutions

These solutions and excel spreadsheets are based on the CP311 2025-2026 syllabus.

The case study that was originally used for each question is linked at the start of each question.

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1. Fall 2024 SDM Exam

Learning Objectives:

2. The candidate will understand how sustainable growth and value can be created through strategic budgeting. The candidate will also understand measures of an organization's value and their uses in decision making.

Learning Outcomes:

(2d) Evaluate and recommend appropriate value measures for an organization.

(2f) Assess an organization's ability to create value and recommend actions to improve value creation.

Sources:

Damordaran on Valuation Book: Chapter 13 Value of Control

Damordaran on Valuation Book: Chapter 15 Value of Synergy

Valuation, Measuring and Managing: Ch 32 Divestitures

Case Study Fall 2024:
https://www.soa.org/4a2fe3/globalassets/assets/files/edu/2024/fall/case-study/cfesdm.pdf

Commentary on Question:

Commentary listed underneath question component.

Solution:

(a) **(LOs 2d)** List the five key inputs that determine value, according to Damodaran.

Commentary on Question:
Candidates did very well, with most receiving full marks.

1. Cash flows from existing assets
2. Expected Growth rate during extraordinary growth period
3. Length of the extraordinary growth period
4. Cost of Capital
5. Cash, cross holdings, and other nonoperating assets

1. Continued

(b) **(LOs 2f)**

(i) Identify one financial synergy that BJA has realized by owning BJT. Justify your answer.

(ii) Identify one operational synergy that BJA has realized by owning BJT. Justify your answer.

(iii) Identify one synergy that Motors Inc. would realize by purchasing BJT. Justify your answer.

Commentary on Question:
(i) The average candidate addressed some aspects of financial synergy, earning partial or full credit based on their response quality. Those who mentioned operational synergy received no credit.

(ii) Most candidates performed well, though those who discussed economies of scale or scope struggled to apply these concepts effectively.

(iii) Most candidates did not answer this part of the question well.

(i) Financial synergy: Tax benefit. BJT has branches in Canada with lower tax rate. Tax benefit from increasing debt capacity. Both firms have positive earnings and stable net income based on the past 3 year's exhibit. This makes their combined report have an even more stable earnings which allows BJA to borrow more if BJA plans to. And this would create a tax benefit for BJA.

(ii) Operating synergy: Improve cost-efficiency: BJA can have tires directly from BJT rather than shopping at different providers. → mark-up is eliminated from the value chain.

(iii) Financial synergy: BJT has positive cash and cash equivalents in 2023, and a combination of a firm with excess cash can and a firm with high-return projects (buyer's fuel-efficient car project) can yield a payoff in terms of higher value for the combined firm.
or Operating synergy: Higher growth in new markets. The Automobile company can utilize BJT's distribution network and brand name recognition to increase sales of its products.

1. Continued

(c) **(LOs 2f)** Assess how each factor (A to D) would apply to divestiture of BJT by BJA. Justify your answers.

Commentary on Question:
Candidates performed better on parts B and C compared to A and D. Partial credit was awarded to those who provided sufficient justification, even if their answers didn't exactly match the listed answers.

a. Disentanglement costs: BJA needs to set up full and detailed disentanglement plans for this divestiture. This would go through legislation that incurs legal and advisory fees. In addition, there are other costs associated with intellectual property, relocation costs and retention bonuses for certain employees of BJA and BJT. BJA needs to evaluate these costs regarding the divestiture. Specific to this transaction, there are potential costs and scrutiny when US & Canada are involved, leading to exacerbation of legal fees.
b. Stranded Costs: BJA and BJT share the IT infrastructure and overhead will be allocated between the two companies. After this divesture, BJA needs to consume all the overhead of the IT infrastructure.
c. Lost synergies: BJA can have tires directly from BJT. However, after the divesture, BJA needs to shop in the market which results in higher costs
d. Stand-Alone value of BJT: BJT has had a good performance in the past 3 years based on its annual report with positive net income and cash flow. Selling BJT will negatively affect BJA's annual report.

(d) **(LOs 2f)** Describe two additional concerns BJA must consider for divestiture.

Commentary on Question:
Few candidates addressed the exact two points listed below. However, partial credit was given if candidates provided sufficient justification for the concerns they mentioned.

a. Legal and Regulatory Barriers
   Divesture might trigger an investigation. This is time-consuming and costly. BJA needs to take this into consideration.
b. Pricing and Liquidity concern
   This divestiture does not occur in the open market, so negotiation of the price might be a concern between Motors and BJA. If BJA wants a quick deal on this divesture, it might need to accept a lower price of selling BJT.

1. Continued

(e) **(LOs 2f)** BJA determines it will divest BJT.

(i) Compare and contrast public vs private transactions for divestitures.

(ii) Recommend whether BJA should sell BJT using a public or private transaction. Justify your answer.

Commentary on Question:
Many candidates' responses were light when comparing in question (i). They would have benefitted from more elaboration on the topic.

(i) Private transactions: used when a company can find a good buyer. Allow the company to sell the business unit at a premium and capture value immediately. However, this will result in taxable gains.
Public transactions: used when a company cannot identify another company as a better owner. Shareholders do not earn premiums from the divestiture, but significant value may be created in the future.

(ii) Recommend private transactions. BJT is a private company and thus IPO does not apply to it. It should use a private transaction type (trade sale or joint venture with valid reasons).

2. Fall 2024 SDM Exam

Learning Objectives:

2. The candidate will understand how sustainable growth and value can be created through strategic budgeting. The candidate will also understand measures of an organization's value and their uses in decision making.

Learning Outcomes:

(2b) Assess how effective strategic budgeting is in tracking progress of an organization's initiatives.

(2c) Demonstrate how an organization's strategic goals can be effectively incorporated into the financial budgeting decision making process.

(2d) Evaluate and recommend appropriate value measures for an organization.

Sources:

Handbook of Budgeting – Ch. 15 Budgeting of Shareholder Value (start from Economic Value-Added Section)

Handbook of Budgeting – Ch. 6 Strategic Planning and Budgeting Process

Cass Study Fall 2024:
https://www.soa.org/4a2fe3/globalassets/assets/files/edu/2024/fall/case-study/cfesdm.pdf

Commentary on Question:

This question evaluates the candidate's understanding of the connection between strategy and budgeting, as well as how strategic planning relates to Economic Value Added (EVA). It also assesses their knowledge of the factors affecting EVA and its application to one of Frenz's growth initiatives. On average, candidates earned just over half of the available points for describing the key factors or concepts.

Solution:

(a) **(LOs 2c)**

(i) Describe the role of strategic business planning in the budgeting process.

(ii) Describe how components of the strategic planning process can be incorporated into EVA implementation.

Commentary on Question:

To receive full credit, candidates needed to explain how budgeting aligns with the company's objectives and priorities outlined in strategic planning, and discuss the dynamics of change. They also had to describe how EVA is implemented in strategic planning and its goals. While most candidates successfully addressed the first part, their responses to the second part often focused on the components of strategic planning without clearly linking it to EVA.

2. Continued

(i) Budgeting supports the priorities and objectives of the company, which are reflected in the strategic planning. An institutionalized program of strategic business planning requires management to regularly assess the market within the context of the company's business objectives, product mix, marketing strategy, research and development program, management and organization structure, operations, and budget.

(ii) Applied to Frenz and their EVA implementation, each of these steps and components should be looked at in terms of potential NPV, EVA, and discounted CF implications and by extension the income statement and balance sheet. For example, for product mix, a company focused on EVA might review the existing product mix and potential investments to expand or change the product mix, and choose the mix with the highest Return on Invested Capital (ROIC), or shift invested funds away from products with lower ROIC to products with higher ROIC. EVA can be used to assess the productivity of capital, together with the other metrics. EVA can then be used to track the progress of initiatives towards meeting the company's objectives.

(b) **(LOs 2d)**

(i) Explain how increasing operating efficiency affects EVA.

(ii) Explain how changes in taxes affect EVA.

(iii) Explain how increasing leverage affects EVA.

(iv) Explain how decreasing average invested capital affects EVA.

Commentary on Question:
To earn full credit, candidates needed to explain the impact of each change. Most candidates successfully did this for part (i). However, the other changes required a deeper understanding of their impact on EVA. Many candidates overlooked that debt has a lower cost of capital, especially after taxes, and missed that the return on invested capital (ROIC) component of EVA includes average invested capital in the denominator, which can increase EVA when average invested capital decreases.

(i) ROIC can be increased by increasing NOPAT, which is done by enhancing operating efficiency. That is enhancing the return on a Frenz's existing invested capital base.

2. Continued

(ii) Changes in taxes affect both parts of the EVA formula, ROIC and COC, with opposite effects, making the net effect unclear. Since taxes have a direct multiplicative effect on NOPAT and only partially affect the COC calc (proportionate to the % of debt), it's likely that a decrease in taxes will increase EVA.

a. A decrease in taxes will increase the after-tax cost of debt, which increases the COC. Increasing the COC will decrease EVA.
b. Decreasing taxes will increase NOPAT, which increases ROIC and EVA.
c. An increase in taxes will have the opposite effects.

(iii) Increasing leverage, that is shifting from equity to debt (since debt has a lower COC, especially after taxes) increases interest cost, but does not affect NOPAT. Lowering the COC will increase EVA.

(iv) Decreasing average invested capital will increase EVA (all else equal), since when you pass average invested capital through the equation, you're left with NOPAT – (COC x Ave IC). In addition, to the degree capital is decreased by removing capital from underperforming projects (those with the lowest ROIC), that would further enhance the improvement in EVA by increasing average ROIC

(c) **(LOs 2b)** Identify the elements of the smart phone app initiative that would impact Frenz's EVA. Justify your answer.

Commentary on Question:
An effective response would require candidates to explain how the initiative could affect the variables that make up EVA. Many candidates were able to identify and justify at least one element. However, responses varied widely. Some candidates focused on one element in detail but overlooked others, while some did not fully or accurately describe the connection to EVA.

Frenz's smart phone app initiative will impact all parts of Frenz's EVA calculation. Specifically:

- Average invested Capital: The smart phone app initiative is a costly endeavor (increasing average invested capital). This will decrease EVA.
- NOPAT: Frenz is making the investment with the expectation that NOPAT will increase. Said another way, Frenz expects that Average ROIC will increase, believing that the smart phone app is relatively more profitable than other Frenz investments.
    - Frenz is hoping the customer data gained can be used and leveraged throughout the business to increase revenue.

2. Continued

  - Frenz is hoping to use the app to better interact with customers, offering incentives for free drinks with app usage or to bring customers back after they've not been a customer for six months. This touch point should boost revenue.
  - Once the app is up and running, it should be relatively easy (less investment heavy/costly) to maintain. That is, lower ongoing expenses (lower average invested capital in the long run).
  - More revenue on two fronts plus the potential for lower ongoing expenses both should lead to higher NOPAT and ROIC, lower future AIC and higher EVA.
- Cost of Capital: Frenz's Debt to Equity ratio is projected to be less than 1 (slightly more equity than debt), with the ratio decreasing over time to about 2/3 (almost 50% more equity than debt). The case study does not list an explicit debt limit but does list the interest rate and capital risks related to making financing decisions. The decreasing debt to equity ratio implies Frenz could fund the smart phone app initiative with debt. This would decrease the cost of capital and improve EVA.
  - The shift to more debt would increase Frenz's interest expense, putting downward pressure on NOPAT, but the net effect would almost certainly be positive.
  - Interest rate risk would increase (or not decrease as the current income statement suggests).
  - Capital risk would also increase as Frenz would likely have less access to the debt markets after the smart phone initiative. At the very least, the higher debt to equity ratio would necessitate a higher interest rate on future debt.
- Taxes: The smart phone initiative is unlikely to impact Frenz's tax position or their tax rate.

5. Fall 2024 SDM Exam

Learning Objectives:

1. The candidate will understand and apply strategic management concepts and frameworks to develop an organization's business strategies and solutions.

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

Learning Outcomes:

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

- Describe and apply strategic management models including Porter's five forces model and value chain analysis
- Assess and recommend an appropriate business-level strategy for a given situation
- Assess and recommend an appropriate corporate-level strategy for a given situation
- Explain the impact of competitive dynamics on strategic management

(3a) Apply fundamental techniques and frameworks of management science to make informed business decisions:

(3c) Evaluate business situations using quantitative and statistical methods.

Sources:

Data Models and Decisions - Ch. 7 Linear Optimization

Data Models and Decisions - Ch. 9 Discrete Optimization

Understanding Michael Porter – Ch. 2

Cass Study Fall 2024:
https://www.soa.org/4a2fe3/globalassets/assets/files/edu/2024/fall/case-study/cfesdm.pdf

Commentary on Question:

Commentary listed underneath question component.

Solution:

(a) **(LOs 3a, 3c)**

(i) State the objective function.

(ii) State the constraint functions.

5. Continued

Commentary on Question:
Candidates performed well on this portion of the questions. Most were able to state the objective function in section i. However, only a few correctly identified the production capacity constraint function. Many did not recognize the production trade-off between cars and trucks, which made it difficult to map the feasible region and find the optimal solution. To earn full marks, candidates needed to: 1) correctly state the final objective function, and 2) accurately state all constraint functions, including integer and non-negative constraints.

(i) Objective function based on profit (i.e. revenue – raw material expense – labor cost): **max(45*x + 100*y)**, where **x = number of car tires**, and **y = number of truck tires**

(ii) Constraint functions: **x + 2.5*y <= 5** (in millions, represents production capacity) **(1)**
-0.3*x + y <= 0 (truck tire limit) **(2)**
0.05*x – y <= 0 (truck tire minimum) **(3)**
x >= 0, **y >= 0** (positive solutions only)
x, **y** are elements of **P** (where **P** is the set of positive integers)

(b) **(LOs 3a, 3c)** For the optimization problem defined in part (a):

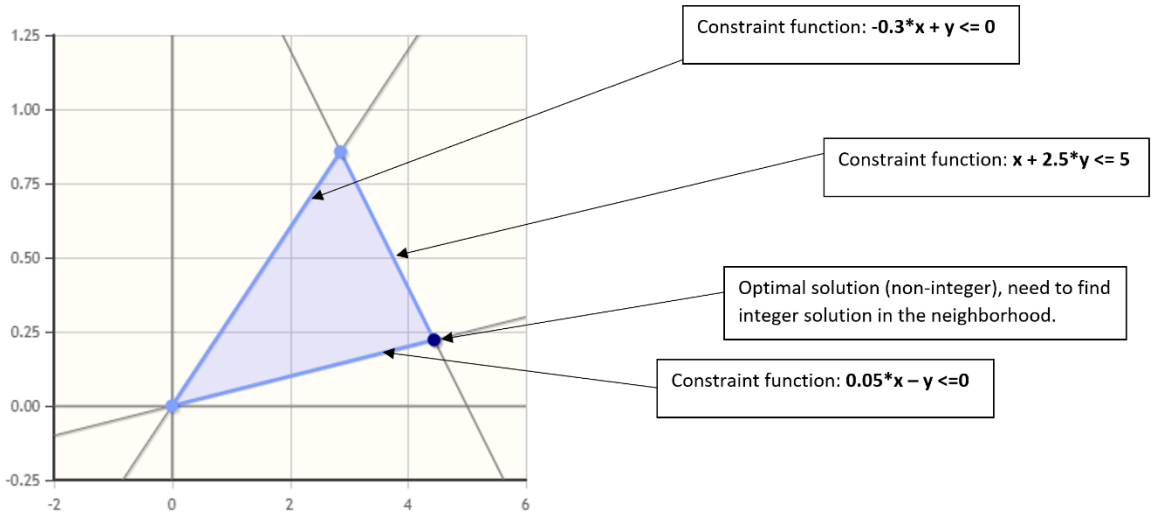
(i) Sketch the feasible region with binding constraints clearly labeled.

(ii) Calculate the optimal solution. Show your work.

Commentary on Question:
Candidates struggled with this section. Those who couldn't correctly identify the production constraint function also had difficulty mapping the feasible region and finding optimal solutions. Common errors included incorrect labeling of constraint functions, not calculating profits for all intersection points, and not checking for integer solutions. To earn full marks, candidates needed to: i) accurately graph the feasible region using the constraint functions from part a, and ii) calculate the optimal solution by comparing the final output at the intersection points.

5. Continued

(i)



(ii) Optimal solution occurs where constraint **(1)** intersects with constraint **(3)** (see intersection point on above chart), but then need to check integer solutions near that point.

Optimal integer solution is: **C = 222,222,225** where **x = 4,444,445** and **y = 222,222**.

BJT will begin producing airplane tires at the new plant, thus the optimization model needs to be reassessed.

(c) **(LOs 3a, 3c)**

(i) State the new objective function.

(ii) State the new constraint functions.

Commentary on Question:

Candidates performed well in this section, with most scoring between 75% and 100% of the total exam points for the question. Most were able to update their answers in part (a) to include the production of airplane tires and consistently calculate the constraint formula.

However, candidates had difficulty formulating the production capacity constraint, both in part (a) and here in part (c). Many assumed the capacity constraint applied to each individual tire, but it should have been considered for all three tires together, viewing rubber as a finite raw material to be allocated among the production of all three types of tires.

5. Continued

(i) Updated objective function from (a) based on profit: **maximize the function**

= (100 – 30 – 25)*x + (300 – 100 – 100)*y + (2000 – 300 – 500)*z

= 45x + 100y + 1200z

Where, **x = number of car tires**, **y = number of truck tires**, and **z = number of airplane tires**

(ii) Updated constraint functions:

- x + 2.5*y + 5*z <= 5 (in millions, represents capacity)
- -0.3*x + y <= 0 (truck tire limit)
- 0.05*x – y <= 0 (truck tire minimum)
- x >= 0, y >= 0, z >= 0 (positive solutions only)

Where, x, y, z are elements of P (where P is the set of positive integers, i.e. positive integer solutions only)

(d) **(LOs 3a, 3c)** BJA determines that BJT will produce airplane tires exclusively for BJA. 10% of BJTs new plant production capacity will be allocated to produce airplane tires. BJA will pay $900 per airplane tire produced.

(i) Calculate the optimal solution to your model in part (c) given this new information. Show your work.

(ii) Compare and contrast how BJA and BJT may interpret the optimal solution in part (i).

(iii) Explain the limitations of this type of linear optimization model analysis.

Commentary on Question:
Overall performance on question (i) ranged from poor to moderate, with very few candidates earning more than 70% of the total exam points. Many candidates failed to isolate the constraint of dedicating 10% of production to airplane tires.

Candidates who couldn't determine the capacity constraint correctly in earlier parts carried those errors forward. Most points were lost due to arithmetic errors or misinterpretation of the capacity constraints provided.

Several candidates who were unsure how to proceed gave a generic explanation of optimizing a set of linear equations without performing any calculations.

5. Continued

Candidates received credit for (ii) if they could describe: (a) how entities were cross-subsidizing each other, (b) how transfer pricing benefits the group as a whole, and (c) how individual entity objectives could conflict, or provide other acceptable rationale.

For question (iii), candidates did not need to explain every reason in the solution. Mentioning 2-3 reasons (or other acceptable justifications) and providing adequate justification or examples of why those limitations hinder true optimization earned them credit.

(i) Since the number of airplane tires, **z**, is now fixed to account for 10% of the total production capacity, we have **z = 10% * (1 million capacity for airplane tires) = 100,000**.

Because **z** is fixed, it is no longer a variable in the updated objective and constraint functions:

Updated objective function based on profit: maximize **(45x + 100y + 100 * 100,000),** where **x** is the number of car tires and **y** is the number of truck tires.

