

CFE 201 Model Solutions

March 2026

1. Learning Objectives:

1. The candidate will understand how an organization optimizes its corporate finance decisions based on its business objectives.

Learning Outcomes:

- (1b) Evaluate and apply the methods to determine the value of a business or project, including the impact of financial and non-financial factors on capital budgeting and allocation decisions.

Sources:

Valuation: Measuring and Managing the Value of Companies (7th Edition) Ch 22: Leases

Valuation: Measuring and Managing the Value of Companies (7th Edition) Ch 39:
Flexibility

Commentary on Question:

Question 1 focused on real options and their applicability to Blue Jay Air in the case study, specifically testing candidate knowledge of decision trees and tying the risk perspective to real options. Candidates generally performed better on the real option descriptions and decision tree portion than the risk perspective recommendation question. In all qualitative sub-parts, candidates could not receive full credit if a clear tie to Blue Jay was missing.

Solution:

- (a) Describe one real option that arises from Blue Jay Air taking each of the following actions:
 - (i) Blue Jay Air leases a plane.
 - (ii) Blue Jay Air buys a plane.
 - (iii) Blue Jay Air upgrades an existing plane.

1. Continued

Commentary on Question:

Many candidates received full credit on this sub-part. The most successful candidates were able to identify a real option for each of the actions and explain how the real options provide a benefit specifically to Blue Jay Air. Less points were awarded for responses that lacked sufficient detail or clear ties to Blue Jay Air.

- (i) Leasing a plane provides Blue Jay Air with the option to expand its capacity. Without the large upfront capital investment associated with a plane purchase or plane upgrade, Blue Jay Air can re-evaluate the financial performance of the first leased plane and then opt to lease more planes in the future if performance is favorable.
 - (ii) Buying a plane provides Blue Jay Air with a follow-on (compound) option. With the purchase of a plane, Blue Jay Air can evaluate their initial investment over time and make further investments or expansions in the future, though they do not have the obligation to do so.
 - (iii) Upgrading an existing plane provides Blue Jay Air with the option to expand or increase scope. The upgrade allows Blue Jay Air to increase the capabilities and capacity of its existing fleet of planes without the purchase of additional planes.
- (b) Calculate the expected net present value of the upgrade using the decision tree and assumptions provided in Excel tab 1_b. Show your work.

Commentary on Question:

Candidate performance was mixed on this calculation. While many candidates were successful in identifying cashflows and discounting to calculate the NPV, the most common mistake was a lack of consideration of the decision node. This is a key concept related to decision trees, but many candidates assigned a 50% probability to each path at the decision node rather than recognizing that Blue Jay Air would have a choice in which action to take. Lower scores were given to candidate responses with larger conceptual errors rather than typing errors or minor miscalculations.

See solution in Excel

- (c) Recommend what action Blue Jay Air should take for each of the items below, solely from a risk perspective. Justify each recommendation.
- I. Initial upgrade
 - II. Assuming the initial upgrade was implemented, the upgrade is successful

1. Continued

III. Assuming the initial upgrade was implemented, the upgrade is unsuccessful

Commentary on Question:

Very few candidates received full points on this part, which required a recommendation for each of the items specifically from the risk perspective. Most candidates made a recommendation based on the financial perspective, often simply including a written commentary of the decision tree from part (b). Successful responses included, but were not limited to, considerations relating to the high chance of a negative outcome, Blue Jay Air's risk tolerance, and strategic impacts.

- (i) Considering the initial upgrade from a risk perspective, Blue Jay Air should consider the impact on cashflows and debt levels. Although the expected NPV is positive, there is a 40% chance of a negative outcome, so management should conduct further analysis on its ability to absorb potential losses.
- (ii) If the initial upgrade was implemented and successful, Blue Jay Air should take a phased approach and upgrade one plane at a time rather than all three at once. Even though the initial upgrade was successful, there is still significant risk of financial distress by upgrading multiple planes at once. Additional considerations could include analysis of the timing of the initial upgrade, potential stress events (e.g. pandemic), and supply chain risks that could alter the projected favorable outcome.
- (iii) If the initial upgrade was implemented and not successful, Blue Jay Air should re-consider the strategic importance of having upgraded planes. Keeping the plane may put a strain on capital due to the anticipated negative cashflows in perpetuity, so management should strongly consider selling the plane while also seeking out different ways to improve operations and remain competitive.