Updated constraint functions:

(x + 2.5y <= 4.5) (in millions, noting that capacity has been reduced by 10%) **(1)**
(-0.3x + y <= 0) (truck tire limit) **(2)**
(0.05x - y <= 0) (truck tire minimum) **(3)**
(x >= 0, y >= 0) (positive solutions only)
Here, **x**, **y**, and **z** are elements of **P**, where **P** is the set of positive integers, indicating that only positive integer solutions are considered.

The updated optimal solution still occurs at the intersection of constraint **(1)** and constraint **(3)**. Although the slope of constraint **(1)** has been slightly modified, it is necessary to check for integer solutions near the optimal point. The updated optimal integer solution is: **C = 210,000,000**, with **x = 4,000,000**, **y = 200,000**, and **z = 100,000** (provided as a constant in the optimization model).

5. Continued

(ii) On a standalone basis, BJT aims to maximize its own profit. However, since BJT is owned by BJA, two dimensions must be considered: the profit of BJT (which is fully owned by BJA) and the overall operational savings/efficiencies achieved by acquiring airplane tires at a price below market value.

From BJT's perspective, selling airplane tires to BJA at $900 per tire is suboptimal, as BJT could earn $2,000 per tire on the open market. This means BJT is sacrificing profit for the benefit of BJA, which is undesirable from BJT's standalone perspective.

From BJA's perspective, receiving airplane tires at such a discounted rate is advantageous compared to the open market price. BJA benefits directly from the cost savings, as BJT forfeits profit by selling at a lower price. From a consolidated BJA viewpoint, it might be sensible for BJT to sacrifice profit to benefit BJA.

(iii) There are certainly limitations to using this type of linear optimization model for decision-making. The model relies on several simplifying assumptions that may not hold true in real-world scenarios. The model assumes that costs and sales prices will remain constant, which is unlikely in practice due to fluctuations in supply and demand. For instance, what happens if the cost of raw materials for tire production changes? Who will bear the financial loss in such a situation? Would BJT still be required to sell tires to BJA at a discounted price? These considerations are not addressed in the linear optimization model.

Additionally, the model requires integer solutions since it's not possible to produce a fraction of a tire. The solution must adhere to whole-number constraints. There may also be other real-world constraints that are not immediately apparent. For example, does it make sense to produce an odd number of tires when vehicles typically use an even number? This could introduce another constraint similar to the need for integer solutions, but focused on groups of tires.

Furthermore, the case study suggests there is a delay before the plant reaches full capacity, a timing element not considered by the linear optimization model.

5. Continued

(e) **(LOs 1a)** Evaluate the North American coffee shop industry under each of Porter's Five Forces.

Commentary on Question:
Candidates generally performed well on this question. To receive full marks, candidates needed to: (a) identify Porter's 5 Forces, earning 1 point for each force; (b) assess the impact from high to low, earning 1 point for the impact; and (c) provide rationale for the chosen impact using examples or other justifications, earning 1-2 points for each rationale.

Candidates may answer along the spectrum from low to high depending on which points they focus on. Examples below highlight items that increase and decrease competitive landscape for each force.

Threat of New Entrants:

Moderate to High: The coffee shop industry has low barriers to entry - initial capital investment and operational costs are not too high.
However, establishing a higher-end brand and achieving customer loyalty can be challenging.
New entrants would need to invest in high-quality products, premium locations, and strong branding to compete effectively, which can be a deterrent.

Bargaining Power of Suppliers:

Moderate: For a higher-end coffee shop, sourcing high-quality coffee beans and other premium ingredients is key. If the shop deals with a limited number of specialty suppliers, those suppliers could have very high bargaining power. However, the coffee shop may mitigate this by establishing strong relationships with multiple suppliers or sourcing directly from coffee growers to reduce dependency on any single supplier. (important to note that we are looking at the general market, not Frenz' position in specific geographies).

Bargaining Power of Buyers:

Moderate to High: Customers of higher-end coffee shops tend to be very picky and have specific preferences for quality and experience. If these customers can easily switch to other premium coffee shops or high-quality coffee-substitutions, their bargaining power increases.
However, brand loyalty and a unique customer experience can help mitigate this power.

5. Continued

Threat of Substitute Products or Services:

High: There are numerous substitutes for coffee, e.g. tea, energy drinks, and other specialty drinks. Additionally, with the prevalence of high-end home coffee/espresso machines customers might opt for homemade drinks (or drinks from convenience stores and fast-food chains).
The coffee shop can differentiate itself through superior product quality, unique offerings, and a premium customer experience to mitigate this threat.

Rivalry Among Existing Competitors:

High: The market for higher-end coffee shops can be quite competitive, especially in urban areas with a large number of similar businesses. Competitors may engage in price wars, promotional activities, and efforts to innovate and enhance customer experience. The intensity of rivalry can pressure profit margins and necessitate continuous improvement and differentiation.

(f) **(LOs 1a)** Explain how BJT's value chain allows it to differentiate itself within the North American tire industry.

Commentary on Question:
Candidates generally performed well on this question. To receive full marks, candidates needed to state three support statements.

Since BJT is owned by BJA, from the BJA shareholder perspective this could be beneficial on a holistic level. Yes, BJT is subsidizing BJA and foregoing some profit that it could get in the open market, but BJA is saving for the same reason. Alternatively, if BJA were to buy in the open market, BJT could be free to produce whatever, but from the BJA shareholder perspective that might be suboptimal. BJT could even opt to sell airplane tires in the open market, but that might result in a situation that has a comparable payoff from the BJA holding company perspective (vs. BJT selling to BJA at a discount).
In this way BJA is benefitting from economies of scope, by increasing efficiencies and controlling another part of the production process that would otherwise need to be outsourced.

1. Spring 2024 SDM Exam

Learning Objectives:

1. The candidate will understand and apply strategic management concepts and frameworks to develop an organization's business strategies and solutions.

2. The candidate will understand how sustainable growth and value can be created through strategic budgeting. The candidate will also understand measures of an organization's value and their uses in decision making.

Learning Outcomes:

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

- Describe and apply strategic management models including Porter's five forces model and value chain analysis
- Assess and recommend an appropriate business-level strategy for a given situation
- Assess and recommend an appropriate corporate-level strategy for a given situation
- Explain the impact of competitive dynamics on strategic management

(2d) Evaluate and recommend appropriate value measures for an organization.

Sources:

Strategic Management – Ch. 6: Corporate-Level Strategy

Valuation, Measuring and Managing the Value of Companies – Ch. 18: Using Multiples & Ch. 43: Banks

Case Study Spring 2024:
https://www.soa.org/49a9d3/globalassets/assets/files/edu/2024/spring/case-study/spring-2024-cfesdm-case-study.pdf

1. Continued

Commentary on Question:
This question tests the candidate's understanding of banks, various metric calculations, management actions, and the ability to evaluate these concepts regarding Big Ben. Overall, there was mixed performance on the various pieces of the question.

Solution:

(a) **(LOs 2d)** Describe the three types of income that Big Ben generates.

Commentary on Question:
Overall, most candidates were able to identify the three types of income. However, some candidates lost points for not providing adequate descriptions.

Interest income
The difference between the interest income that the bank earns from lending and the interest expense it pays to borrow its funds is its net interest income.

Fees and commissions income
Bank charges fees and commissions for services such as transaction advisory, managing investment assets, and securities brokerage.

Trading income
These are profits generated by trading a wide variety of products including but not limited to stocks, bonds, foreign exchange, credit default swaps and asset backed debt obligations.

1. Continued

(b) **(LOs 2d)**

(i) Explain why equity discounted cashflows (equity DCF) is an appropriate valuation method for Big Ben. Justify your answer.

(ii) Explain three pitfalls of equity DCF valuation.

Commentary on Question:
To receive marks for part b, candidates needed to provide responses based on the source materials. Several candidates recalled the information very well, while many received partial marks for inadequate explanations or generic responses not found in source materials.

(i) Unlike non-financial companies, operating and financing decisions for banks are the same because interest income and expense decisions are the main operations of a bank. This is why equity DCF model is better to value banks because it accounts for both operational and financial CFs.

(ii) The 3 pitfalls are the following:

Source of value creation.
The equity DCF model doesn't tell whether the bank is creating or destroying value.

Impact of leverage and business risk on cost of equity.
Equity DCF assumes constant cost of equity which is not accurate. If bank decreases equity risk capital, the return on equity goes up but it shouldn't result in higher bank value. This is because the CFs are now riskier so cost of equity should change as well.

Tax penalty on holding equity risk capital.
How the bank is funding its capital, i.e., via debt or equity will have an impact on cost of equity. If the bank funds through equity, it will be paying taxes on interest income vs dividend payments on debts are tax deductible.

(c) **(LOs 2d)**

(i) Critique the use of Price-to-Earnings as a metric for comparing the value of financial institutions.

(ii) Recommend a more appropriate ratio for comparing the value of financial institutions. Justify your answer.

1. Continued

Commentary on Question:
Answering part (i), candidates needed to mention that P/E does not account for the capital structure/makeup of companies. Part (ii), only one of the two ratios listed below was needed. Several candidates answered this question well, but many received only partial points. Some candidates made up their own ratio of different values in part (ii) instead of using one from the source materials or did not provide sufficient justification.

(i) Pro: P/E is easy to calculate, compare and widely used by analysts.
Con: Low P/E can indicate that a company is trading at a discount, but it should be investigated further because P/E does not account for capital makeup of companies.

(ii) I would recommend Net Enterprise value to EBITA (Earnings before income, tax, and amortization) or Net Enterprise value to NOPAT (Net operating profit after tax). These ratios are better because they account for the distorting effects of capital structure, non-operating assets, and non-operating income statement items such as non-operating portion of pension expense.

(d) **(LOs 2d)** Assume that Big Ben's growth rate, as defined for equity DCF, will be 3.5% every year after the year 2027.

(i) Calculate the value of the commercial banking business equity using an equity DCF model as of January 1, 2024. Show your work.

(ii) Recommend whether Big Ben should decrease its commercial banking operations. Justify your answer.

Commentary on Question:
Many candidates were able to correctly calculate the net income, cash flow to equity, and return on equity components, though several missed deducting income tax in the net income calculation. Candidates struggled with calculating the continuing value, however, and thus did not get the correct value of the commercial banking business equity. Most candidates identified in part (ii) that the commercial banking operations should not be decreased, but some lost points due to inadequate justification.

1. Continued

(i) *See Excel Solution for Work.*
Value of Commercial Banking Equity = 5,982.6.

(ii) Big Ben should not decrease its commercial banking operations because it is creating value. This is supported by the return on equity of 11%. The market to book value is also positive. Big Ben should compare this return with ROE from other businesses. Another way to measure the value that commercial banking is creating is to do Multiple Analysis where Big Ben's multiples can be compared with other similar business. The asset management business multiples should not directly be compared to commercial business because they are different business. Care must be taken to choose the right subset of companies to compare the commercial business multiples against.

(g) **(LOs 2d)**

(i) Critique your colleague's recommendation.

(ii) Recommend an alternative metric. Justify your answer.

Commentary on Question:
Most candidates identified that growth in interest income does not consider riskiness or could encourage riskier loans. Few recognized that it is not a good indicator of overall profitability. Alternative metrics differing from total economic spread were accepted for part (ii) if reasonable, but many candidates lost points due to insufficient justification.

(i) Growth in interest income does incentivize employees to grow the loan book; however, it does not consider the riskiness of business nor overall profitability.

(ii) I recommend using total economic spread. This metric tracks growth of the block in absolute terms, addresses profitability, considers riskiness, and would require minimum and maximum targets.

1. Continued

(h) **(LOs 1a)**

(i) Explain the diversification strategy being proposed.

(ii) Explain how this diversification strategy can be value-creating.

(iii) Explain a potential risk of using a common customer service software. Justify your response.

Commentary on Question:
Some candidates correctly identified the diversification strategy, while some did not. Most were able to explain that this would create cost savings/economies of scope. Other potential risks were accepted if reasonable and sufficiently justified.

(i) Related constrained – this diversification strategy is sharing technology (resource) for customer service (operations).

(ii) Economies of scope can create cost savings. In this case, sharing contact center software (resource) is reducing the overall cost.

(iii) Resource sharing requires careful coordination between the two departments. In this case, there could be limited resources to manage the software so there can be challenges in prioritizing support for the software to the benefit of either Big Ben or Darwin Life.

(i) **(LOs 1a)**

(i) Describe how to transfer a core competency.

(ii) Explain two ways value is created for Darwin by transferring the marketing core competency from Big Ben.

(iii) Explain two potential pitfalls in transferring Big Ben's marketing core competency to Darwin.

Commentary on Question:
Overall candidates did well on this question. Some candidates received partial credit instead of full marks as they only provided one way to transfer a core competency or did not provide two distinct ways value is created/two distinct pitfalls in (ii) and (iii) – e.g., providing both responses to part (ii) related to competitive advantage or both responses in part (iii) related to integration issues instead of providing two distinct responses on each. Other pitfalls than the ones listed below were accepted if reasonable and sufficiently explained.

1. Continued

(i) To transfer a core competency, the company can transfer staff with key knowledge (such as managers), the firm with the core competency completes work on behalf of another (outsourcing), or the knowledge can be transferred via training meetings, discussions, etc.

(ii) The expense of developing (or outsourcing) a core competency in marketing has been already incurred by Big Ben, therefore it eliminates the need for Darwin to allocate resources to develop it.

Additionally, the recognized industry-wide marketing expertise of Big Ben is an intangible resource and is hard for Darwin's competitors to understand and imitate. By transferring this competency, Darwin should gain an immediate competitive advantage over its rival.

(iii) Transferring managerial resources might be challenging as the manager at Big Ben might be reluctant to transfer key people. Furthermore, these key people might not want to transfer over. If it requires transferring technological knowledge, differences in how the business operates can increase integration costs.

Second, there can be managerial motives at Big Ben to diversify their marketing competency such as increased compensation and reduced managerial risk. This can be value reducing if sufficient controls are not in place to limit managerial tendencies to over diversify.

3. Spring 2024 SDM Exam

Learning Objectives:

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

Learning Outcomes:

(3a) Apply fundamental techniques and frameworks of management science to make informed business decisions.

(3b) Apply statistical and quantification methods to analyze managerial decisions with uncertain conditions.

(3c) Evaluate business situations using quantitative and statistical methods.

Sources:

Data Models and Decisions - Ch. 5

Case Study Spring 2024:
https://www.soa.org/49a9d3/globalassets/assets/files/edu/2024/spring/case-study/spring-2024-cfesdm-case-study.pdf

Commentary on Question:

Candidates generally performed well on this question, in particular the Excel calculations. Although most candidates were able to come up with one or two model limitations and recommendations, few candidates were able to come up with four distinct limitations. Many candidates did not link their recommendations to the case study.

Solution:

(a) **(LOs 3a, 3b, 3c)** Complete the 100-day simulation model template provided in the exam Excel File to answer the following items.

(i) Calculate the expected income for the 100-day simulation of the original route and the new route. Show your work.

(ii) Calculate the probability that the new route earns more than the original route on any given day. Show your work.

(iii) Calculate the probability that SEA will lose money on the new route on any given day. Show your work.

3. Continued

Commentary on Question:
Most candidates were able to calculate the correct answer in excel and got full marks. Partial marks have been awarded for the remaining candidates.

The response for this part is provided in the Excel spreadsheet.

(b) **(LOs 3a, 3b, 3c)**

(i) Identify four limitations of the current model architecture. Justify your answers.

(ii) Recommend how to address each limitation identified in part (i).

(iii) Describe the expected impacts on the model results if the recommendations in part (ii) are adopted.

Commentary on Question:
Candidates were generally able to come up with two to four limitations of the model. Different variations of the same type of limitation were not awarded points.

(i) Identify four limitations of the current model architecture. Justify your answers.

1- 100-day time horizon: The model only looks at a simulation for 100 days which may not be large enough to have a credible conclusion.
2- Oversimplification of model factors: The total cost is only a factor of number of flights. Fixed and variable costs can be factored in in a more robust way.
3- Lack of seasonality: The model doesn't take seasonality into consideration. According to the case study, seasonality is an important factor for SEA.
4- Independent variables: In the current model, variables are independent of each other, however, in reality, the cost, number of flights, supply of pilots, and price may all be dependent on each other.

(ii) Recommend how to address each limitation identified in part (i).

1- 100-day time horizon: Higher number of simulations would add credibility to the results. Either the number of days in one simulation or the number of simulations can be increased.
2- Oversimplification of model factors: Variables can be added to improve the model. From the cost perspective, fixed and variable cost factors can be introduced, or the distribution model can be made more inclusive rather than a limited 4-point model.

3. Continued

3- Lack of seasonality: Different sets of model results can be driven depending on the model. Parameters and variables need to be added to allow seasonality.
4- Independent variables: Covariance function can be introduced to have dependence between variables (i.e., price dependent on number flights per day).

(iii) Describe the expected impacts on the model results if the recommendations in part (ii) are adopted.

1- With more simulations, the result is going to be more credible. It might even lead to a different conclusion from the one we draw from the current simulation and model.
2- The cost over 100 days should be relatively close to the 100-day view that we get from the current model as we use a normal distribution. However, we might be able to draw a different conclusion on the profitability of any given day because there is more variability of profitability on any given day after we make cost a variable.
3- We are going to have different sets of model results as we have different sets of parameters for the variables for the routes. And with different sets of model results, we might also draw a different conclusion for busy season vs. non-busy season such as implementing the new route for busy season but not implementing the new route for non-busy season.
4- Covariance will add a more realistic perspective to the model. The results can be significantly different than the current model especially if tail risk is introduced into the model.

(c) **(LOs 3a, 3b, 3c)** Recommend whether SEA should implement the new route. Justify your answer.

Commentary on Question:
Most candidates concluded that SEA should implement the new route. Reasonable conclusions were awarded points even if the model calculations were incorrect, but the candidates interpreted them appropriately. The recommendation needed to link to the case study for full marks.

I would recommend SEA to implement the new route.
1- As shown in model results, the total expected income over 100 days of the new route (25,001) is higher than the original route (20,000) which means the new route is more profitable for SEA over a 100-day period.
2- On any given day, it is more likely (53%) that the new route would earn more than the original route.

3. Continued

3- There is about 20% probability that SEA will lose money on the new route on any given day, however this may be an acceptable risk to take given the potential cumulative earnings in the long run.
4- From a strategy perspective, a new route with multiple number of flights depending on the demand would provide diversification and could better meet the needs of the customers. This aligns with SEA's objectives to prioritize customer needs. They compete against ferries and other alternatives, so flexible fares and schedules align with SEA's competitive strategy.

1. Fall 2023 SDM Exam

Learning Objectives:

2. The candidate will understand how sustainable growth and value can be created through strategic budgeting. The candidate will also understand measures of an organization's value and their uses in decision making.

Learning Outcomes:

(2a) Explain how strategic budgeting can create value and sustainable growth.
(2b) Assess how effective strategic budgeting is in tracking progress of an organization's initiatives.
(2c) Demonstrate how an organization's strategic goals can be effectively incorporated into the financial budgeting decision making process.
(2d) Evaluate and recommend appropriate value measures for an organization.
(2e) Assess the impact of performance measures and incentives on key business decisions and stakeholder value

Sources:

Handbook of Budgeting – Ch. 30 ZBB

Handbook of Budgeting – Ch. 2 Strategic Balanced Scorecard-based Budgeting & Performance Management

Handbook of Budgeting – Ch. 15 Budgeting of Shareholder Value (excl. pp 667-676)

2023 Fall Case Study:
https://www.soa.org/4ac521/globalassets/assets/files/edu/2023/fall/exams/fall-2023-cfesdm-exam-case-study.pdf

Commentary on Question:

Candidates generally performed well on this question, in particular on the recall and comprehension parts. The Candidates did often provide reasonable responses to questions requiring application to the case study.

Solution:

(a) **(LOs 2a, 2b, 2c)** List the six problems for top management created by the traditional incremental approach.

Commentary on Question:

This was scored out of 4. Almost all Candidates got this.

1. Budgeting requests exceed funding availability, often forcing management to recycle the process.
2. Difficulty in translating long-term objectives into action plans (and budgets).
3. Key problems and decision areas are not highlighted.
4. Alternatives are not identified

1. Continued

5. Difficulty in adjusting budgets and operations readily to changing situations
6. Trade-offs among long-term goals and programs, operating needs, and profits are not clearly identified

(b) **(LOs 2a, 2b, 2c, 2d, 2e)**

(i) Explain how the evaluation of alternatives under ZBB reinforces a particular method of securing an increase in Economic Value Added (EVA). Justify your answer.

(ii) Identify a change made to BJA's Operations that is an example of (i). Justify your answer.

Commentary on Question:
Part i was done well. For part ii, some candidates did not identify a change made but a potential change that could be made; partial credit was awarded in this case. Also for part ii, some candidates did not provide justification for their answer.

(i) EVA – Capital is withdrawn from uneconomic activities or sent to more economic activities.

ZBB – Alternatives to top management include "Eliminate the operation if no decision packages are approved".

Which of these funding levels is appropriate will be determined by the priorities established by top management and by the availability of total funding, which links back to withdrawing from uneconomic activities

(ii) BJA discontinued its travel agency. The travel agency's economic performance was not sufficient since it was only breaking even.

(c) **(LOs 2a, 2b, 2c, 2e)** Explain how a decision package would consider the IT manager's proposed initiative during the ZBB process.

Commentary on Question:
There were many reasonable responses to this question. Most candidates listed out what a decision package does and how each part applies.

Decision packages are used for evaluating and comparing alternatives.
The IT Manager's proposed initiative is an alternative method to achieve the objective of expanding Lucky 7. The alternative method is to expand the degree of effort by increasing staffing and maintaining CRM. There will be a cost benefit analysis against leveraging existing staff. The decision package can look at leveraging existing fees or charging new fees to implement the new solution.

1. Continued

(d) **(LOs 2a, 2b, 2c, 2e)**

(i) Identify the type of each alternative being considered by BJA's management team. Justify your answer.

(ii) Explain why the ZBB process would reject these alternatives.

Commentary on Question:
Part i was done well. For part ii, though, most earned only partial credit. Some candidates noted that BJA's business strategy was targeted towards business class and some candidates noted that the return was not adequate. It was rare that both points were presented, which was required for full points.

(i) **Elimination –** the loyalty program is removed from the operation.

Current level – by definition, the same level of effort is being kept by BJA.

(ii) When determining the minimum level of effort…

1. The minimum level may not completely achieve the total objective of the operation. (Even the additional levels of effort recommended may not completely achieve the objective because of realistic budget and/or achievement levels.)
2. The minimum level should address itself to the most critical population being served or should attack the most serious problem areas.

2. Fall 2023 SDM Exam

Learning Objectives:

2. The candidate will understand how sustainable growth and value can be created through strategic budgeting. The candidate will also understand measures of an organization's value and their uses in decision making.

Learning Outcomes:

(2d) Evaluate and recommend appropriate value measures for an organization

(2f) Assess an organization's ability to create value and recommend actions to improve value creation

Sources:

Damodaran on Valuation – Chapter 15

2023 Fall Case Study:
https://www.soa.org/4ac521/globalassets/assets/files/edu/2023/fall/exams/fall-2023-cfesdm-exam-case-study.pdf

Commentary on Question:

The question tested candidates' ability to quantify synergy and evaluate a company's ability to move up the power curve. Candidates who performed well on this question accurately calculated the value of firm's synergy and thoroughly evaluated the acquisition's effectiveness in helping Snappy move up the power curve.

Solution:

(a) **(LOs 2f)**

(i) Calculate the value of Snappy using Discounted Cashflows for the next 5 years. Show your work.

(ii) Calculate the value of Snarky using Discounted Cashflows for the next 5 years. Show your work.

Commentary on Question:

Candidates generally performed poorly on this question. To receive full marks, candidates needed to show each step in calculating the value of each firm. Many candidates left out the terminal value calculation and/or did not discount the terminal value back to valuation date.

Values provided in Excel workbook are rounded. No mark is deducted for using either rounded or unrounded numbers.

2. Continued

Model solution is included in Excel workbook.

(b) **(LOs 2d, 2f)**

(i) Calculate the value of the synergy. Show your work.

(ii) Calculate an additional financial metric to evaluate Snappy's acquisition of Snarky. Justify your answer.

(iii) Discuss whether or not Snappy should pursue an acquisition of Snarky based on your answers in (i) and (ii).

Commentary on Question:
Candidates generally performed well on this question. To receive full marks, candidates needed to calculate the synergy generated by the acquisition and identify an appropriate financial metric such as ROC. Either conclusion (to or not to acquire) was accepted, but the justification needed to correspond to the calculated synergy and metric values.

Model solution for part (i) is included in Excel workbook.

(ii) Additional metric: Return On Capital. ROC is a good metric for executive performance as it is an useful measure of how efficiently a company is using its capital to generate profits
In the acquisition of Snarky, ROC increases with the combined firm.
- Snappy ROC: 7.31%
- Combined ROC: 7.35%

(iii) Recommendation: Acquire Snarky
The synergy calculated in part (i) is positive, however Snappy needs to ensure that not all of the synergy value will be given to Snarky (i.e. needs to retain some synergy value by reducing the purchase price). The increased ROC reaffirms the recommendation.

(c) **(LOs 2f)**Explain how Snappy can compare acquiring Snarky versus paying Snarky to produce projections as a service.

Commentary on Question:
Candidates generally performed poorly on this question. To receive full marks, candidates needed to provide an approach such as a cost-benefit analysis on the acquisition (what is paid and what is gained). The question only asked what questions/decisions should be considered to perform the analysis.

2. Continued

1. What is the market premium Snappy will pay?
2. Will the value of the synergy be immediately realized, or will there be a time horizon?
3. What is the difference between the market premium and the [PV] of the synergy?
4. What is the present value of the services rendered over a similar time horizon as 2.?
5. Is there a control premium earned by Snappy in addition to the value of synergy?
6. What is the cost of transaction vs other opportunities in the market? How do the benefits compare on a relative basis over the cost?
7. Is the annual fee of using the service cheaper or more expensive than pursuing acquisition on a PV basis?
8. Are Snarky's services accretive or dilutive of current Snappy sales?

5. Fall 2023 SDM Exam

Learning Objectives:

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

Learning Outcomes:

(3a) Apply fundamental techniques and frameworks of management science to make informed business decisions.

(3b) Apply statistical and quantification methods to analyze managerial decisions with uncertain conditions.

(3c) Evaluate business situations and describe how quantitative and statistical methods.

Sources:

Data, Models, and Decisions - Ch. 7 Linear Optimization, Data, Models, and Decisions - Ch. 8 Nonlinear Optimization

2023 Fall Case Study:
https://www.soa.org/4ac521/globalassets/assets/files/edu/2023/fall/exams/fall-2023-cfesdm-exam-case-study.pdf

Commentary on Question:

This question tests candidates' knowledge of linear and non-linear optimization models. Successful candidates demonstrated ability to set up objective functions and constraints based on business context. Generally, candidates performed well in the first half of the question, related to linear optimization model. Performance varied in the second half, related to non-linear optimization model.

Solution:

(a) **(LOs 3a, 3b, 3c)** State the objective function.

Commentary on Question:
Candidates generally did well for this part of the question. To receive full marks, candidates needed to include the $10,000 reimbursement as revenue. Partial marks were awarded for otherwise setting up the revenue and expense structure correctly.

B = Price for Business seat
E = Price for Economy Seat

Revenue = (50 * 70% * B) + (230 * 80% * E) +10,000
Expense = 200,000 + 150,000
Income = Revenue - E*pense

Max Income = (50 * 70% * B) + (230 * 80% * E) +10,000 – (200,000 + 150,000)

5. Continued

Given the model is set up with fixed demand (i.e. 70% occupancy for business and 80% occupancy for economy), the flight load is always greater than 100 passengers, hence the revenue reimbursement of $10,000 is maxed out.

(b) **(LOs 3a, 3b, 3c)** State the constraints.

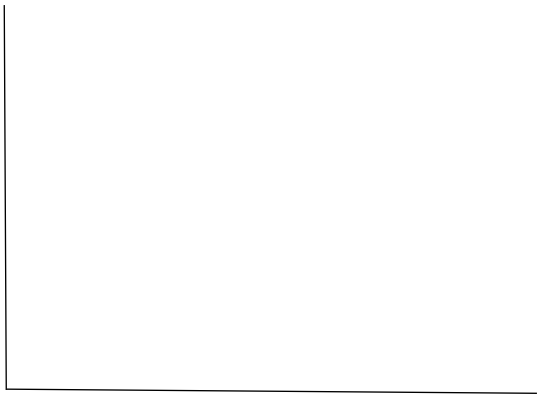
Commentary on Question:
Most candidates were able to successfully state the constraints. A large portion of candidates failed to include the $10,000 reimbursement as revenue.

Profit Margin = (Revenue – Expenses) / Revenue <=10%
(35B + 184E + 340,000) / (35B + 184E + 10,000) <= 10%

B/E<=5
Non-negativity B, E > 0

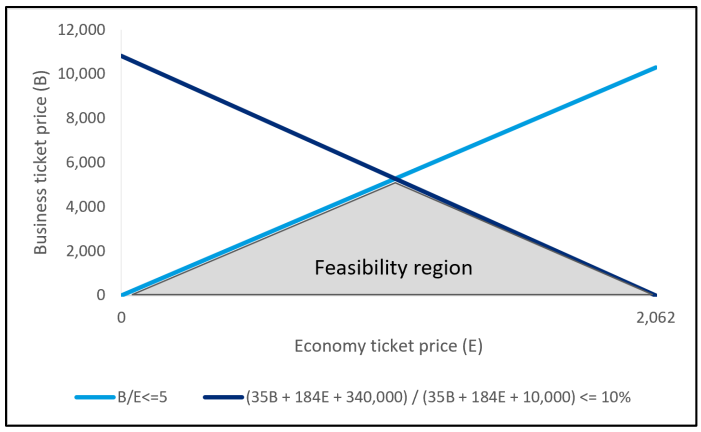
(c) **(LOs 3a, 3b, 3c)** Sketch the feasibility region.

ANSWER:



Commentary on Question:
Candidates generally did well for this part of the question. Marks were awarded for graphing constraints from part b) and correctly identifying the feasibility region.

5. Continued



Non-negativity constraints are considered by not plotting past x- and y-axis.

(d) **(LOs 3a, 3b, 3c)** Determine the optimal prices for each Business and Economy class seat.

Commentary on Question:
Candidates generally did well for this part of the question. Successful candidates were able to identify that optimal solution is where the constraint functions cross and solve the system of linear equations. To receive full marks, the profitability margin constraint must include the $10,000 reimbursement as revenue.

The optimal solution is where constraints cross, hence solving for the system of linear equations:

(35B + 184E +10,000 – 350,000)/ (35B + 184E +10,000) < 10%
B <= 5E

35B + 184E – 34,0000 < 3.5B + 18.4E + 1,000
31.5B + 165.6E <341,000
(plug in B = 5E)
31.5 * 5E + 165.6E < 341,000

E=1,055
B= 5,277

(e) **(LOs 3a, 3b, 3c)** State three areas of flexibility when using the two-stage linear optimization modeling paradigm.

Commentary on Question:
Performance varied for this part of the question. To receive full marks, candidates need to state all three areas of flexibility related to two-stage linear optimization model.

5. Continued

1. Modeling different number of states of the world
2. Modeling different probabilities of states of the world
3. Modeling different number of stages

(f) **(LOs 3a, 3b, 3c)** List the possible states arising from the Demand and Fuel Cost Scenarios.

Commentary on Question:
Candidates performed well for this part of the question. Most candidates received full marks, which required listing out the four combinations of demand and fuel cost scenarios.

State	Fuel Cost	Reimbursement	Probability
1	50,000	50/passenger up to 7500	0.25
2	50,000	50/passenger up to 7500	0.25
3	500,000	200/passenger up to 10000	0.25
4	500,000	200/passenger up to 10000	0.25

(g) **(LOs 3a, 3b, 3c)** State the objective function for the new two-stage model.

Commentary on Question:
Performance varied for this part of the question. Successful candidates were able to list out the four states, assign equal probability, and recognize the different reimbursement payments and fuel costs.

Max Income
= 0.25 * [(50 * 70% * B) + (230 * 80% * E) + 7,500 – (500,000 + 150,000)]
+ 0.25 * [(50 * 70% * B) + (230 * 80% * E) + 7,500 – (50,000 + 150,000)]
+ 0.25 * [(50 * 70% * B) + (230 * 80% * E) + 10,000 – (500,000 + 150,000)]
+ 0.25 * [(50 * 70% * B) + (230 * 80% * E) + 10,000 – (50,000 + 150,000)]

(h) **(LOs 3a, 3b, 3c)** State the updated objective function.

Commentary on Question:
Most candidates were unable to incorporate the demand functions into the ticket sales. Very few candidates incorporated the demand functions into the reimbursement.

B = Price for Business seat
D_b = Demand for Business seat
E = Price for Economy Seat
D_e = Demand for Economy seat

D_b = (4,000 – B) / (4,000 – 1,000) => (4,000 – B) / 3,000
D_e = (2,000 – E) / (2,000 – 500) => (2,000 – E) / 1,500

5. Continued

Revenue = (50 * D_b * B) + (230 * D_e * E) + min(10,000, 100 * [50 * D_b + 230 * D_e])
Expense = 200,000 + 150,000
Objective function = Revenue - Expense

(i) **(LOs 3a, 3b, 3c)** State the updated constraints.

Commentary on Question:
Candidates that did well on (h) were generally able to update the constraints correctly. Most candidates carried forward the constraints that did not change and were awarded partial marks.

Updated constraints:
Profit Margin = (Revenue – Expenses) / Revenue <=10%
Revenue = (50 * (4,000 – B) / 3,000 * B) + (230 * (2,000 – E) / 1,500 * E) + min(10,000, 100 * [50 * (4,000 – B) / 3,000 + 230 * (2,000 – E) / 1,500])
Expense = 200,000 + 150,000

1,000 <= B <= 4,000
500 <= E <=2,000

Old constraints carried forward:
B/E <= 5
Non-negativity B, E > 0

(j) **(LOs 3a, 3b, 3c)** Recommend two additional enhancements to make the model more realistic. Justify your answer.

Commentary on Question:
Most candidates were able to suggest reasonable enhancements to the model. Full marks were only awarded for both describing the enhancement and proposing how the model should be updated.

Sample responses:
Demand can be enhanced with a seasonality component; this can be modeled based on the months in a year and historical business and leisure travel levels.
Fuel price can be enhanced with a variable component that depends on the load of the plane, such as the number of seats sold.

1. Spring 2023 SDM Exam

Learning Objectives:

2. The candidate will understand how sustainable growth and value can be created through strategic budgeting. The candidate will also understand measures of an organization's value and their uses in decision making.

Learning Outcomes:

(2a) Explain how strategic budgeting can create value and sustainable growth

(2b) Assess how effective strategic budgeting is in tracking progress of an organization's initiatives.

(2c) Demonstrate how an organization's strategic goals can be effectively incorporated into the financial budgeting decision making process.

(2e) Assess the impact of performance measures and incentives on key business decisions and stakeholder value

Sources:

Handbook of Budgeting – Ch. 30 Zero-Based Budgeting

Handbook of Budgeting – Ch. 2 Balanced Scorecard-based Budgeting & Performance Management

2023 Spring Case Study:
https://www.soa.org/49ac19/globalassets/assets/files/edu/2023/spring/exams/spring-2023-exam-cfesdm-case-study.pdf

Commentary on Question:

In general candidates performed well on this question. This question tests candidates' mastery of ZBB. To perform well on this question, candidates need to demonstrate how to apply the ZBB to help BJA achieve their objectives.

Solution:

(a) **(LOs 2b, 2c)**

(i) Identify a leading measure on the balanced score card. Justify your answer.

(ii) Identify a lagging measure on the balanced score card. Justify your answer.

(iii) Identify an efficiency measure on the balanced score card. Justify your answer.

(iv) Identify an effectiveness measure on the balanced score card. Justify your answer.

Commentary on Question:

Candidates in general did well on this question. To receive full marks, candidates need to identify a measurement and provide valid reasonings. Some candidates failed to consider the corresponding objective when assessing the property of the measure.

1. **Continued**

Leading Measure:
Leading measures are often referred to as early-warning measures. These indicators are generally more prevalent in the operations and learning and growth perspectives of your BSC to provide a month or quarter heads-up to activities or events that will manifest themselves later in the financial results measures. However, leading measures can occasionally be financial as well.

From BJA's scorecard:
- Website visits for objective increase direct online sale
- Higher tangible assets for objective asset utilization
- Number of participants for objective enhancing loyalty program

Lagging Measure:
Lagging measures, or rearview-mirror-based measures, such as Free Cash Flow, record history of what took place last month, last quarter, or last year. While these measures provide a historical perspective, they are not always reliable predictors of future performance.

From BJA's scorecard:
- Total revenue for objective revenue growth
- Business class load factor for frequent business travels
- Total operating expense for expense reduction

Efficiency Measure:
Efficiency (process) measures provide visibility into how well a given process or set of processes is functioning. Fundamentally, BSC should be tracking key attributes of processes or an index of several processes. Examples of process measures include productivity measures such as process cost per unit of output (economic), turnaround time (cycle time), and process reliability and repeatability.

From BJA's scorecard:
- On time departure for objective turnaround
- Decrease staff expenses for labor efficiencies

1. Continued

Effectiveness Measure:
Effectiveness (output) measures complement efficiency measures and provide instruction on the quality of process outputs. In quality terms, these are your customer-facing deliverables, or so-called Ys. Examples include percent defective items, number of errors, and invoicing accuracy.

From BJA's scorecard:
- Industry safety index rank for objective safety
- Employee satisfaction for objective labor relationship management
- Utilization of internet and mobile app for objective booking system enhancements

(b) **(LOs 2a, 2b, 2c, 2e)**

(i) State the two questions that the ZBB Ranking Process answers.

(ii) Define "decision package" as it relates to the ZBB Ranking Process.

(iii) Explain how management would use the ZBB Ranking Process to compare different initiatives.

Commentary on Question:
Candidates performed well for part i) and part ii). To receive full mark for this question, candidates need to provide the definition in terms of how it works in the ZBB ranking process. They should also understand the key differences between ZBB and the traditional budgeting process for part iii).

(i) The ranking in ZBB process attempts to provide management with a technique for allocating its limited resources by answering two questions:

(1) What objectives should we attempt to achieve based on companies' core values?
(2) How much should we spend on this attempt?

(ii) A "decision package" provides a description and evaluation of each decision unit for management review and decision making. The decision package is designed to produce an evaluation of each decision unit that will describe the:

1. Continued

(1) Purpose or objective
(2) Description of actions
(3) Costs and benefits
(4) Workload and performance measures
(5) Alternative means of accomplishing objectives
(6) Various level of efforts

(iii)

- Management takes decision packages identified and ranks them in order of decreasing benefit to the organization
- ZBB allows management to have the option to fund all packages, no packages, or any number of packages, and can ensure both current and new packages are considered when making the budgeting decisions
- Management uses the rankings to analyze the trade-offs among different initiatives, and compares the marginal benefits of funding additional decision packages against the organization's profit needs

(c) **(LOs 2a, 2b, 2c)** Recommend a relevant decision unit to use during the ZBB Ranking process for each initiative (A – D). Justify your answers.