2. Learning Objectives:

2. The candidate will understand how to gauge an organization's performance through an evaluation of its financial reports.

Learning Outcomes:

- (2a) Analyze the reported financial statements and the interrelationships among them, in order to measure financial performance.

Sources:

International Financial Statement Analysis 4th Ed, Ch. 6 Financial Analysis Techniques

Commentary on Question:

The question is trying to test the conceptual understanding of financial analysis, analytical judgement, interpretation and technical application of financial analysis. The subparts (a) and (b) are fairly straightforward questions. Parts (c) and (d) requires Candidates to suggest their ideas with justifications, which can have several answers that are correct. Overall, Candidates perform moderate on this question. Possible areas to improve are "Answer the question that was asked", and "Justify your answers using specific information from case study".

Solution:

- (a) Explain the benefit of common-size financial statements and financial ratios to analyze investment opportunities.

Commentary on Question:

Candidates who showed understanding of these three concepts in their answers ("remove the effect of size", "cross-sectional", and "time series analysis") receive full credits. Other answers were given credit as well, but the best candidates showed understanding of the three primary concepts.

Common-size financial statements and financial ratios remove the effect of size, allowing comparisons of a company with peer companies (cross-sectional analysis) and comparison of a company's results overtime (trend or time series analysis).

- (b) Calculate the Leverage Ratio and the Return on Equity (ROE) for each of the following Case study companies for the years 2023 and 2024. Show your work.
 - I. Frenz Corporation
 - II. Blue Jay Air
 - III. Big Ben Bank
 - IV. Darwin Life Insurance Company

2. Continued

Commentary on Question:

Candidates performed well on this question. To get full credits, candidates needed to show correct formulas and take correct numbers from financial statement data into calculation. Minor calculation errors were able to get full credit.

Formula:

Average Total Assets = (Total Assets BOY + Total Assets EOY)/2

Average Total Capital = (Total Capital BOY + Total Capital EOY)/2

Leverage Ratio = Average Total Assets/Average Total Capital

ROE = Net Income/ Average Total Capital

(i) Frenz Corporation

Leverage Ratio (2023) = $(209,920 + 219,771) / (91,000 + 92,478) * 2 = 2.34$

Leverage Ratio (2024) = $(219,771 + 260,145) / (92,478 + 124,059) * 2 = 2.22$

ROE (2023) = $42,092 / (91,000 + 92,478) * 2 = 46\%$

ROE (2024) = $71,488 / (92,478 + 124,059) * 2 = 66\%$

(ii) Blue Jay Air

Leverage Ratio (2023) = $(1,373 + 1,667) / (22 + 77) * 2 = 30.71$

Leverage Ratio (2024) = $(1,667 + 1,924) / (77 + 199) * 2 = 13.01$

ROE (2023) = $75 / (22 + 77) * 2 = 152\%$

ROE (2024) = $117 / (77 + 199) * 2 = 85\%$

(iii) Big Ben Bank

Leverage Ratio (2023) = $(35,801) / (1,760) = 20.34$

Leverage Ratio (2024) = $(35,957) / (1,897) = 18.95$

ROE (2023) = $68 / (1,760) = 4\%$

ROE (2024) = $153 / (1,897) = 8\%$

(iv) Darwin Life Insurance Company

Leverage Ratio (2023) = $(12,497,215) / (700,364) = 17.84$

Leverage Ratio (2024) = $(13,616,751) / (702,452) = 19.38$

ROE (2023) = $161,967 / (700,364) = 23\%$

ROE (2024) = $174,763 / (702,452) = 25\%$

- (c) Identify two additional metrics for evaluating the performance of the companies in part (b). Justify why each metric is appropriate.

Commentary on Question:

Only small portion of candidates received full credit on this question. The most common mistake was candidates not properly justifying their answers. Many candidates calculated their metrics for each company instead of justifying why they choose each metric.

2. Continued

Any choice of liquidity, activity, solvency, profitability or valuation ratios outside of the two (ROE and leverage) from part (b) can be used here, but must be explained as a practicing actuary, how they are applicable in this scenario.

Example:

a) Total Asset Turnover = Revenue / Average Total Assets

This metric is a measure of the efficiency of a company, which could tell you as an investor whether a company is operating efficiently or not.

b) Current Ratio = Current Assets / Current Liabilities

This metric is a measure of liquidity. As an investor, it might be troublesome to invest in companies that are relying on operating cashflows to cover short-term obligations.