Commentary on Question:
Overall, candidates performed poorly on this question. Most candidates failed to demonstrate the correct understanding the decision unit concept. For example, many candidates listed different measurements (such as number of years in IT expertise) or the actual decisions to be made (such as how many IT staffs should be hired) as decision units. No mark is awarded if decision units are not correctly identified. Some candidates were able to correctly identify decision units but failed to justify the relevancy to the initiatives and only received partial marks.

Decision units are meaningful elements of each organization must be defined that can be isolated for analysis and decision making. For those organizations with a detailed cost center structure, the decision unit may correspond to the cost center. In some case the cost center manager may wish to identify separately different functions or operations within the cost center if they are significant in size and require separate analysis.

1. **Continued**

A – Expand the current IT team and acquire employees with mobile app development expertise

Relevant decision unit: The IT team at BJA. Cost required to acquire mobile app development expertise (e.g. salary range of an app developer) should be analyzed by the IT department

B – Update employee training courses and increase the frequency of employee training

Relevant decision unit: The human resources department at BJA. The HR team's operational expenses include expenses to develop new training.

C – Renovate and improve amenities in business lounges in major hubs

Relevant decision unit: Lounge renovation project team. Since this is a niche initiative and it's outside of BJA's core operations, there should be a project team dedicated to this objective. They will be responsible to analyze required costs and expected outcomes of lounge improvement for management's decision making

D – Reduce staff working hours and staffing for short domestic flights

Relevant decision unit: The human resources department at BJA. The HR department is responsible for staff working assignments and need to ensure a minimum level of staffing required for each flight. They can also reallocate staff with higher experience level to flights with low staffing to ensure service quality

(d) **(LOs 2a, 2b, 2c)** Recommend a ranking for the initiatives (A – D). Justify your answer.

Commentary on Question:
Overall, candidates performed poorly on this question. Most of the candidates were able to tie the initiatives ranking to BJA values and received partial points. However, candidates struggled to apply the concept of ZBB when recommending the ranking.

1. Continued

Multiple rankings of the initiatives are acceptable as long as they are consistent with BJA priorities.

Example:

- C – Renovate the business lounges
    - This initiative should rank highest since it fits into BJA's 'new strategic vision to become the most customer-oriented airline company in the world' with 'comfort, punctuality and safety' as the three important virtues that the company has adopted. Additionally, business professionals are over half (55%) of BJA's customers, so this initiative will not only fit their new strategic vision, but will also cater to their customer base
    - This initiative should be either fully funded or funded at a higher level. The lounges renovation projects team should assess whether increased funding levels will significantly increase business professionals as a proportion of their customer base, which will in turn boost BJA objective of increased frequency of business traveling

- B - Update employee training courses
    - This initiative should rank second highest. Alongside comfort and punctuality, safety is one of BJA. With the recent cut back on training programs, BJA needs to review its training courses to ensure comprehensiveness (i.e. no reduction in employees performance quality despise cut back on program)
    - This initiative should be fully funded, given cost is likely low. BJA HR department should assess correlation between employee training quality and industry safety index ranking to better predict if increased funding level could lead to BJA's higher ranking on the index

1. Continued

- A - Expand the current IT team and acquire employees with mobile app expertise
    - This initiative should rank third. This initiative is a good fit to their goal of becoming the most customer-oriented airline – which is important for strategic growth even though it's not directly in scope of BJA's core value. A new booking app will appeal to demographics that prefer to book flights through online portal (e.g. leisure travelers), which will in turn increase direct online sales.
    - The initiative should be fully funded, or partially funded if budget constraint exists at this point. BJA IT department should assess whether a reduced version of the app (developed with fewer resources) will still have value added in term of increased website visits

- D- Reduce staff working hours and staffing for short domestic flights
    - This initiative should be ranked last. Reduced hours might negatively impact employee satisfaction, even though it might fit into BJA objectives of reduced staff expenses. Short domestic flights are popular among business travelers, and decreasing employee morale will most likely result in service quality decline, which directly goes against BJA's values
    - This initiative should not be funded. HR department should seek alternatives to reduce staff expense without reducing staffing and working hours

2. Spring 2023 SDM Exam

Learning Objectives:

1. The candidate will understand and apply strategic management concepts and frameworks to develop an organization's business strategies and solutions.

2. The candidate will understand how sustainable growth and value can be created through strategic budgeting. The candidate will also understand measures of an organization's value and their uses in decision making.

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 strategic management models, including Porter's five forces and value chain analysis.
- 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.

(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, utilizing the applicable strategic management models.

(2d) Evaluate and recommend appropriate value measures for an organization.

(2f) Assess an organization's ability to create value and recommend actions to improve value creation.

Sources:

Understanding Michael Porter.
Strategic Management - Chapter 6
Damodaran on Valuation:

- Chapter 13 Value of Control
- Chapter 14 Value of Liquidity
- Chapter 15 Value of Synergy

Valuation, Measuring and Managing the Value of Companies – Ch. 18: Using Multiples

2023 Spring Case Study:
https://www.soa.org/49ac19/globalassets/assets/files/edu/2023/spring/exams/spring-2023-exam-cfesdm-case-study.pdf

2. Continued

Commentary on Question:
The goal of this question is to test candidates on Damodaran Valuation. Candidates are expected to:

- *Understand ways to add firm value*
- *Apply valuation models to calculate firm value*
- *Understand how liquidity changes firm value*
- *Understand the difference between value of control vs. value of synergy*
- *Make an informed decision on bidding of acquisition target*

In general, candidates performed well on some parts of the question, but very poorly on other parts: specifically (c), (d), (h), (l).

Solution:

(a) **(LOs 2d)** Identify the best target (I – III) based on each of the following criteria. Justify your answer.

(i) Growth potential

(ii) Volatility

(iii) Value

Commentary on Question:
Candidates did very well on (i) and (ii), but many struggled with (iii). Either qualitative or quantitative justifications are accepted for full credits.

(i) Growth: Yolo has the highest investment rate and return on equity

(ii) Volatility: ABC has the lowest beta/volatility

(iii) Value: XYZ has the lowest price to book ratio

(b) **(LOs 2d)** Explain how the valuation of Snappy may differ from I – III due to it being privately owned.

Commentary on Question:
Many candidates were unable to point out the illiquidity in Snappy's assets as privately owned entity.

Snappy is privately owned and therefore is less liquid than public firms – should be valued with an illiquidity discount.

2. Continued

(c) **(LOs 1a)**

(i) Define "strategy" according to Porter.

(ii) Critique Frank's statement.

Commentary on Question:

Candidates struggled with recalling Porter's definition for strategy from the syllabus which led to less focused answers for part (ii).

(i) Strategy explains how an organization, faced with competition, will achieve superior performance.

(ii) "Competition to be the best" is not a strategy, because it doesn't explain how an organization, faced with competition will achieve superior performance.
When all rivals compete on the same dimension, no one gains a competitive advantage. This would lead to competitive convergence, where over time, all rivals would look alike and can only compete on price.
The descent into price competition would lead to drop in industry profitability and lead to industry consolidation, with a few players dominating the market.

(d) **(LOs 1a)**

(i) Define economies of scope.

(ii) Define corporate-level core competency.

(iii) Identify the value-creating diversification strategy Darwin is pursuing by acquiring Snappy. Justify your answer.

Commentary on Question:
Candidates did poorly on this question, especially part (iii). Many confused economies of scale with economies of scope. Very few could identify the value-creating diversification strategy from the reading. Partial credits were given for recognizing that Darwin and Snappy would share/transfer core competencies.

(i) <u>Define economies of scope.</u>
Cost savings that a firm creates by successfully sharing resources and capabilities or transferring one or more corporate level core competencies that were developed in one of its businesses to another of its businesses.

2. Continued

(ii) Define Corporate-level core Competency.
These are complex sets of resources and capabilities that link different businesses primarily through managerial and technological knowledge, experience, and expertise.

(iii) Identify the value-creating diversification strategy is Darwin pursuing by acquiring Snappy. Justify your answer.
Either **(1) or (2)** below.

(1) Related Linked Diversification

(a) This is when operational relatedness (sharing activities between businesses) is low.

(i) For the most part the activity functions between Darwin and Snappy are the different in practice:

1. Snappy's Distribution is more digital.
2. Snappy's UW and admin are more modern and automated, while Darwin's are manual.

(b) and Corporate relatedness (transferring Core Competencies into businesses) is high.

(i) Darwin and Snappy are selling the same products: Term Life and Whole life.

(2) Both Operational and Corporate relatedness

(a) This is when operational relatedness is high.

(i) For the most part the activity functions between Darwin and Snappy are the same: Distribution, admin, and underwriting.

(b) and Corporate relatedness is high.

(i) Darwin and Snappy are selling the same products: Term Life and Whole life.

(e) **(LOs 2d, 2f)** Propose one way Darwin's acquisition of Snappy could increase the value of the combined firm through value of control. Justify your answer.
Commentary on Question:
Candidates did well on this part. There are many ways to change Snappy's operation and thereby add value. Below are some examples that received full marks.

2. Continued

Value of control - change the way Snappy is operated

- Make the executive team more balanced by adding more technical staff as the current team only has sales and marketing background
- De-risk the pricing process by lessening influence from marketing
- De-risk the underwriting process by giving more control the automated underwriting (depending on regulatory impacts)
- Redeploy investment from bonds (majority of Snappy's assets) into higher yield assets

(f) **(LOs 2d, 2f)** Propose one way Darwin's acquisition of Snappy could increase the value of the combined firm by creating an operating synergy. Justify your answer.

Commentary on Question:
Candidates did well on this part. Either economies of scale or economies of scope with justifications from the case study are accepted.

- Economies of scale
    - Same lines of business (whole life, level term)
    - Aligns with Darwin's cost reduction program
- Economies of scope / Combination of different functional strengths (transfer of corporate level core competencies)
    - Snappy's digital distribution platform and modernized systems will help implement Darwin's digital distribution plan and improve underdeveloped manual admin system
    - Snappy's combination of AI and Simplified Underwriting is a competitive advantage that can enhance overall sales
    - Lack of capital is a limiting factor for Snappy. The combined entity would allow for higher sales capacity
    - Darwin's well established and experienced actuarial team will complement Snappy's lack of expertise in modeling and financial projections
    - Darwin has a formal risk management function and will help improve Snappy's risk mitigation strategies

2. Continued

(g) **(LOs 2d, 2f)** Propose one way Darwin's acquisition of Snappy could increase the value of the combined firm by creating a financial synergy. Justify your answer.

Commentary on Question:
Candidates did well on this part. Either cash slack or debt capacity with justifications from the case study are accepted.

- Cash slack - combination of a firm with excess cash and a firm with high growth
    - Darwin has $210m cash and Snappy is capital strained
    - Darwin is a larger established insurer and Snappy is new and growing fast
- Debt capacity increases compared to individual firms
    - Snappy's earnings have been very volatile in the last 4 years.
    - The combined firm will have steadier and more predictable cash flows.

(h) **(LOs 2d, 2f)** Snappy is planning to begin selling variable annuities. The estimated NPV for the project is $10 million. Gabriela Martinez says, "If we acquire Snappy today, the value of synergy will be $10 million on this project alone, in addition to other aspects of the acquisition."

Critique Gabriela's statement.

Commentary on Question:
Candidates struggled with this part. Some understood that the $10 shouldn't be considered value of synergy. But few recognized that the loss of PV in waiting to undertake the project would be the value of synergy.

The CFO assumes the $10m NPV will be lost forever, if the acquisition doesn't happen. Snappy might be able to find another way to finance the project without the acquisition happening, in which case it would simply be value added to standalone Snappy instead of value of synergy. If Snappy cannot fund the project now on its own because of capital constraints, the value of synergy should be the loss in PV in waiting to undertake this investment rather than invest the entire $10m today.

2. Continued

(i) **(LOs 2d, 2f)**

(i) Recommend which model (A or B) is appropriate for valuing Darwin prior to the acquisition. Justify your answer.

(ii) Recommend which model (A or B) is appropriate for valuing Snappy prior to the acquisition. Justify your answer.

(iii) Describe the model for valuing the combined firm once the acquisition is complete. Justify your answer.

Commentary on Question:
Candidates did poorly on this part. Partial credits were given for part (iii) for answering two-stage model due to potential synergies and high growth post-acquisition.

(i) Darwin pre-acquisition
Stable-growth model – Darwin is established/slow-growing

(ii) Snappy pre-acquisition

Two-stage model – Snappy is new/fast-growing

(iii) The combined firm post-acquisition

Hybrid – The combined firm will be somewhere in between, closer to the stable-growth model since Snappy is much smaller than Darwin

(j) **(LOs 2d, 2f)** Calculate the value of control. Show your work.

Commentary on Question:
Candidates generally did well on this part. Most understood to use the new cost of capital to calculate the value of control. A common mistake was failing to re-calculate the reinvestment rate after change of cost of capital. Credits were given whether the stable-growth model or the two-stage model was used, as long as it was consistent with the answers provided in part (i).

Improved Snappy – Current Snappy = $8m (rounded)

2. Continued

(k) **(LOs 2d, 2f)** Calculate the value of synergy. Show your work.

Commentary on Question:
Candidates did well on this part. Most understood to use the cost savings to calculate the value of synergy of the combined firm. Credit was given whether the stable-growth model or the two-stage model was used, as long as it was consistent with the answers provided in part (i).

Combined firm with synergy - Combined firm without synergy = $11m

(l) **(LOs 2d, 2f)** Evaluate the decision with respect to the answers in parts i, j, and k.

Commentary on Question:
Candidates did poorly on this part. Most only compared the $60m to value of Snappy + value of control + value of synergy but failed to further analyze how much of each value should be paid.

- Darwin is paying the sum of value of Snappy, the value of control and the value of synergy. This is an overpayment with 100% of control value and 100% of synergy value.
- Per the textbook, "we may be willing to pay close to 100 percent of the control value (arguing that the target firm could have made the changes on its own) but only a portion of synergy value (since synergy could not have been created without the acquiring firm)." In Snappy's case, Darwin should pay only a small portion of value of control, since it's unlikely to change on its own due to its current management. On the other hand, Darwin may be willing to pay a good amount for value of synergy, since Darwin will be utilizing Snappy's automation technology to improve its own operation and save cost along the way.
- Also, both the stable-growth model and the two-stage growth model use EBIT from the income statements. Darwin's earnings are relatively stable over time, whereas Snappy's are very volatile, which makes the valuations potentially unreliable and risky.

3. Spring 2023 SDM Exam

Learning Objectives:

1. The candidate will understand and apply strategic management concepts and frameworks to develop an organization's business strategies and solutions.

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 strategic management models, including Porter's five forces and value chain analysis.
- 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.

(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, utilizing the applicable strategic management models.

Sources:
Understanding Michael Porter – Ch. 3

2023 Spring Case Study:
https://www.soa.org/49ac19/globalassets/assets/files/edu/2023/spring/exams/spring-2023-exam-cfesdm-case-study.pdf

Commentary on Question:
Commentary listed underneath question component.

3. **Continued**

Solution:

(a) **(LOs 1a, 1b)**

(i) Explain any flaws in each of Lotte's statements (X – Z)**.**

(ii) Describe the use of return on invested capital (ROIC) according to Porter.

(iii) Calculate Frenz's ROIC for current year and prior year. Show your work.

(iv) Evaluate Frenz's ROIC results assuming the industry average is 40% over the same period. Justify your answer.

Commentary on Question:
Candidates did well on this part demonstrating a logical reasoning in their explanations in part (i). Partial marks were awarded in (ii) for only stating the formula. Full marks were given for (iv) as long as they were consistent with answers in (iii).

(i) X: In the short run, the differentiation of having a new drink may have led to a higher relative price but given that competitors can imitate easily, this is likely not sustainable and wouldn't be considered a competitive advantage

Y: Relative costs have increased (note: calculations were not necessary) which indicates that costs would overtake sales in the long run even if current year profits have increased in absolute figures

Z: Market share increasing indicates that they have achieved some success; however, when gaging competitive advantage, returns must be measured relative to other companies. Also, competitive success needs to account for how effective resources are being used

(ii) ROIC is a metric to measure competitive success that accounts for how effective resources are being used. It weighs the profit a company generates versus all the funds invested in it

(iii) 55.6% in prior year and 48.4% in current year

3. Continued

(iv) Answers could include but are not limited to commentary around:

- ROIC decreasing from 56% to 48%, trend of ROIC weakening over time but might be worth observing over a longer period
- ROIC needs to be compared against other companies within the same industry who are facing similar challenges
- ROIC should be measured over a longer period of time, particularly a period of time that is appropriate for the market cycle of the industry in question comparison with the industry average and concluding that Frenz is under 60% and would be underperforming

4. Spring 2023 SDM Exam

Learning Objectives:

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

Learning Outcomes:

(3a) Apply fundamental techniques and frameworks of management science to make informed business decisions:

(3b) Apply statistical and quantification methods to analyze managerial decisions with uncertain conditions:

(3c) Evaluate business situations and describe how quantitative and statistical methods.

Sources:

Data Models and Decisions - Ch. 5

2023 Spring Case Study:
https://www.soa.org/49ac19/globalassets/assets/files/edu/2023/spring/exams/spring-2023-exam-cfesdm-case-study.pdf

Commentary on Question:

Many parts of the question allowed for alternate answers and candidates were not penalized if appropriate justification was provided. Most candidates did well on the excel portion of the question and received most of the allocated points even if there were formula errors but the set up was mostly correct.

Solution:

(a) **(LOs 3a, 3b, 3c)** Critique the model in Section 4 Exhibit 2b. Justify your answer.

Commentary on Question:

Most candidates were able to provide some criticism, however, they only received full marks if their points were justified. The critique needed to be of the model shown in Section 4 Exhibit 2b, and not a critique of the potential agreement itself to receive points.

Among a few positive aspects, the current model is very simple. This makes the model easy to communicate among stakeholders and understand the outcomes. It compares the percentile risk measures between the two scenarios with or without the Vietombia agreement.

4. Continued

However, the current model may be overly simplified. It does not address an expected return on investment, and it fails to provide valuable information such as:

- Expected profit/loss or return on investment
- Loss distributions, variables, or potential outcomes in adverse scenarios events
- Informative tail risk statistics such as VaR or CTE
- Information on upside scenarios
- Consideration of foreign currency risk, especially given Vietombia's political and economic instability
- Details of any non-linearity in the model or the convolution of multiple random variables

The model also fails to incorporate intangible factors such as synergy issues or productivity measures that might be impacted by weather events. Evidently, it does not provide enough information to stakeholders to allow risk-adjusted decision making.

(b) **(LOs 3a, 3b, 3c)**

(i) Calculate the profit (loss) for each of the 10,000 simulations, with and without the Vietombia agreement in place. Show your work.

(ii) Calculate each of the relevant statistics identified in rows 29-40 of the Excel spreadsheet, with and without the Vietombia agreement in place. Show your work.

Commentary on Question:
There were common formula errors, but candidates received at least partial marks if the formulas were close to the correct ones. Many candidates were able to set up the formulas correctly to generate scenarios of profit and loss. A majority of candidates were able to formulate the risk measures in part (ii) and they received partial marks even if they failed to generate the correct set of scenarios in the first part.

Model solution can be found in the excel sheet attached.

(c) **(LOs 3a, 3b, 3c)**

(i) Evaluate the Vietombia agreement based solely on the model output and statistics calculated.

(ii) Recommend whether or not Frenz should enter into the Vietombia agreement. Justify your answer.

4. Continued

Commentary on Question:
Many candidates received most of the points if they correctly interpreted the outcome of the model and justified their answers based on their findings in part (b) even if they did not have the correct values in part (b).

The Vietombia deal has higher expected value as evidenced by the higher mean and median for similar and slightly lower standard deviation. Additionally, the deal has favorable 1-in-5 year VaR. However, the deal has much more severe VaR at 1-in-10 and beyond, as well as worse CTE from 1-in-5 and beyond, with the key caveat being CTE99 for the no deal case is worse. Additionally, the deal has higher probability of loss given the possibility of supply disruption preventing Frenz from recouping startup costs. Overall, the decision to proceed comes down to the company's risk appetite, and whether the risk of severe tail losses is worth the expected earnings expansion.

(d) **(LOs 3a, 3b, 3c)**

(i) Identify two limitations of the current model design.

(ii) Recommend how the model can be enhanced to address the limitations identified in part (i). Justify your answer.

Commentary on Question:
Almost all candidates were able to identify at least two limitations. Most candidates were successful in providing recommendations to address these limitations with justification.

- There may be supply chain issues which are not addressed by the model.
    - To address this the model can consider inventory and logistical factors in addition to demand. Another dimension to consider would be the external factors impacting the supply chain. These factors would have significant impact on the quality and quantity of sold product.
- Correlations between risk factors are ignored.
    - The model assumes that each variable is independent. However, there may be some dependencies between risk factors. For instance, political issues in Vietombia may impact the demand or the price of coffee. It could affect the company image and skew the profit and loss in a systemic way. This can be addressed by incorporating interdependencies into the model such as co-variates.

1. Fall 2022 SDM Exam

Learning Objectives:

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

Learning Outcomes:

(3a) Apply fundamental techniques and frameworks of management science to make informed business decisions.

(3b) Apply statistical and quantification methods to analyze managerial decisions with uncertain conditions.

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

1. Continued

Sources:
Case Study, Fall 2022
https://www.soa.org/4ac732/globalassets/assets/files/edu/2022/spring/exams/fall-2022-exam-cfesdm-case-study.pdf

Data, Models, and Decisions: The fundamental of Management Science
Chp 8, Non-Linear Optimization

CP311-101-25: The Hard Side of Change Management

Commentary on Question:
Commentary listed underneath question component.

Solution:
(a) **(LOs 3c)**
(i) Define each component of the DICE score formula.

(ii) Describe how a DICE framework is used.

Commentary on Question:
Most candidates did well on this question. Full marks were awarded for accurate description on each component of the DICE Framework for Part (i). In Part (ii), some candidates did not describe how DICE is used, instead just gave a range of score for the likelihood of success. This was only awarded partial points.

Part (i)
D = Duration - time until the change program is completed if it has a short life span; if not short, the amount of time between reviews of milestones.

I = Integrity – the project team's performance integrity; that is, its ability to complete the initiative on time. That depends on members' skills and traits relative to the project's requirements.

C = Commitment – the commitment to change that top management (C1 – most influential executives) and employees affected by the change display (C2 - the people who must deal with the new system, processes, or ways of working).

1. Continued

E = Effort – the effort over and above the usual work that change initiative demands of employees.

Part (ii)

A DICE framework is used to monitor, assess, predict, and provide guidance to change management activities in an organization. Each project is given a DICE score based on the equation above:

- Scores from 1-14 are likely to be successful
- Scores of 15,16 are uncertain
- Scores 17 and above are likely to fail

(b) **(LOs 3c)** Describe what is being measured by each DICE score variable in the context of the above change.

Commentary on Question:
Most candidates did well on this section. They were able to describe and the variables to specific examples in the case study to support their points. Simply assigning scores to variables was not enough for a full mark.

Duration would measure how often reviews occur to evaluate the progress being made. Here, they would be measuring whether production has improved based on the changes they have made. If it will only be reviewed after 6 months, then a score of 3 points will be assigned.

Integrity is the quality of the senior leadership and the competency of the associates. Adding another 100 part-time workers may not signal a high level of competence and it is not clear whether the local management team is well respected. Therefore, assign 3 points for this.

1. Continued

C1 would measure how BJT management are showing their commitment to the change, through their words and actions. C2 would measure how eager the plant employees - managers and workers - are to the change – whether they are excited to improve production at their plant or simply willing to do as told.

Effort would measure how much additional effort is required to achieve the change. These changes require significant effort – hiring, training, and managing new part-time workers will require significant time, and operating two shifts is effectively doubling the effort compared to current levels. Assign 2 points

(c) **(LOs 3c)** Explain how the DICE score formula would differ if the above shift changes were enacted entirely by the US plant's local management.

Commentary on Question:
Most candidates did not do well on this part and failed to identify the changes on the formula or justify their argument. Partial marks were awarded for reasonable suggestions if the answer is consistent with the previous section.

The commitment would change from C1 being BJT management to local plant management, and C2 would be the workers only and increase the overall commitment level (or lower score), as local plant management would likely do a better job at explaining how these changes will address the production issues leading to higher employee buy-in. Other variables would stay the same.

(d) **(LOs 3a, 3b, 3c)** Interpret the relationship between the DICE variable E and each of the components of the proposed formula.

Commentary on Question:
Most candidates were able to interpret the three variables (N, S and Q) correctly, however many of them failed to interpret the N variable.

- N – keeping all other variables constant, a higher value N would increase both the nominator and the denominator so the impact would be uncertain.
- S – keeping all other variables constant, a higher value of S_i would increase the numerator and decrease the value of E. Higher salary suggests less effort needed and leads to a better score.

1. Continued

- Q – keeping all other variables constant, a higher value of Q_i would increase the numerator and decrease the value of E. Better job proficiency suggests less effort needed and leads to a better score.
- T – keeping all other variables constant, a higher value of T_{ij} would increase the numerator and decrease the value of E. Better collaboration and teamwork between colleagues suggests less effort needed and leads to a better score.

(e) **(LOs 3a, 3b, 3c)**

(i) Describe the objective of negotiating Employee 1's retention in terms of a linear program. Justify your answer.

(ii) Describe three relevant constraints that would apply when negotiating Employee 1's retention.

Commentary on Question:
Most candidates struggled to clearly articulate the objective of the negotiations in part i and provide all three constraints in part ii.

Part (i)
The objective is to maximize S_1 within the constraints. In other words, increase Employee 1's salary enough to retain him, but not to the point where the E score is negatively impacted by more than 10%.

Part (ii)

1- The E_new <= 1.1 x E_old: BJT cannot increase the salary to the point where the teamwork score is decreased and the overall net impact on the score is greater than 10%.

2- Minimum S_1 to retain the employee: there will be a minimum salary amount that the employee would be willing to accept to stay with the company.

3- Salary budget: BJT would typically have a company-wide budget for salaries or salary bands based on seniority levels and this would be a natural constraint.

(f) **(LOs 3a, 3b, 3c)** Describe how C1 and C2 may exhibit non-linearity. Justify your answer.

Commentary on Question:
Most candidates failed to address non-linearity from each C1 and C2 perspectives, and they only got full marks if they justified their responses with relevant examples.

1. Continued

Senior leadership and employees may have different goals and motivators as well as different levels of influence on a given change project.

C1 represents the commitment from the senior management which revolves around the dynamic between the senior executives. Senior managers could have different priorities or biases towards different projects. Their self-agenda within the company may determine their commitment level - they could be more committed to a project if they feel it would serve their self-interest and that could have an amplified impact on the result of the project and vice versa. This would exhibit a non-linearity shortcoming in the DICE formula.
Whereas, C2 measures the commitment of the employees being impacted by the change and this could be a function of how enthusiastic and empowered employees feel in the change agenda. Employees could be impacted disproportionately by the change in their job scopes and this could result in varying commitment levels. They could have an amplified impact on the project which may exhibit a non-linearity shortcoming in the DICE formulae.

2. Fall 2022 SDM Exam

Learning Objectives:

1. The candidate will understand and apply strategic management concepts and frameworks to develop an organization's business strategies and solutions.
2. The candidate will understand how sustainable growth and value can be created through strategic budgeting. The candidate will also understand measures of an organization's value and their uses in decision making.
4. The candidate will understand the role organizational behavior plays in organizational decision-making and efficacy

Learning Outcomes:

(1a) Evaluate and apply strategic management concepts, recognizing factors that affect development and implementation of strategies:
- Describe and apply strategic management models including Porter's five forces model and value chain analysis
- Assess and recommend an appropriate business-level strategy for a given situation
- Assess and recommend an appropriate corporate-level strategy for a given situation

(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, utilizing the applicable strategic management models.

(2a) Explain how strategic budgeting can create value and sustainable growth

(2b) Assess how effective strategic budgeting is in tracking progress of an organization's initiatives

(2d) Evaluate and recommend appropriate value measures for an organization

(4b) Explain the role of cognitive biases in making suboptimal decisions

Sources:

Valuation, Measuring and Managing the Value of Companies – Ch. 3: Fundamental Principles of Value Creation
Valuation, Measuring and Managing the Value of Companies – Ch. 18: Using Multiples
Damordaran on Valuation, Chapter 13 – Value of Control
Handbook of Budgeting – Ch. 2 Balanced Scorecard-based Budgeting & Performance Management
Handbook of Budgeting – Ch. 15 Budgeting of Shareholder Value
CP311-105-25: Capital Bias
Strategic Management - Ch. 6
Strategic Management - Ch. 7

2. Continued

Case Study, Fall 2022
https://www.soa.org/4ac732/globalassets/assets/files/edu/2022/spring/exams/fall-2022-exam-cfesdm-case-study.pdf

Commentary on Question:
This question aims at testing candidates' understanding and utilization of measurements on valuing organizations and related decision making. This question also tests candidates understanding on bias and communication barriers existing in organizations. Most candidates lost points for not answering the questions based on the syllabus material.

Solution:

(a) **(LOs 2d)** Snappy should be valued at a 50% premium to the life insurance industry average price-to-book ratio.

(i) Determine Snappy's fair market value. Show your work.

(ii) Explain three reasons why a single company may have a higher price-to-book multiple than its industry average.

Commentary on Question:
Most candidates answered part (i) well, but struggled with part (ii). Full points in (ii) were awarded for answers providing correctly following the syllabus material and case study.

(i) Industry average Price-to-book ratio form Darwin's Exhibit 1 is equal to 1.4.
Snappy Life's 2021 Surplus is equal to $2,276,000
50% premium should be considered.
Therefore, Fair market value of Snappy is equal to 1.4 * 2,276,000 * 1.5 = 4,779,600

2. Continued

(ii) Growth rate: As the growth rate of a firm increases, so do future cashflows and the overall economic value of a company. If the growth rate for a firm is larger than its peers, then the multiple will be larger than the industry average.

Asset quality: The higher the asset quality, the higher the return on capital that is achievable and the higher the EV multiple. If a company has higher quality performing assets than the industry, it will have a higher multiple.

Tax rate: The higher the tax rate, the smaller the reported net income. The smaller the income, the smaller the economic value reported and multiple. A firm could operate in a jurisdiction that has a smaller tax rate than the industry thus having a higher multiple.

(b) **(LOs 4b)**

(i) Identify three capital decision biases demonstrated by your colleague. Justify your answer.

(ii) Recommend a mitigation technique for each bias identified in part (i). Justify your answer.

Commentary on Question:
Most candidates did well on this question. For part (ii) to get full points candidates had to provide a correct mitigation strategy for the correctly identified bias.

(i) Expert bias: relying on the analysis of a single expert over other considerations. The colleague is demonstrating expert bias because he based his opinion on the opinion of a single expert. The colleague did not gather further data points.

Narrow framing bias: focusing on a single attribute rather than looking at the entire breadth of metrics and information. The colleague is demonstrating narrow framing because he is focusing on one individual metric (sales) as a justification for the entire value of the project.

Optimism bias: having too much confidence in your own abilities without considering other evidence. The colleague believes that Snappy would achieve the same results as other retail companies. However, there is no supporting evidence to suggest that Snappy has the same abilities, so the colleague is too optimistic.

2. Continued

(ii) Expert bias: The colleague should seek advice from more experts and other sources of information.

Narrow framing bias: The colleague should factor in more metrics than just sales to judge the online sales channel. Things like return on investment, total traffic on the site, and other metrics may also be important.

Optimism bias: The colleague should analyze a broad range of possible outcomes, track predictions against reality and remove anecdotal data points from the decision-making process.

(c) **(LOs 2d, 2f)** Snappy's optimal value is $5.8 million.

(i) Define control premium.

(ii) Calculate the implied control premium using your answer from (a)(i). Show your work.

(iii) Interpret your answer in (c)(ii).

(iv) Explain a potential problem in Snappy's Balance Sheet that could be fixed by changing management.

Commentary on Question:
Most candidates did well on parts (i)-(iii). In order to get full points in (iii), a solution had to specify that the change of management is required in order to realize the value of the control premium. However, many candidates struggled with (iv). The question required considerations specific to the Balance Sheet that could have been addressed by change in the management. In order to get full points, both aspects needed to be explained in the solution. Points were given for well justified considerations related to asset allocation or debt considerations.

(i) Control premium is the difference between when the value of the firm when the firm is optimally managed and the value of the firm in its status quo.

(ii) Snappy's Fair Market Value is $4,779,600 from (a)(i).

Control premium = Snappy's Optimal Value / Snappy's Fair Market Value – 1 = 5,800,000 / 4,779,600 – 1 = 21.3%

2. Continued

(iii) 21.3% control premium implies that there is a benefit in replacing Veltro's management team. Therefore, currently Snappy is not optimally managed.

(iv) Currently, Snappy is no using debt to finance its business. Snappy's new management can use some level of debt so to reach an optimal financial leverage. We do not know the industry average, but the optimal D/E ratio must be more than 0. With an optimal financial leverage, cost of capital can be lower and firm value can increase.

(e) **(LOs 2a, 2b, 2d)** Gabriela is satisfied with your calculations, but she knows the Board will want assurances that the acquisition creates value for the combined organization over time. Gabriela will review your work and present it to the board members.

(i) Explain how Economic Value Added can be used to address the board's concerns.

(ii) Recommend 5 components for the balanced scorecard for the acquisition of Snappy. Justify your answer.

Commentary on Question:
Candidates did poorly on (i) and (ii). For (i) some candidates were unable to recall either the formula or definition for EVA. For (ii) most candidates forgot at least one component of the balance scorecard

(i) EVA is calculated as EVA = (ROIC - COC) * Average Invested Capital. Therefore, there are two ways to add EVA:
EVA is added when income generated by the acquisition exceeds the cost of capital (ROIC -COC).
EVA is added when more invested capital is added after the acquisition.

(ii) Example (5 components must be explicitly stated):
Objective: increase firm value
Measure: EVA
Target: EVA is a $ measure; candidates do not need to provide a specific target, just reference that one must be set.
Sponsor: identify who will be accountable for the objective. It is reasonable that this is assigned to Gabriela.
Initiative: Acquisition of Snappy

2. Continued

(f) **(LOs 1a, 2a, 2b)** Darwin's Board is also mindful of the initiatives currently underway.

(i) Describe the purpose of a strategy map.

(ii) Compare and contrast Darwin's strategy map with Snappy's for each of the three Internal Perspective components.

(iii) Assess whether Darwin is a first mover, second mover, or late mover. Justify your answer.

(iv) Critique the alignment of Darwin's resources based on your assessment in part (iii).

Commentary on Question:
Candidates did poorly on part (f). They did relatively well on parts (i) and (iii) but most of them scored no or very few points on parts (ii) and (iv). To get full credit for part (ii), candidates needed to identify the three Internal Perspective components, and discuss similarities and differences of those components for Darwin and Snappy. For part (iv), candidates needed to point out the way Darwin currently operates does not align well with their second mover strategy, e.g., its misallocation of resources, and spending on innovation products (more of a first mover strategy). Also, its manual processes are holding it back from quickly replicating first movers' products.

2. Continued

(i) A cause-and-effect or linkage diagram. When read from the bottom to the top, the map is intended to capture key drivers that affect successive perspectives moving upward. Used to map how well your company is achieving its vision and implementing its strategy.

(ii) Internal Perspective components are:

1. Customer growth/customer incentives (relationship):
Both companies focus on getting quick turnarounds with customer, Darwin with phone calls answered within four rings 95% of the time, while Snappy's underwriting process for customers are based on AI and would be quick to process.

2. Technology (product):
Darwin has invested in system enhancements to sell new products and be a quick follower in the market. Therefore there are many systems with corresponding new product unique features introduced. Snappy has AI in underwriting process, but only sells simplified insurance products. Similarity is where they have invested in system enhancements. Differences are that Darwin is able to introduce new products, whereas Snappy's system enhancement allows quicker processing, while selling a limited number of products.

3. Operational Excellence (low-cost): Darwin does not pursue this as they have high costs partly due to misaligned resources, where legacy products and systems have drained resources. Contrary, Snappy is known to have automated process, hence maintaining expenses at a low cost.

(iii) Darwin is a second mover. As mentioned in the case study, "Darwin has not pursued a first to market strategy but has developed competency to be a fast follower and replicate new product designs in the market".
First mover would be the first to introduce new products into the market and be innovative. However from the statement, Darwin will closely follow the market hence is a second mover, rather than a late mover which only follow the market trend after a significant amount of time.

(iv) Second movers are successful if they are able to quickly replicate advances of first-movers while at the same time improving quality and efficiency. Darwin invests heavily in product R&D /Darwin has its innovation program (i.e., scanning and imitating). Darwin has more expenses due to manual processes and legacy systems (i.e., not efficient). Darwin's resources/budgeting are not allocated corrected.

2. Continued

(g) **(LOs 1b)** Evaluate the potential acquisition of Snappy by Darwin with respect to four of the seven problems in achieving acquisition success. Justify your answers.

Commentary on Question:
Candidates' performance varied on this question. To get full credits, candidates needed to identify four acquisition problems discussed in the source materials and apply them to the case study to explain how they favor or disfavor Darwin's acquisition of Snappy.

Other acquisition problems (Too much diversification, company becomes too large, or too much debt) were also acceptable if sufficient supporting evidence was provided from the case study.

(i) Difficulty in merging two very different corporate cultures. Darwin is a more traditional insurance company with pretty developed risk capabilities while Snappy doesn't really have a risk department and is more concerned with making the sale every time. Also Frank will only sell if current management is kept in place but a change in management might give Snappy a higher valuation.

(ii) Difficulty in achieving synergies. Darwin has old back office admin software while Snappy is state of the art in this regard. If they were going to merge the two systems this would be costly.

(iii) Inadequate evaluation of target: This could lead Darwin to overpay for Snappy. We valued Snappy at a 50% premium compared to the industry average presumably because it is fast growing but there are other considerations here that should be considered. Such as, Snappy has a surplus issue with their growth rates. This isn't factored into the analysis.

2. Continued

(iv) Too much time spent on acquisitions. Darwin might be better off investing in its own business rather than trying to acquire Snappy. A lot of focus of senior management has been on this acquisition. But maybe Darwin would be better off investing in its innovation program which could lower Darwin's costs and make them more competitive.

(h) **(LOs 1b)** Recommend whether or not Darwin should acquire Snappy. Justify your answer.

Commentary on Question:
Most candidates did well on part (h). They were able to recognize that Darwin should not acquire Snappy, given the challenges that were described in part (g). Partial credits were given for recommending to acquire if justification is logically consistent with the rest of the question.

I think Darwin should not acquire Snappy. Snappy and Darwin have two very different cultures that would be hard to merge. Also, there are suboptimal synergies here. Snappy and Darwin have two very different admin systems so there would be little cost savings on that front. They also sell very similar products so there would not be any increased product diversity.

1. Spring 2022 SDM Exam

Learning Objectives:

1. The candidate will understand and apply strategic management concepts and frameworks to develop an organization's business strategies and solutions.
2. The candidate will understand how sustainable growth and value can be created through strategic budgeting. The candidate will also understand measures of an organization's value and their uses in decision making.

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, utilizing the applicable strategic management models.