- (d) Rank the overall performance of each company, from RPPC's perspective, using the metrics in parts (b) and (c). Justify your response.

Commentary on Question:

To get full credit, candidates needed to justify their answers properly by using information from case study along with their answers in parts (b) or (c).

From RPPC Cost of Capital information, the target D/V ratio is 40% and Cost of equity is 14%. This mean that RPPC target leverage ratio to be around $1 / (1 - 40\%) = 1.67$. The ideal company for RPPC to invest should have at least ROE of 14% and not too high leverage ratio.

- All companies have Leverage Ratio above prefer RPPC target.
- Frenz Corporation has lowest leverage ratio among the company lists and ROE is more than 14%.
 - (i) The Frenz CRO is also to try to balance Frenz Expansion Strategy so that Frenz's leverage ratio does not exceed Frenz's internal limit which is a good sign that Frenz managements do care about risks in a way that RPPC want.
- Darwin Life Insurance Company has leverage ratio around 20x, but the ROE is still more than 14%.
 - (i) Among insurance industry, Darwin Life ROE is exceed industry level of 11%. Although Darwin Life leverage ratio is higher than industry level of 1.67.

2. Continued

- Big Ben Bank has leverage ratio around 20x which is similar to Darwin Life Insurance Company, but Big Ben Bank ROE is below 10% which do not meet RPPC target return.
 - (i) Big Ben Bank also has lower ROE and higher leverage ratio than overall Bank industry. For overbank industry, ROE is 12% and leverage is $1 / (1 - 60\%) = 2.5$. This indicate that there are other banks that can provide better risk reward than Big Ben Bank.
- Blue Jay Air has leverage ratio around 30x which is nature of Airline Company that is a highly-leveraged capital-intensive company. It will take around 4% drop in the value of company assets to completely wipe out its capital which does not suitable to RPPC risk appetite that expect the capital to withstand one 1-in-100 year event

Similar analysis should be done for the other two metrics identified in part (c) and applied appropriately to these four companies for ranking purposes. (Example: These companies come from different industries so wouldn't expect comparable percentages for each chosen ratio, but the decrease in Current Ratio for Big Ben could be an indication of making more loans with customer deposits, which could be problematic if customers take their deposits out. Frenz also has significantly higher asset turnover than Blue Jay Air, might be an indication of relative efficiency between the companies, or perhaps is just reflective of efficiency of the industries.)

Rank (could have other ranking, with justification):

- I) Frenz Corporation
- II) Darwin Life Insurance Company
- III) Big Ben Bank
- IV) Blue Jay Air

3. Learning Objectives:

3. The candidate will understand how managerial accounting and operational processes impact an organization's performance evaluation and decision making.

Learning Outcomes:

- (3c) Recommend best practices in business processes to achieve operational excellence.

Sources:

Managing Business Process Flows, Ch 1: Products, Processes, and Performance

Managing Business Process Flows, Ch 2: Operations Strategy and Management

Commentary on Question:

This question was designed to assess candidates' ability to link operations strategy to business strategy, specifically within the context of a service industry (airlines). It required an understanding of:

1. *The concept of operations trade-offs (operations frontier)*
2. *How firms position themselves along dimensions such as cost vs. service/quality*
3. *The ability to translate a stated strategic vision (customer-oriented, comfort, punctuality, safety) into operational implications*
4. *The distinction between current state vs. target state positioning*

Additionally, the question tested whether candidates could move beyond theory and apply concepts to a real-world case, including making reasonable assumptions where data was not explicitly provided.

To receive full marks, candidates needed to:

- *Clearly justify axis selection*
Simply stating axes (e.g., cost vs. comfort) was insufficient. High-scoring responses explicitly explained why these dimensions represent the key trade-off in the airline industry and how they relate to Blue Jay Air's strategy.
- *Accurately describe the operations frontier*
Strong answers referenced that the frontier represents the maximum achievable performance trade-offs, and that firms can move toward the frontier through operational effectiveness or along it through strategic positioning.
- *Correctly position Blue Jay Air (current vs. target)*

Candidates needed to:

- *Place BJA's current position appropriately (mid-cost, mid-service)*
- *Show a clear directional shift (upward and rightward toward higher service and higher cost)*
- *Ensure consistency between the positioning and the stated strategy*
- *Explain, not just describe*
Many candidates lost marks by labeling points without explaining