(2a) Explain how strategic budgeting can create value and sustainable growth

(2b) Assess how effective strategic budgeting is in tracking progress of an organization's initiatives

(2c) Demonstrate how an organization's strategic goals can be effectively incorporated into the financial budgeting decision making process

(2e) Assess the impact of performance measures and incentives on key business decisions and stakeholder value

1. Continued

Sources:
Handbook of Budgeting – Ch. 30 ZBB

CP311-100-25: What Everyone gets wrong about Change Management

Case Study Spring 2022
https://www.soa.org/49af5b/globalassets/assets/files/edu/2022/fall/exams/spring-2022-exam-cfesdm-case-study.pdf

Commentary on Question:
Overall, candidates had difficulty applying budgeting and change management concepts to the case study.

Solution:

(a) **(LOs 2a, 2b)** Big Ben senior management is considering next year's funding goals for the four strategic initiatives: digital banking, cryptocurrency, the insurance opportunity with Darwin, and solar energy financing. Management faces both conflicting demands and limited resources. They decide to focus on making incremental changes from the previous year's expenditure level to set next year's budget.

List the shortfalls under this budgeting approach.

Commentary on Question:
Most candidates were able to list at least one or two shortfalls of incremental budgeting. To receive full marks, candidates needed to list and explain at least four shortfalls.

The incremental approach to budgeting has several shortfalls, including the following:

- It is hard to adapt to changing environments – incremental budgeting does not establish priorities; hence companies have a tough time adjusting to changing situations
- Alternatives are not considered for accomplishing the desired objectives. There may be other methos not in the current budget that could achieve the same outcome at less cost
- The funding requests often exceed the budgeted amounts, which causes managers to recycle the existing process
- Incremental budgeting does not recognize the tradeoffs between the long-term goals and the operating needs

1. Continued

- Key problems and decision areas in funding one initiative versus the others are not highlighted

(b) **(LOs 1b)** Identify all applicable Quest categories for each of the four strategic initiatives. Justify your answers.

Commentary on Question:
Candidates often did not demonstrate a complete analysis to justify which quest types were applicable for each opportunity, resulting in candidates not receiving full marks.

A – Global Presence
B – Customer Focus
C – Nimbleness
D – Innovation
E – Sustainability

1. Digital Banking
   B: By creating digital solutions, Big Ben provides customers with an excellent customer interface design, online chat systems and resolve customer problems quickly.
   C: Big Ben saw that Neobank are growing in popularity and decided to be agile and avoid having to deal with legacy systems.
   D: Big Ben wants to expand its digital banking presence by potentially collaborating with or acquiring or create a Neobank, which is digital, cloud-based solution and uses artificial intelligence. These new offerings exploit new opportunity, which is innovative.

2. Cryptocurrency
   B: Supports the customer quest since it would allow customers to access new products (savings account and ETF) that would give them more options for how they want to bank with Big Ben.
   D: The initiative would increase Big Ben's customer offerings by giving customers access to new innovative cryptocurrency products. These products are not currently used by Big Ben's competitors and would be an innovative step to evolve their banking offerings.

3. Insurance opportunity with Darwin
   A: Since it is travel insurance and is offered digitally, it will reach Big Ben's globally mobile customers.
   B: By providing travel insurance to its customers, customers will feel that they are cared for in all aspects. The idea is borne from the need of the customer.

1. Continued

D: Big Ben is planning to use its mobile app to provide travel insurance, which is building internal synergies.

4. Solar financing

B: The solar project gives customers a new option for how to power their home. This product will allow Big Ben to further develop their relationship with their customers.

D: Would be a differentiated product offering. If Big Ben is the first to offer this program, then it should be considered an innovation.

E: The main quest for the solar project is sustainability. This project will incentivize more homeowners to get solar powered energy for their home which will help the environment and help Big Ben's brand as it relates to being a sustainable company.

(c) **(LOs 2a, 2b, 2c, 2e)** Big Ben management feels that digital banking and cryptocurrency are the two best options. They wish to use the Zero-Based Budgeting approach (ZBB) to help answer the question "If we can only implement either Digital *or* Crypto, which should we choose?"

There are Five Key Elements of Zero-Based Budgeting.

Apply each element of ZBB within the context of the two alternatives.

Commentary on Question:
Candidates did poorly on this question. Only a few candidates were able to correctly identify the 5 elements of ZBB and apply them to the case study. Candidates showed lack of understanding of ZBB and the case study materials.

The 5 elements of ZBB are:

- Identify the objectives
- Evaluation of the alternative ways of performing an activity
- Evaluation of alternative funding levels
- Evaluation of workload and performance measures
- Establish priorities

Identify the objectives
The overall objective of the ZBB budgeting for Big Ben is to allocate the resources to the identified initiatives as much as possible given the limited resources and conflicting demands.
The objective for Digital Banking is to compete with FinTechs, to maintain Big Ben's market power realizing threats from NeoBanks, and to expand its digital presence and reach more 'unbanked' customers and digital-oriented markets.
The objective of Crypto is new product development and to expand to the crypto market.

1. Continued

Evaluation of the alternatives

For Digital Banking, there are multiple ways to achieve this initiative. Big Ben can:

- Build an in-house digital banking division to compete with NeoBanks
- Partner with NeoBanks that lack banking license
- Acquire an existing NeoBank

For Crypto, Big Ben can:

- Build in-house capacity for offering crypto products
- Have alliance with existing crypto ETF managers to leverage their experiences in launching crypto ETF products
- Acquire a crypto security provider and distribution channel

Evaluation of alternative funding levels

Both Digital and Crypto are new initiatives that did not exist before. Big Ben must evaluate their cost-benefit relationships to identify the appropriate funding levels. Big Ben can leverage existing initiatives that have a similar nature to these 2 and assess if they should: 1) not funding, 2) fund at reduced, current, or increased level, 3) fund one or both.

Evaluation of workload and performance measures

Once the funding level is determined, Big Ben needs to determine the resources needed to support the initiatives. Big Ben should also determine the appropriate performance measures to evaluate the efficiency and effectiveness of the initiatives.

For example, for both Digital and Crypto, Big Ben will likely need to invest in relevant technology and acquire experienced IT personnel to support in-house building.

Establish priorities

Given the limited resources and conflicting demands, Big Ben needs to prioritize the initiatives based on their strategic importance to Big Ben's success. Big Ben should also set up a short term, interim, long-term plan for budgeting.

(d) **(LOs 2a, 2b, 2c, 2e)** Explain what is wrong with management's use of ZBB.

Commentary on Question:
Candidates generally did not understand the principle of ZBB and therefore had difficulty answering this question.

ZBB is not designed to look at two options in a vacuum. Management needs to evaluate current activities and alternatives at the same time as new programs are identified and considered.

1. Continued

(e) **(LOs 2a, 2b, 2c, 2e)** Management wants to maximize Big Ben's 5-year income from their investment. If the initiative is unsuccessful, it will merely break even over five years. Ignore effects of time value of money.

Item	Initiative	Initial investment ($M)	Annual Income ($M)	# of internal departments impacted	Overall Probability of success
1	Digital banking	9	2	8	60%
2	Crypto	13	2.5	5	30%

(i) Develop a metric that best compares the initiatives. Justify your answer.

(ii) Calculate the metric for each initiative.

(iii) Rank the initiatives by order of preference.

(iv) Interpret the results of the ranking.

Commentary on Question:
Candidates generally performed well in this question. Common mistakes for the metric calculation include: 1) using the number of internal department in the calculation, and 2) multiplying the probability of success with the initial investment.

(i) Metric should include 5-year income, weight by probability of success (as that is a relevant factor) and compare this to the initial investment.
We can add up the 5 years of income, weighted by prob of success, and then subtract off the initial investment, to get the dollar contribution of each initiative.

(ii) Digital banking = (2 x 5)(0.6) - 9 = -3
Crypto = (2.5 x 5)(0.3) - 13 = -9.25

(iii) 1.Digital banking
2.Crypto

(iv) Both projects have a negative metric, which means that the projects are expected to contribute losses to the organization. However, if we had to choose one project from the two choices based only on the metric above, we should choose digital banking as it contributes a smaller loss.

1. Continued

(f) **(LOs 2a, 2b, 2c, 2e)** Explain two important reasons for defining a minimum level of funding for the digital banking initiative.

Commentary on Question:
Candidates generally performed poorly on this question.

Defining a minimum level of funding requires managers to make an in-depth evaluation of their operations, and forces them to consider alternatives. Without this exercise, managers may avoid a full analysis and simply recommend to continue past practices.

Managers needs the option of elimination and reduction if funds are to be allocated with conflicting demands. If only one level of effort was analyzed, management would be forced to make a yes-or-no decision on the funding request. This in turn result in either funding at the requested level, eliminating the program, making arbitrary reductions, or recycling the budget process in the event funding requests exceed funding availability.

(g) **(LOs 2a, 2b, 2c, 2e)** Critique Mr. Patel's statement.

Commentary on Question:
Most candidates agreed that the minimum level of effort is the hardest to determine. However, candidates had trouble explaining the flaws of Mr. Patel's statement. In order to receive full marks for this question, both the correct and incorrect potions of Mr. Patel's statement need to be addressed.

Mr. Patel is correct that minimum level of effort is the most difficult to identify.

Mr. Patel is incorrect to assume 75% is the correct minimum level. The minimum level must be identified by each manager in charge of the related operations. This minimum level must be below the current level of effort and identify the critical level of effort below which the operation would be discontinued because it loses its viability of effectiveness.

2. Spring 2022 SDM Exam

Learning Objectives:

1. The candidate will understand and apply strategic management concepts and frameworks to develop an organization's business strategies and solutions.

2. The candidate will understand how sustainable growth and value can be created through strategic budgeting. The candidate will also understand measures of an organization's value and their uses in decision making.

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, utilizing the applicable strategic management models.

(2a) Explain how strategic budgeting can create value and sustainable growth

(2b) Assess how effective strategic budgeting is in tracking progress of an organization's initiatives

(2c) Demonstrate how an organization's strategic goals can be effectively incorporated into the financial budgeting decision making process

(2e) Assess the impact of performance measures and incentives on key business decisions and stakeholder value

Sources:

Handbook Budgeting Chapter 29

CP311-102-25: Cultural Change that Sticks

Case Study Spring 2022
https://www.soa.org/49af5b/globalassets/assets/files/edu/2022/fall/exams/spring-2022-exam-cfesdm-case-study.pdf

Commentary on Question:

Commentary listed underneath question component.

Solution:

(a) **(2a, 2b, 2c)** Define Corporate Performance Management.

Commentary on Question:

This definition should be recalled directly from the syllabus. Definitions that matched the meaning from the text were given full credit. Credit was not given for generically describing performance management without providing a definition.

2. Continued

CPM is defined as "*an umbrella term that describes the methodologies, metrics, processes and systems used to monitor and manage the business performance of an enterprise*"

(b) **(2a, 2b, 2c, 2e)** Critique SEA's proposed expansion plan with respect to CPM.

Commentary on Question:
Candidates that did well provided both pros and cons that are specifically linked to CPM. Many candidates only pointed out holes in the SEA plan, without addressing where the plan was consistent with well-designed CPM. No credit was given for criticism of the SEA plan not linked to CPM.

- Pros:
  - Each tactic/goal has a measure
  - Each tactic is aligned to the strategy
- Cons:
  - No responsible party is defined for the strategy/goals
  - "By flight" should be included in Dimension
  - CPM should not be done in a silo; the SEA plan does not address how this will be integrated into company operations
  - This plan does not address the target culture of the company

(c) **(LOs 1b)** Critique SEA's proposed expansion plan based on the Five Principles to Help Cultural Changes Stick.

Commentary on Question:
Candidates that did well provided each of the Five Principles to Help Cultural Changes Stick and then indicated whether or not the SEA plan addressed each principle. Credit was given for listing principles consistent with the text without matching the principles word for word. No credit was given for answers not justified by the case study or inconsistent with the Five Principles from the text.

1. Match Strategy and Culture
   The SEA plan aligns goals with the company strategy of safety/strong maintenance. It fails to address the strategy to be cost competitive directly.
2. Focus on a few critical shifts in behavior
   It is not obvious how SEA plans to monitor the shifts in behavior needed to align company culture. They have not set metrics to measure new behaviors.
3. Honor the strengths of your existing culture
   The plan points to safety, but could more directly point to the culture within the maintenance department that achieve their superior safety metrics.
4. Integrate formal and informal interventions

2. Continued

The current CPM is silent on informal interventions, but does define formal interventions in the form of incentives for company performance and safety.

5. Measure and monitor cultural evolution
   Business performance is both measured and monitored, milestones/timelines are defined for this performance measures. Critical behaviors necessary to achieve this performance are not defined. It is not specified how the company plans to monitor their employees beliefs and feelings.

(d) **(LOs 2a, 2b, 2c, 2e)** Recommend two changes to SEA's proposed expansion plan based on your assessment in (c). Justify your answer.

Commentary on Question:
Candidates that did well on this question identified 2 of the 5 principles from part C where they did not believe the current SEA plan addressed cultural change appropriately and provided a reasonable solution to do so.

SEA should:

- Add informal interventions to measure satisfaction via staff and management interviews that can be measured against formal metrics for sales.
- Add customer satisfaction surveys to ensure the behaviors and experience are consistent for the expansion.

3. Spring 2022 SDM Exam

Learning Objectives:

1. The candidate will understand and apply strategic management concepts and frameworks to develop an organization's business strategies and solutions.

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

Learning Outcomes:

(1a) Evaluate and apply strategic management concepts, recognizing factors that affect development and implementation of strategies:
- Describe and apply strategic management models including Porter's five forces model and value chain analysis
- Assess and recommend an appropriate business-level strategy for a given situation
- Assess and recommend an appropriate corporate-level strategy for a given situation
- Explain the impact of competitive dynamics on strategic management

(3a) Apply fundamental techniques and frameworks of management science to make informed business decisions:

(3b) Apply statistical and quantification methods to analyze managerial decisions with uncertain conditions:

(3c) Evaluate business decisions using quantitative and statistical methods

Sources:

Data Models and Decisions - Ch. 5

Strategic Management – Chapter 1
Case Study Spring 2022
https://www.soa.org/49af5b/globalassets/assets/files/edu/2022/fall/exams/spring-2022-exam-cfesdm-case-study.pdf

Commentary on Question:

Commentary listed underneath question component.

Solution:

(a) **(LOs 1a)** Big Ben is considering providing financing under the solar energy subsidy program described in section 5.4 of the case study. Stakeholders of the program may be in 1 of 3 categories:

I. Capital market stakeholders
II. Product market stakeholders
III. Organizational stakeholders

List the stakeholders that are in each category (I through III). Justify your answers.

3. Continued

Commentary on Question:
Many candidates received partial points on Part a. Only a few candidates were able to identify all three groups accurately and received full points.

I. Capital market stakeholders
The company, Big Ben or RPPC: Shareholders and debtholders of the company essentially provide the capital necessary to invest in the project. They also share the embedded risk in the project.

II. Product market stakeholder
Homeowners: They are customers of Big Ben, as they will be borrowing from the bank to pay for their solar panels.
Solar Panel Providers: They are the customers of Big Ben and will depend on Big Ben for processing financing when selling solar panels to customers.
Electric Utilities: In this case, the utilities are stakeholders since homeowners can only pay back the loan if utility companies purchase electricity from them.

III. Organizational Stakeholders
Big Ben employees and management will have a stake in the success of the solar energy program.

(b) **(LOs 3a, 3b)** Calculate the expected annual loan repayment. Show your work.

Commentary on Question:
Most candidates were able to set up the expected value of EEP and RP correctly but only few candidates identified U as a Bernoulli Distribution. Partial points were awarded for the setup of the different components of the expected payments.

Expected Repayment = Expected [EEP] x Expected [RP] x Expected [U]
= 75 x 0.55 x (3 x 0.8 + 1 x 0.2)
= 107.25

(c) **(LOs 3a, 3b)** Calculate the standard deviation of the annual loan repayment. Show your work.
Commentary on Question:
Candidates did poorly on Part C as most had a hard time correctly calculating the standard deviation for loan repayments. Most of the candidates incorrectly calculated Variance of EEP, RP and U independently. Partial points were awarded for each component of the calculation below.

Variance [Repayment] = Expected [Payment^2] – Expected [Payment]^2
= Expected [EEP^2 x 9 x RP^2 x U^2] – 99^2
= 6125 x 9 x (Variance [RP] + Expected [RP]^2) x (Variance [U] + Expected [U]^2) – 99^2

3. Continued

= 6125 x 0.3425 x (9 x 0.8 + 1 x 0.2) – 107.25^2
= 4021.25

Standard Deviation [Repayment] = SQRT(Variance [Repayment)]
= 63.4133

(d) **(LOs 3c)** Explain why a simulation model is a useful tool to evaluate this investment.

Commentary on Question:
Points were awarded for answers that were relevant to the question and case study. Most candidates were able to receive at least partial points however full points were only awarded for candidates that were able to justify their response.

There is a lot of non-linearity in the return profile, driven by the convolution of multiple random variables that result in variability in a given payment for a given year. Moreover, the overall transaction IRR is a non-linear calculation on a sequence of 20 such random outputs, resulting in a highly non-linear result overall. The use of simulation allows the modeler to delineate complex outputs such as this transaction IRR calculations into tractable variables to model.

(e) **(LOs 3a, 3b)**

(iii) Calculate the simulated payment amount for each year in the above scenario.

(iv) Calculate the Internal Rate of Return (IRR) to Big Ben with respect to the investment under this scenario.

Commentary on Question:
Most candidates were able to set up the first two distributions (EEP and RP) correctly but had a difficult time setting up the third distribution (U). Some candidates also struggled in identifying the loan amount of $1,000 to be used in the IRR calculation. Partial points were awarded if the Payment was calculated incorrectly but the IRR calculation was set up correctly.

An example of how to map each randomly generated number to a variable in each distribution:
0.18 in EEP = 50
-0.75 in RP = 0.55 - 0.75*0.2 = 0.4
0.60 in U = 1
Expected [Repayment] = 50 x 0.4 x 3 x 1 = 60

3. Continued

Year	EEP	RP	U	Payment
0				-1,000
1	100	0.546	1	54.6
2	75	0.31	1	23.25
3	75	0.436	3	98.1
4	75	0.468	3	105.3
5	50	0.722	3	108.3
6	25	0.578	3	43.35
7	50	0.914	1	45.7
8	50	0.568	3	85.2
9	75	0.35	3	78.75
10	75	0.602	3	135.45
11	75	0.698	3	157.05
12	75	0.598	1	44.85
13	75	0.25	3	56.25
14	75	0.772	3	173.7
15	75	0.608	3	136.8
16	75	0.674	3	151.65
17	125	0.768	3	288
18	100	0.658	1	65.8
19	75	0.428	1	32.1
20	75	0.838	3	188.55

IRR = 6.81%

(f) **(LOs 3a, 3b, 3c)** Recommend two risk measures Big Ben should consider when evaluating this investment. Justify your recommendation.

Commentary on Question:
Candidates did well on this part of the question. Most candidates were able to provide acceptable risk measures, but only received full points if they provided explanation on how it would apply to Big Ben.

Value at Risk / TVaR – articulates the potential returns at a specified extreme tail scenario, useful for downside risk management of Big Ben.
Probability of negative return – allows Big Ben to analyze how principal protected the investment is.

(g) **(LOs 3a, 3b, 3c)** Explain how the simulation output can be used to help Big Ben decide whether or not invest.

3. Continued

Commentary on Question:
Most candidates received partial points for reasonable answers. However, full points were only awarded for good supporting justification to their answers.

Simulation output provides decision maker with comprehensive range of possible outcomes, so that probabilities may be assigned to various scenarios, to inform risk-adjusted decision making rather than single deterministic analysis. It provides insight into tail risk so that appropriate risk management responses can be developed. When part of a larger simulation engine, can easily add positions to exiting portfolio / build in relevant hedging effects, etc. so that portfolio accumulations, diversifications, hedge effectiveness can all be better understood for optimal decision making.

(h) **(LOs 3a, 3b, 3c)** Assume no relevant factors have been omitted from the model.

(i) Identify two shortcomings of the simulation model used by Big Ben.

(ii) Recommend two enhancements to the model that address your findings in part (i). Justify your recommendation.

Commentary on Question:
Most candidates were able to identify the shortcomings of the simulation model. Full points were awarded only when justifications were provided.

- The payment is not floored at zero which is unrealistic – there is no scenario where the bank would have to put additional funds toward the project as presently defined.
- The variables do not vary/correlate over time which is may not be realistic as underlying drivers (e.g., weather, energy markets, utilities willingness to participate, etc.) may have cyclical or autocorrelated features.
- The variables are assumed to be independent which may not be realistic as it is likely that the retail price would influence the utilities' willingness to participate, for example.
- The Bank does not reflect any potential salvage value of the solar panel after the 20-year period, which may be a factor.

3. Continued

(i) **(LOs 3a, 3b, 3c)** Assume the model ***does not*** capture all relevant factors:

(i) Identify two additional factors Big Ben should consider in its analysis. Justify your answer.

(ii) Describe how each additional factor identified in part (i) could affect Big Bank's investment decision. Justify your answer.

Commentary on Question:
Most candidates were able to identify additional factors and did well on this question.

- Should consider within an ERM / portfolio context; what is an appropriate rate of return / downside risk for this type of investment given the underlying risk drivers relative to other Bank investments?
- The deal model is based on $1000 of solar panel financing but is not necessarily scalable to a larger portfolio. In reality, the underlying risk factors are highly correlated / systemic across all such loans (e.g., energy prices) so the law of large numbers doesn't necessarily apply here. The model does not provide any insight on how to diversify the book of loans.
- Potential synergies with other products (e.g., can solar panel financing be embedded in the bank's mortgage process).

2. Fall 2021 SDM Exam

Learning Objectives:

1. The candidate will understand and apply strategic management concepts and frameworks to develop an organization's business strategies and solutions.

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

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 business strategies under different business situations and market opportunities, utilizing the applicable strategic or change management models

(3a) Apply fundamental techniques and frameworks of management science to make informed business decisions:

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

Sources:

Data, Models, and Decisions: The fundamentals of Management Science – Ch. 7,

Strategic Management – Ch. 9

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Commentary on Question:

Commentary listed underneath question component.

2. Continued

Solution:

(a) **(LOs 3a, 3c)** State the objective function and constraint functions.

Commentary on Question:
Many candidates failed to consider the denominator in the objection function and only received partial marks for this question.

Let D and C be the number of domestic and international (continental) flights respectively.

Objection function:

$$Max\left[\frac{D\big((99\%)(0.1)+1\%\,(-0.4)\big)+C\,\big((97\%)(0.15)+3\%(-0.6)\big)}{50}\right]$$

$$=\ Max\,[0.0019D+0.00255C]$$

Constraints:
D+C = 50
D, C >= 0

$Var\,(D)+Var\,(C)\leq 0.81$
$D(99\%)(0.01)+C(97\%)(0.03)\leq 0.81$
$0.0099D+0.0291C\leq 0.81$

2. Continued

(b) **(LOs 3a, 3c)** For the optimization problem defined in part (c):

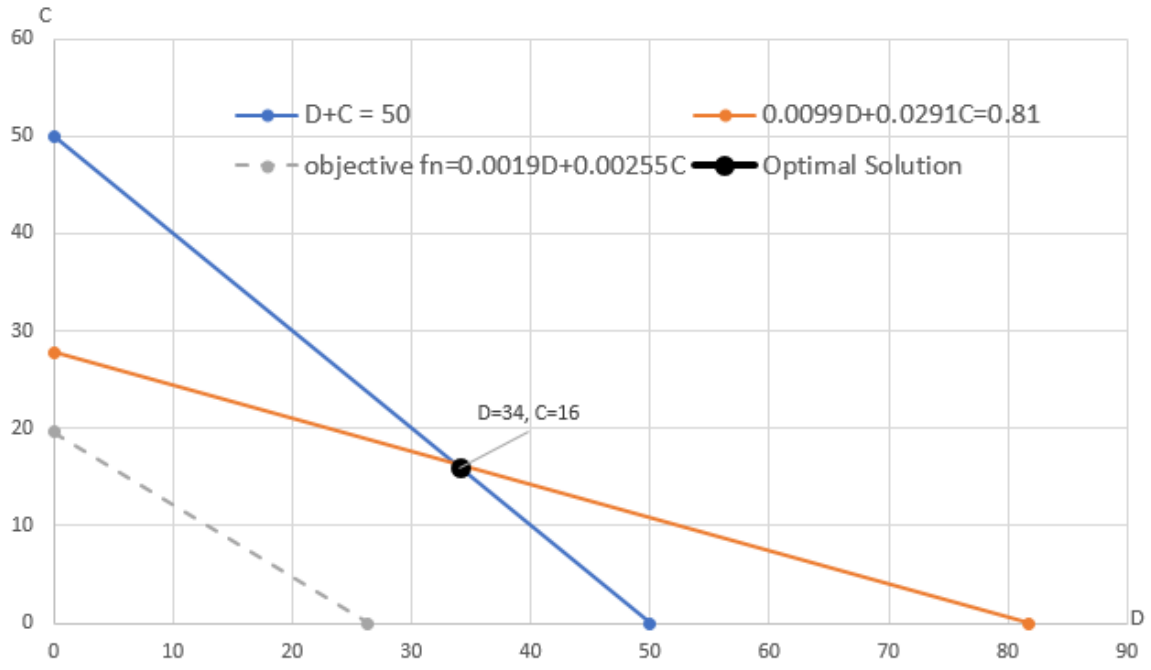
(i) Calculate the optimal solution. Show your work.

(ii) Critique BJA management's assumptions under the current model.

(iii) Explain the implications of Reputational Risk and how it relates to the current model.

Commentary on Question:
Many candidates struggled with part (i) as they could not arrive at a reasonable solution. Parts (ii) and (iii) were well done.

(i)
Plotting the constraints and the objective function from part (c), we see that the optimal solution lies where the variance constraint and the sum constraint intercepts, where D= 34 and C=16.
The objective function at the maximum is equal to 10.54%.



2. Continued

(ii)
There are a few issues with BJA management's assumptions. Assuming all flights are independent may not be appropriate. If the virus begins to spread in one region, adjacent regions, or other regions that are linked are more likely to become affected than completely unrelated regions. Management should consider that, especially considering that a lot of the routes might share destination stops. Further, personnel such as flight attendants, mechanics, and pilots might be used on more than one flight/route, which creates further dependence between them.

(iii)
BJA management is not considering reputational risk at all in their current model. If an outbreak occurs on one of their flights, it is highly likely that profitability could be impacted across the organization, as the organization is viewed as a collective. So management should consider the company-wide implications of reputational damage occurring from even a single instance of a viral outbreak occurring on one of their flights.

(c) **(LOs 3a, 3c)** Recommend two ways to improve the model. Justify your answer.

Commentary on Question:
Connecting the solution with answers from c(ii) and c(iii) were required for full marks.

Consider correlation between prior flight's possibility of outbreak to subsequent flight's outbreaks. As mentioned in previous statements, BJA's model assumes independence of outbreaks between each flight. BJA should adapt a negative binomial instead of current binomial model which ignores interdependence.
BJA should add an additional constraint around reputational risk to the model in the form of estimated financial impacts due to bad reputation causing reduction in number of customers. This helps reflect and adjust profit margins based on the risks BJA bears for these situations.

2. Continued

(d) **(LOs 1b)** It is expected that passenger traffic across the industry will be reduced by 99% during a pandemic. BJA is considering using Code Sharing as a response.

(i) Identify the type of strategic alliance that best describes code sharing. Justify your answer.

(ii) Recommend a specific action to help manage competitive risks in the type of alliance identified in (i). Justify your answer.

(iii) Explain whether using code sharing is a valid strategic response to a 99% drop in passenger traffic.

Commentary on Question:
For (ii), Candidate responses must be based on the reading, citing risks applicable to the material and a valid approach to managing the risk.
For (iii), candidates must conclude "No" to receive the full credits.

(i)
This is a Horizontal Complimentary Strategic Alliance. Firms are sharing planes (resources) at the same stage of the value chain.

(ii)
BJA and its partner(s) should clearly identify and document the logistics of the alliance, for example, which routes will each partner take, which fleets will be used, etc. In the code sharing agreement, BJA should clearly outline responsibilities of all of the airlines.

(iii)
No. Code sharing would minimize cost while allowing BJA to offer service to passengers. Complimentary Strategic Alliances are often used in response to rivals/competition. A drop in traffic due to the pandemic is likely a temporary change in the external environment that will not be sustained, thus it is not the right reason to use this strategy.

3. Fall 2021 SDM Exam

Learning Objectives:

4. The candidate will understand the role of organizational behavior play in organizational decision-making and efficacy.

Learning Outcomes:

(4b) Explain the role of cognitive biases on making suboptimal individual decisions:

Sources:

CP311-105-25: Capital Bias

Case Study Fall 2021:
https://www.soa.org/4ae43d/globalassets/assets/files/edu/2021/fall/exams/fall-2021-exam-cfesdm-case-study.pdf

Commentary on Question:

Commentary listed underneath question component.

Solution:

(a) **(LOs 4b)**

(i) Recommend a metric that avoids narrow framing and bias. Justify your answer.

(ii) Calculate the recommended metric for each initiative. Show your work.

(iii) Recommend which initiative(s) should be approved based on your answer to parts (i) and (ii). Justify your answer.

Commentary on Question:

Most candidates showed the understanding of narrow framing and bias. Most candidates could calculate correctly, but about half of the candidates didn't test option 1 and 3 together as the sum of these 2 is still under the budget.

(i) To avoid bias, the management desirability rating should be excluded from the metric. To avoid narrow framing, the metric should include all other 3 factors into the calculation. Since the goal is to minimize the number of infections, a good metric could be the cost of each infected person reduced (Cost / (Number of customers impacted * Infection rate reduction)).

(ii) Option 1: 500,000/(15%*100,000)=$33.33
Option 2: 700,000/(25%*90,000)=$31.11
Option 3: 350,000/(10%*50,000)=$70
Option 1&3: (500,000+350,000)/(15%*100,000+10%*50,000)=$42.5

3. **Continued**

(iii) Based on the results from previous step, the lower number the better option is, the option 2 will be recommended. Even with option 1 and 3 together, which is still under the budget of 1 million, the cost efficient is still not as good as option 2.

4. Fall 2021 SDM Exam

Learning Objectives:

1. The candidate will understand and apply strategic management concepts and frameworks to develop an organization's business strategies and solutions.
2. The candidate will understand measures or corporate value and their uses in corporate decision making.
4. The candidate will understand the role that organizational behavior and communication play in organizational decision making and efficacy

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 business strategies under different business situations and market opportunities, utilizing the applicable strategic or change management models

(2d) Evaluate and recommend appropriate value measures for an organization

(2f) Assess an organization's ability to create value and recommend actions to improve value creation

(4b) Explain the role of cognitive biases on making suboptimal individual decisions.

Sources:

Strategic Management – Ch. 7
Damordaran on Valuation Chapter 13 Value of Control
CP311-104-25: Leaders as Decision Architects

Case Study Fall 2021:
https://www.soa.org/4ae43d/globalassets/assets/files/edu/2021/fall/exams/fall-2021-exam-cfesdm-case-study.pdf

Commentary on Question:

Commentary listed underneath question component.

Solution:

(a) **(LOs 1b)**

(i) Explain the benefits of a Cross-Border Acquisition for an acquiring firm.

(ii) Explain why Cross-Border Acquisitions are subject to more risk than those within a firm's home country.

(iii) Describe three pitfalls QRS may encounter with the acquisition of Darwin. Justify your answer.

(iv) Describe two ways QRS can mitigate the pitfalls mentioned in (ii). Justify your answer.

4. Continued

(i) The acquired firm understands the customers in its home region and offers an established brand.

(ii) There are legal and political obstacles in different countries that make cross-border acquisitions more risky.

(iii) **Too much diversification (geographic)**: the scope created by additional amounts of diversification often causes managers to rely on financial rather than strategic controls to evaluate business units' performance, rather than a true understanding of the business. For new regulation and a new portfolio of insurance products, ABC senior management will focus on short-term investments rather than long-term investments
Relying on acquisitions (instead of internal development): This results in the ability to innovate decreasing and causing a need for acquisitions to compete.
Becoming too large: size can also increase the complexity of the managerial challenge and create diseconomies of scope - not enough economic benefit to outweigh the costs of managing the more complex organization. Because ABC Life's management has a relatively simple product suite and regional scope, the increased complexity that Darwin brings to the organization will reduce or eliminate any economies of scale that could be achieved.

(iv) ABC can make sure the people in place at every level of management are knowledgeable and effective. This makes sure that the right information is being presented to the right people and the correct decisions are being made

If ABC ensures Darwin has robust R&D capabilities, they can maintain long-term competitive advantages

(b) **(LOs 2d, 2f)** QRS proposes to acquire Darwin for $1.6 billion.

(i) Explain the implication of a 0% control premium.

(ii) Describe two changes QRS could make at Darwin that would increase Firm Value. Justify your answer.

Independent analysts determine Darwin's optimal value is $1.4 billion.

(iii) Calculate the control premium using a value of 1.226 billion. Show your work.

4. Continued

(iv) Interpret the difference between the purchase price QRS is willing to pay and the optimal value. Justify your answer.

(v) Explain how Darwin's activities and performance over the last 10 years have affected firm value. Justify your answer.

(i) If control premium is 0%, this implies that the target company is optimally managed and the acquiring company cannot increase value through change in management.

(ii) **Existing assets may be are poorly managed** → Darwin's margins are low (per case study), but QRS may have sufficient returns to have excess cash to invest and expand.

Management is overusing debt → Per case study. ABC has cash to reduce debt load.

(iii) Control Premium = Optimal value / Fair Market Value – 100%
= ($1400 / 1226) -1 = 14.2%

(iv) The purchase price includes the control premium as well as the expected value of synergies created by purchase. ABC is looking for a distribution network, part of Darwin's growth has been by selling more products through financial institutions.

(v) <u>Increase growth from new investments</u>
In 2013 the company expanded annuity distribution into financial institutions. It aims to add major new outlets, penetrate existing outlets, and expand the agency distribution by 2 - 3 regional offices per year. → Increase firm value.

<u>Lengthening the high growth period</u>
Darwin has invested in technology and staff to service both the customer and distribution channels and established a team so that a client service representative answers the phone within four rings 95% of the time. This attention on customer and distribution sets the company apart from its peer group and supports an aggressive organic growth strategy. → Increase firm value.

<u>Increase efficiency in usage of existing assets</u>
Unfavourably high leverage, expenses, operating income margin. → Decrease firm value.

4. Continued

(c) **(LOs 4b)** Explain the cognitive bias in each statement and its potential risks in decision making.

(i) "One clear benefit of QRS acquiring us is we will be able to leverage the technology and business techniques that may not be popular here yet. It will put us way ahead of our competitors without question!"

(ii) "Just last week, I read an article in the Wall Street Journal about how product innovation is just terrific in most European jurisdictions. We should be open to following QRS's example to avoid being left behind here."

(iii) "It's great QRS made the first offer and showed their hand on how much they're willing to pay. We can just negotiate the price up from there."

(iv) "We've been consistently hitting our strategic targets since being acquired by RPPC in 2014. I'm certain we'll be able to take on the growth opportunities from being acquired by QRS!"

(i) **Optimism bias** → it is assumed that there will be at least as much value in the technology applied in Darwin's region as it is in QRS'.

(ii) **Recency bias** → more weight is being placed on evidence that confirms previously made claim rather than looking at a complete picture.

(iii) **Anchoring bias** → Too much reliance is being put on the first piece of information being presented.

(iv) **Overconfidence bias** → The statement shows that despite the increased risk and complexity of the merger, there is still confidence that growth targets can be hit.

(d) **(LOs 4b)** Explain how an email from an assigned devil's advocate could help combat the bias in the email sent by Brandon.

Since people know that the devil's advocate is assigned into their role, they can present opposing ideas without fear of people judging or getting upset at them

By presenting the best opposing argument in writing, recipients can leverage both Brandon's and the devil's advocate's messages and facilitate conversation.

1. Spring 2021 SDM Exam

Learning Objectives:

4. The candidate will understand the role that organizational behavior and communication play in organizational decision making and efficacy

Learning Outcomes:

(4b) Explain the role of cognitive biases on making suboptimal individual decisions

Sources:

CP311-104-25: Leaders as Decision Architects

Case Study Spring 2021
https://www.soa.org/49c13e/globalassets/assets/files/edu/2021/spring/exams/spring-2021-exam-cfesdm-case-study.pdf

(a) **(LOs 4b)** Describe two biases exhibited by John Feather. Justify your answer.

Commentary on Question:
Candidates were generally able to describe biases but many failed to justify their answers.
Any bias being discussed have to be justified with content from the case study and the question. If there is no such relationship, even if the biases being correct, no credit will be given to the candidates. Any two are sufficient. The following 3 are not the exhaustive list,other biases were accepted with reasonable justification.

Present bias – we value immediate rewards very highly and undervalue long-term gains. John Feather is worried about preserving the immediate cash outflow and undervalues the long term value from customer loyalty and the potential future gains from goodwill.

Status quo bias – John would like to keep the voucher policy the same as what BJA currently has. He is failing to consider that the pandemic environment requires a different policy than the normal business environment when the original policy was created.

Loss Aversion bias – John is concerned with loss of cash flow rather than potential future gains from a successful weathering of the pandemic.

(b) **(LOs 4b)**

(i) Explain the difference between System 1 and System 2 thinking.

1. **Continued**

(ii) Explain how System 1 thinking is used in the proposed approach. Justify your answer.

(iii) Explain how System 2 thinking is used in the proposed approach. Justify your answer.

(iv) Explain an improvement to the proposed approach that could bypass both systems.

Commentary on Question:
Almost all candidates scored well on this question. Higher scoring candidates differentiated themselves in part (iii), where some e candidates did not provide System 2 nudges.

(i) Two systems:
- System 1 thinking is automatic, instinctive, and emotional. It relies on mental shortcuts that generate intuitive answers to problems as they arise.
- System 2 thinking is slow, logical, and deliberate.

(ii) System 1 nudges include:
- Arouse Emotions – The proposal shows pictures of people traveling before offering the choice to receive a credit or refund, nudging people to the travel credit.
- Simplify the process – BJA has made it a lot easier to obtain the credit instead of a full refund

(iii) System 2 nudges include:
- Use joint evaluation – Customers are simultaneously offered choices which favors accepting the credit (worth 115% of the ticket price) over the cash refund (for 100% of the ticket price)
- Create opportunities for reflection – Customers are required to reflect while completing a survey about travelling after the pandemic.
- Use planning prompts – Email communication is sent after customers have completed the transaction which may remind customers to schedule a use for their voucher.

(iv) To bypass both systems, set the crediting option as the default option. Customers who do nothing will automatically receive a voucher.

2. Spring 2021 SDM Exam

Learning Objectives:

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

Learning Outcomes:

(3a) Apply fundamental techniques and frameworks of management science to make informed business decisions.

(3b) Apply statistical and quantification methods to analyze managerial decisions with uncertain conditions:

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

Sources:

Data, Models, and Decisions – Ch. 8

Case Study Spring 2021
https://www.soa.org/49c13e/globalassets/assets/files/edu/2021/spring/exams/spring-2021-exam-cfesdm-case-study.pdf

Commentary on Question:

Commentary listed underneath question component.