3. Continued

Areas Where Candidates Performed Well

- *Most candidates correctly identified cost vs. service/comfort as the appropriate axes*
- *Many recognized that Blue Jay Air is not a low-cost carrier and should not be positioned as such*
- *Strong responses clearly linked upgrades (planes, lounges) to a move toward higher service levels*

Common Areas of Difficulty

- *Superficial explanations*
A common issue was stating conclusions (e.g., “BJA moves up the curve”) without explaining the operational drivers behind that movement.
- *Confusion between operational effectiveness and strategic positioning*
Some candidates incorrectly suggested that improving both cost and service simultaneously moves the firm beyond trade-offs, rather than recognizing movement along the frontier.
- *Inconsistent positioning*
Some responses placed BJA in a high-service/low-cost quadrant, which is generally not sustainable in the airline industry and contradicts the frontier concept.
- *Failure to reference the frontier concept explicitly*
Weaker answers described a graph but did not explain that the curve represents efficient trade-offs or how firms relate to it.
- *Ignoring the customer segment (business travelers)*
High-quality answers incorporated the fact that business travelers prioritize time, reliability, and comfort over price, while weaker responses treated all customers uniformly.

Solution:

- (a) Rank the four dimensions of product attributes based on how relevant each is to Blue Jay Air’s new strategic vision. Justify your response.

Commentary on Question:

See above

3. Continued

Blue Jay Air's new strategic vision is to become the most customer-oriented airline, emphasizing comfort, punctuality, and safety, with a customer base largely composed of business travelers. Based on this strategy, the four product attributes can be ranked as follows:

1. Product Quality (Most Important)

Product quality is the most critical attribute, as it directly encompasses the airline's core strategic pillars of comfort and safety. Improvements such as upgraded aircraft interiors, enhanced in-flight services, and premium lounge experience all contribute to a superior customer experience.

2. Product Delivery – Response Time

Product delivery, interpreted as on-time performance and operational reliability, is the second most important attribute. This directly supports the company's focus on punctuality, which is especially critical for business travelers who value time efficiency. Delays can significantly undermine customer satisfaction, regardless of service quality. As such, strong operational execution to ensure timely departures and arrivals is essential to delivering on the firm's value proposition.

3. Product Variety

Product variety is of moderate importance. While offering multiple service tiers (e.g., economy, business class, lounge access) can enhance customer experience and cater to different preferences, it is not the primary driver of competitive advantage in this strategy.

Business travelers typically prioritize consistency, reliability, and quality over a wide range of options. Therefore, variety supports the strategy but does not define it.

4. Product Cost (Least Important)

Product cost is the least important attribute under this strategic vision. Blue Jay Air does not pursue a low-cost leadership strategy; instead, it is investing in higher quality service and customer experience.

Given the target segment of business travelers—who are generally less price-sensitive, the airline can justify premium pricing in exchange for superior comfort, punctuality, and safety. Competing primarily on cost would be inconsistent with the firm's desired market position.

3. Continued

- (b)
- (i) Assess the operational effectiveness of Blue Jay Air's planned operations changes (Case Study section 2.5) to planes, business lounges, and baggage fees in the context of the company's new strategy.
 - (ii) Propose one additional operations change that would align with an unaddressed aspect of the new strategy.

Operational effectiveness refers to how well a company's processes and operational decisions support its chosen strategic position and are executed relative to competitors. Blue Jay Air's strategy is to become the most customer-oriented airline, emphasizing comfort, punctuality, and safety, with a strong focus on business travelers. Each planned operational change can be assessed in this context:

Planes (Fleet Upgrades)

The planned upgrades to both the international and domestic fleet are highly operationally effective and strongly aligned with the strategy.

- **Alignment with strategy:** These upgrades directly enhance comfort (e.g., seating, cabin environment) and can also support safety and reliability through newer or better-maintained aircraft.
 - **Impact on target segment:** Business travelers place high value on comfort and reliability, making this investment strategically sound.
 - **Trade-off:** While capital-intensive, the increased cost is consistent with premium positioning and can be supported through higher fares.
- Overall, this change reinforces Blue Jay Air's desired movement toward the high-service end of the frontier operations.

Business Lounges

Investments in business lounges are also operationally effective, though slightly more indirect in impact compared to fleet upgrades.