Solution:

(a) **(LOs 3a, 3b, 3c)** Explain the difference between management science models and active management in the investment management industry with respect to each of the following:

(i) Selection of assets

(ii) Consideration of risks

Commentary on Question:

Candidates either scored very well or very poorly on this question. When candidates did not score well, they provided general differences that were not related to selection of assets or consideration of risks.

(i) Active management uses specific special advisors with expertise in its own area of practice to pick assets. This is subject to bias. Management science uses available data to construct a portfolio based on all available constraints and objective function.

(ii) The active management advisors might perceive risk differently than the broader market while management science will use available public data. Management science can also look more broadly at how different risk can be mitigated and diversified with different types of assets.

2. Continued

(b) **(LOs 3a, 3b, 3c)** Describe two techniques of management science Darwin Life can use to assist with its business operations, specifically as it pertains to managing investments. Justify your answer.

Commentary on Question:
Candidates generally performed poorly on this question. Many candidates did not mention management science techniques in their answers. In addition to the techniques listed below, candidates were given points if they mentioned either a) the use of trading strategies to minimize trading costs, or b) the evaluation of financial assets such as options and other derivative securities.

Analysis of Financial Data – Darwin Life can reduce cost by taking advantage of the computerization and automation of financial data. Nonlinear optimization allows Darwin Life to use the metric available underlying each asset to best fit an investment portfolio that will fit its investment and risk needs. The benefit of relying on data and nonlinear optimization can allow Darwin Life to adjust its portfolio quickly achieve its needs.

Forecasting Future Performance of Assets – Darwin can benefit using data to more accurately model future asset scenarios. This can also allow Darwin to quickly react to market conditions and predict capital ratios based on available information.

Construction and management of Efficient Portfolios – Darwin's goal is to construct a portfolio that can back the liabilities while also minimizing asset management cost associated with managing the assets. Management science allows the construction of an efficient portfolio where the Sharpe ratio can be minimized which satisfy Darwin's goal.

(c) **(LOs 3a, 3b, 3c)** You have been asked to maximize the Sharpe ratio of the asset portfolio using only nonlinear optimization.

$$\text{Sharpe Ratio:} = \frac{E[R_a - R_b]}{\sigma_a}$$

where…

- R_a is the rate of return of the portfolio.
- R_b is the risk-free rate of return.
- σ_a is the standard deviation of the portfolio rate of return in excess of the risk-free rate of return.

2. Continued

(i) State the objective function.

(ii) State all of the unique constraints necessary to implement the above investment strategy.

(iii) Compare and contrast linear optimization and nonlinear optimization as approaches for maximizing the Sharpe ratio.

(iv) Propose an approach that uses the results of both linear optimization and nonlinear optimization to maximize the Sharpe ratio. Justify your answer.

Commentary on Question:
For part (i), two answers were accepted. Either choosing sigma as an objective function, or choosing the entire Sharpe ratio as an objective function. Maximizing the expected return was not accepted, as it doesn't require non-linear optimization.

(i) Minimize either the volatility, or the Sharpe ratio.

- σ = sqrt (Var (Port_return) = sqrt(A^2 * var(A_return) + B^2 * var(B_return) + M^2 * var(M_return) + AB*Cov(A_return, B_return) + AC* Cov(A_return, C_return) + BM* Cov(B_return, M_return))
  σ = sqrt (A^2 * 0.25 + B^2 * 0.0025 + M^2 * 0.09 + AB * -0.5 * 0.05 * 0.5 + AM * -0.35 * 0.3 * 0.5 + BM * 0.5 * 0.3 * 0.05.
  σ = sqrt (A^2 * 0.25 + B^2 * 0.0025 + M^2 * 0.09 + AB * -0.5 * 0.05 * 0.5 + AM * -0.25 * 0.3 * 0.5 + BM * 0.5 * 0.3 * 0.05.

- Sharpe ratio = (0.02B + 0.07M + 0.16A - 0) / σ

(ii)

- Return: 2%B + 7%M + 16%A >= 5%
- Fractions: B + M + A = 1.0
- Rating: 2B + 4M + 8A <= 3.5
- Duration: 12B + 5M + 2A <= 8.5
- Duration 12B + 5M + 2A >= 5.5
- Nonnegativity: B, M, A > 0

(iii) Both approaches are subject to the same constraints, which mean they both have the same feasible region. One could use linear optimization to maximize the portfolio return or non-linear optimization to minimize the volatility or to maximize the Sharpe ratio.
Non-linear optimization may find a local maximum which is not necessarily a global maximum.

2. Continued

(iv) Use linear optimization to maximize the numerator and use non-linear optimization to minimize the denominator. Linear optimization will find the optimal rate of return, nonlinear will find the optimal standard deviation. The Sharpe ratio will be maximized with the asset mix that is on the "edge" connecting these two points. Candidates were expected to apply logic similar to finding an integer solution: find the "best" answer, and then move around the neighborhood to find the answer that fits the business limitations.

3. Spring 2021 SDM Exam

Learning Objectives:

4. The candidate will understand the role that organizational behavior and communication play in organizational decision making and efficacy

Learning Outcomes:

(4a) Evaluate the impact of human behavior factors on the effectiveness of decision-making processes within organizations

(4b) Explain the role of cognitive biases on making suboptimal individual decisions

Sources:

CP311-106-25: Chapter 19 (Sections 19.1 – 19.4) of *Quantitative Enterprise Risk Management*

CP311-104-25: Leaders as Decision Architects

(a) **(LOs 4a, 4b)**

(i) Describe two cognitive biases that may limit the success of the rewards program. Justify your answer.

(ii) Recommend actions Frenz can take to combat each bias described in (i). Justify your answer.

Commentary on Question:

Most candidates performed well on this part.. Points were lost where biases were tied to the digital strategy, and not the rewards program.

(i) Loss Aversion – Customers will be upset with the lower value once the initial reward has already been in place. They will feel like they lose value from the rewards and are less appreciated.

Illusion of control (self-attribution bias)– Customers should not be rewarded for negative behavior (not making a purchase)

(ii) Loss Aversion – Keep program at a constant level with low risk of needing to reduce the rewards

Illusion of control (self-attribution bias)– Ensure customers are rewarded for positive behavior (e.g. provide coupons for loyal customers)

4. Spring 2021 SDM Exam

Learning Objectives:

1. The candidate will understand and apply strategic management concepts and frameworks to to develop an organization's business strategies and solutions.

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

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 business strategies under different business situations and market opportunities, utilizing the applicable strategic or change management models

(3a) Apply fundamental techniques and frameworks of management science to make informed business decisions:

(3b) Apply statistical and quantification methods to analyze managerial decisions with uncertain conditions:

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

Sources:

Strategic Management: Competitiveness and Globalization, Concepts
Ch. 9, Cooperative Strategy

Data, Models, and Decisions
Ch 5 –Simulation Modeling

Commentary on Question:

The calculation and modelling components of this question were generally done well. Nearly all candidates took advantage of using tools in MS Excel to efficiently and accurately solve the problem.

4. Continued

Solution:

(a) **(LOs 3a, 3b, 3c)**

(i) Design a model to project the supplier's earnings from the dedicated facility.

(ii) Calculate projected earnings over the next 10 months using the random numbers provided. Show your work.

Commentary on Question:
In general, this part was done well. The most common mistake was in part (ii): inventory was not properly incorporated into the solution. Some candidates ignored it entirely (i.e., whatever the market demands would be provided) others only considered the remaining surplus in the month.

Full marks for (i) were awarded if price and market demand for coffee beans were identified as the random variables to model and each modelled correctly using the information in the question.

Revenue from Frenz is included in the calculation below, but not explicitly called out in separate columns due to size.

Month	Opening Inventory	Beans Produced	Available for Open Market Sale	Market Demand	Sold in Open Market	Closing Inventory	Market Price	Revenue from Frenz	Revenue from Open Market	Earnings	Gross Margin
1	0	1000	250	250	-250	0	$25.00	$22,500	$6,250	$3,750	15%
2	0	1000	250	0	0	250	$42.50	$22,500	$0	($2,500)	-10%
3	250	1000	500	0	0	500	$35.00	$22,500	$0	($2,500)	-10%
4	500	1000	750	500	-500	250	$20.00	$22,500	$10,000	$7,500	30%
5	250	1000	500	250	-250	250	$45.00	$22,500	$11,250	$8,750	35%
6	250	1000	500	500	-500	0	$55.00	$22,500	$27,500	$25,000	100%
7	0	1000	250	250	-250	0	$17.50	$22,500	$4,375	$1,875	8%
8	0	1000	250	0	0	250	$37.50	$22,500	$0	($2,500)	-10%
9	250	1000	500	0	0	500	$27.50	$22,500	$0	($2,500)	-10%
10	500	1000	750	0	0	750	$30.00	$22,500	$0	($2,500)	-10%

(b) **(LOs 3a, 3b, 3c)** Recommend two metrics the bean producer could use to evaluate earnings risk from the dedicated facility. Justify your answer.

Commentary on Question:
The most common error in this part was recommending a measure that did not actually measure risk or uncertainty (e.g., ROI). No marks were awarded for these answers.

4. Continued

1. **Probability [Earnings <= 0]** = 5/10 = 50% by counting the number of simulations that resulted in losses. Supplier can expect to make a profit 50% of the time. This is a good metric to understand the propensity of loss-making months and can be used to inform a risk appetite around earnings volatility.
2. **Sample standard deviation of earnings** = 8k. This is a large number so there is substantial variability in the earnings. Tells us how much variability there is around the mean.

(c) **(LOs 1b)** Describe two considerations as to whether or not Frenz should proceed with the alliance. Justify your answer.

Commentary on Question:
The majority of marks lost on this question were in this part. To receive full marks, candidates needed to consider both material from the case study on Frenz and the syllabus material applicable to Frenz entering into an alliance with the coffee producer.

Many candidates simply re-stated the premise of the question (e.g., achieve price certainty). No marks were awarded for these answers.

1. **Control of supplier can improve product quality.** Frenz's business strategy is differentiation. It distinguishes itself from competitors by offering high quality coffee and experience. They currently have several supplier relationships and strive to ensure customer satisfaction of the product. By acquiring a supplier and having a dedicated facility, they would be able to control the quality of product with suitable investment and oversight.
2. **Sale of surplus inventory in secondary markets can dilute brand value.** Frenz's competitive advantage is that their coffee quality and café experience is costly to imitate and non-substitutable. Having the same beans used by other competitors may undermine this competitive advantage; however the current economics for the supplier requires secondary market sales to turn a profit.

6. Fall 2020 SDM Exam

Learning Objectives:

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

4. The candidate will understand the role of organizational behavior play in organizational decision-making and efficacy.

Learning Outcomes:

(3a) Apply fundamental techniques and frameworks of management science to make informed business decisions:
(3c) Evaluate business decisions using quantitative and statistical methods
(4a) Evaluate the impact of human behavior factors on the effectiveness of decision-making processes within organizations:
(4b) Explain the role of cognitive biases on making suboptimal individual decisions

Sources:

Data, Models, and Decisions – Ch. 7, 9

CP311-104-25: Leaders as Decision Architects

Case Study Fall 2020
https://www.soa.org/4ad2a4/globalassets/assets/files/edu/2020/fall/exams/edu-2020-fall-cfesdm-exam-case-study.pdf

Commentary on Question:

Candidates were intended to demonstrate knowledge of linear and discrete optimization via the set-up of a relatively straight-forward discrete optimization. Candidates that interpreted the ask to maximize revenue generally received full or nearly-full credit throughout the question. Partial credit was given to those that attempted to maximize profit or set up their original constraints incorrectly, as long as future optimization was correct for their given set-up. However, many candidates that attempted to maximize profit rather than revenue struggled to adequately describe how they accounted for the cost of a voucher opposed to the cash refund and construct appropriate constraints for each scenario.

6. Continued

Solution:

(a) **(LOs 3a)**

(i) Define discrete optimization.

(ii) Explain how linear optimization can be used to approximate solutions to discrete optimization problems.

Commentary on Question:
Part (a) was generally well answered with those receiving full credit adequately describing discrete optimization as requiring a whole number solution.

(i) An optimization model is said to be a discrete optimization model if all of the constraints and the objective function are linear functions, and all of the decision variables are required to be whole numbers.

(ii) The usual linear optimization method can be used to find an 'approximate' solution without consideration for the discrete requirement that the solution be a whole number. This solution is certain to be close to the discrete solution. The solution can then be rounded and the nearest possible discrete solutions tested to determine the optimal solution with this additional constraint.

(b) **(LOs 3a, 3c)**

(i) State the objective function.

(ii) State the constraint functions.

Commentary on Question:
Candidates that did well on Part (b) recognized the question requested revenue to be optimized and recognized that vouchers do not impact revenue. Partial credit was given to those that attempted to optimize profit with adequate explanation of how they handled the cost of the voucher. Candidates that approached this route should have recognized the cost of the voucher is less than the face amount.

Objective – maximize revenue from ticket sales
Let **x** be the number of tickets sold
Let **y** be the number of "overbooked" passengers who arrive, but are not given a seat on a flight

(i) The objective function is: Max 900 * **x**

6. Continued

(ii) The constraint functions are:
0.02 * 900 * **x** – 1200 * **y** >= 0 ; vouchers issued are no more than 2% of final ticket sale revenue
0.01 * **x** – **y** >= 0 ; no more than 1% of customers issued vouchers for overbooking
x has a positive integer value

(c) **(LOs 3a, LOs 3c)** For the optimization problem defined in part (b):

(i) Calculate the optimal solution. Show your work.

(ii) Critique the inclusion of both constraint functions in the model.

Commentary on Question:
Candidates who correctly identified the objective function and constraint functions in part (b) performed well on part (c) as well. Full credit was given for correct optimization of alternate answers to part (b); however, many candidates constructed answers to part (b) that were more difficult to optimize and achieve credit on part (c)

(i) the expectation of **y** can be expressed as a function of **x**, namely:

y = max(0.95*x – 300, 0)

if **x <= 315** then **y = 0**
if **x > 315** then **y > 0**

when **x > 315**,

0.02*900*x – 1,200*(0.95*x – 300) >= 0
= 18*x >= 1,140*x – 360,000
= x <= 360,000/1,122 = 320.86
since x must be discrete, **x <= 320**

0.01*x – (0.95*x – 300) >= 0
= -0.94*x >= -300
= x <= 300/0.94 = 319.15
since x must be discrete, **x <= 319**

Therefore, the optimal solution subject to all the constraints occurs when **x = 319**. The optimal solution is **900*319 = 287,100**.

6. Continued

(ii) Since the expectation of y can be expressed as a function of x (as they are defined in part b)), this problem can be simplified into a one-dimensional linear optimization problem. As such, one constraint will always dominate the other. In this case, the requirement to have issued voucher value be no greater than 2% of total revenue is dominated by the requirement to have no more than 1% of customers subject to overbooking.

(d) **(LOs 3a, 3c)** Recent legislation was passed that requires airlines to offer overbooked customers a voucher valued at a minimum of $600 plus twice the value of the original ticket price.

State the new constraint functions.

Commentary on Question:
To obtain full credit, candidates only needed to restate the value of the voucher in the constraint function. Those candidates that attempted to optimize revenue or include the cost of vouchers as a revenue item struggled with part (f) as their set up complicated this constraint.

Due to the recent legislation, the refund voucher must be at least a value of:
$600 + $900*2 = $2,400

Therefore, the objective function remains unchanged as follows:
max 900*x

The new constraint functions are as follows:
0.02 * 900 * **x** – 2400 * **y** >= 0 ; vouchers issued are no more than 2% of final ticket sale revenue
0.01 * **x** – **y** >= 0 ; no more than 1% of customers issued vouchers for overbooking
x has a positive integer value

(e) **(LOs 3a, 3c)**

(i) Calculate the optimal solution for the optimization model defined in part (d). Show your work.

(ii) Explain how the relationship between the constraint functions has changed compared to how they were defined in part (b).

Commentary on Question:
Candidates that correctly solved their stated optimization and constraint functions received full credit for part (i). Partial credit was given for correct optimization of constraints that set up incorrectly.

6. Continued

(i) when **x > 315**,

0.02*900*x – 2,400*(0.95*x – 300) >= 0
= 18*x >= 2,280*x – 720,000
= x <= 720,000/2,262 = 318.30
since x must be discrete, **x <= 318**

Therefore, the new optimal solution subject to all the constraints occurs when **x = 318**. The optimal solution is **900*318 = 286,200**.

(ii) Due to the more severe penalty imposed on BJA when overbooking, the requirement to have issued voucher value be no greater than 2% of total revenue becomes more stringent than the requirement to have no more than 1% of customers subject to overbooking (which as a result is no longer the dominant constraint).

(f) **(LOs 3a, 3c)** Assuming all overbooked customers elect to take the cash refund option:

(i) Explain how this new legislation changes the model.

(ii) Calculate the new optimal solution. Show your work.

Commentary on Question:
Candidates that recognized the original vouchers did not cost BJA the full cash amount did well on part (f). No credit was given for answers that assumed cash and vouchers were of equivalent value.

(i) This latest legislation will impact BJA's revenue, as BJA can no longer rely on providing reimbursements in the form of vouchers to overbooked customers. BJA must now provide cash refunds to customers who are overbooked, which will directly impact revenue and consequently the objective function.

Therefore, the objective function must be redefined as follows:
max 900*x – 2,400*y

(ii) The consequence of this change is that **y** must now be minimized in order to maximize the objective function, while keeping **x** as large as possible.

6. Continued

y = 0.95*x – 300
set **y = 0** and solve for **x**,
0 = 0.95*x – 300
300/0.95 = x = 315.79
since x must be discrete, either **x = 315** or **x = 316**

when **x = 315**, **y = max(0.95*315 – 300, 0) = 0**
objective function: **900*315 – 2,400*0 = 283,500**

when **x = 316**, **y = max(0.95*316 – 300, 0) = 0.2**
objective function: **900*316 – 2,400*0.2 = 283,920**

Therefore, the new optimal solution is **283,920** and occurs when **x = 316**

(g) **(LOs 3a, 3c)** Critique the optimization model's representation of:

(i) The overbooking strategy. Justify your answer.

(ii) BJA's business strategy. Justify your answer.

Commentary on Question:
Candidates generally provided adequate answers critiquing the model in light of BJA's corporate strategy. Full credit answers should recognize the model for overbooking was too simplistic and didn't account for a number of variables that would impact the number of overbooked passengers nor longer term revenue impacts of overbooking. A full credit answer would also recognize BJA's strategy of emphasizing safety and/or their target business travel customer.

(i) The model is too simple. The current version of the model is deterministic and does not consider that there is variability in the number of people who do/do not show up for a flight (i.e., will be higher or lower than 5%, even 0%, for each flight).

(ii) The strategy of optimizing revenue via allowing for overbooking does not consider BJA's overall business strategy. It may be inconsistent with a strategy and marketing an emphasis on safety and commitment to quality. The potential of overbooking may be unacceptable to business travelers and could cause BJA to ultimately lose revenue from that segment.

(h) **(LOs 4a, 4b)** Design a solution to incentivize overbooked customers to choose the voucher over the full cash refund equivalent to the voucher value. Justify using decision architecture.

6. Continued

Commentary on Question:
Candidates were intended to answer part (h) within the context of system 1 and 2 thinking about how each could be used or bypassed to incentivize passengers to choose a travel voucher. Partial credit was given for sound strategies to influence a passenger's decision without reference to rational based on choice architecture.

BJA may incentivize customers to choose a voucher by instantly issuing digital vouchers and attaching pictures of locations that could be reached with a voucher of their amount. This leverage system 1 thinking by both simplifying the process for obtaining a voucher vs. requesting cash and arousing a passenger's emotion by illustrating the locations they could visit.