- **Alignment with strategy:** Lounges improve the end-to-end customer experience, particularly comfort and convenience before flights.
- **Relevance to customer segment:** This is especially valuable for business travelers, who frequently use lounges and associate them with premium service.
- **Operational impact:** While lounges do not directly affect flight operations, they enhance perceived service quality and customer satisfaction.

Baggage Fees

The introduction of baggage fees is less operationally effective and potentially misaligned with the strategy.

- **Misalignment with strategy:** Charging for baggage may conflict with the goal of being the most customer-oriented airline, as such fees are often perceived negatively by customers.

3. Continued

- Competitive positioning: While this aligns with industry norms, simply matching competitors does not create differentiation.
- Trade-off: Although baggage fees generate revenue to offset higher costs, they may undermine customer satisfaction, particularly for a premium brand. Overall, this change risks diluting the customer's experience and is not fully consistent with premium service-focused positioning.

(b)(ii) Additional Operations Change

One additional operational change that would align with an unaddressed aspect of the strategy (punctuality) is investment in Crew and Scheduling Resilience (e.g., Reserve Pilots and Crew Buffers). An operational change aligned to punctuality could be to expand the number of pilots on staff, to have a slightly higher than average number of back-up pilots, to help prevent cascading delays from crews not making it to their next flight after a delay.

(c)

- (i) Recommend two potential performance metrics for Blue Jay Air to track progress against their new strategy.
- (ii) Describe how each metric in (i) would be measured and tracked.
- (iii) Explain why each metric in (i) is appropriate for measuring the performance of Blue Jay Air.

1. Performance Measure #1 - On-time departure tracking. This metric would be used to track improvements against the goal of punctuality. This is one of most straightforward metrics to track, as the airline needs to simply track the scheduled departure time against the actual departure time. More advanced metric tracking would also include why there was a delay if there was a delay (weather, maintenance, etc.) and if the landing was still on time, even if the takeoff was delayed.

2. Performance Measure #2 - Plane safety incidents. This is the easiest metric to measure and track for safety. The metric would log the total number of plane crashes, abandoned landings or takeoffs, deployments of oxygen masks, etc. This should be measured as a percentage of total flights, with a benchmark target of zero.

3. Performance Measure #3 - Customer satisfaction with business lounges - this would have to be measured via voluntary surveys, and should be tracked over time with regard to areas like food quality, access, seating, etc.

3. Continued

4. Performance Measure #4 - Increase in customer base - this is a secondary metric, which may be tough to assign direct causation to, but if BJA is achieving its efforts around comfort, punctuality, and safety, then controlling costs, the customer base should increase.

- (d) Complete the “operations frontier” for the airline industry provided on Excel tab 3_d, and plot Blue Jay Air’s current and target location based on Blue Jay Air’s history and current market position. Justify your choice of axes and Blue Jay Air’s positions.

See the spreadsheet

4. Learning Objectives:

4. The candidate will understand the appropriate application of evolving quantitative methods and technologies that help to manage the business.

Learning Outcomes:

- (4a) Evaluate the appropriateness of applying evolving methods and technologies to manage specific business issues.
- (4b) Apply evolving methods and technologies for quantifying and managing business risks and opportunities.

Sources:

Kelleher, Mac Namee, and D'Arcy, Fundamentals of Machine Learning for Predictive Analytics 2nd Ed, Ch. 9 Evaluations

Kelleher, Mac Namee, and D'Arcy, Fundamentals of Machine Learning for Predictive Analytics 2nd Ed, Ch. 12 Case Study: Customer Churn

Kelleher, Mac Namee, and D'Arcy, Fundamentals of Machine Learning for Predictive Analytics 2nd Ed, Ch. 14 The Art of Machine Learning for Predictive Data Analytics

Commentary on Question:

Commentary listed underneath question component.

Solution:

- (a) Explain the threefold purpose of this model evaluation exercise.

Commentary on Question:

Candidate performance on this question was mixed. Candidates who performed well on this question were both able to identify the threefold purpose of the model evaluation exercise and relate them to the question stem. Strong partial credit was given to both candidates who were able to identify part of threefold purpose (i.e. two of the three purposes) and adequately relate it back to the question stem and candidates who were able to identify all three purposes but not adequately relate them to the question stem. Candidates who performed less well on this question were able to identify less than two of the purposes and did not adequately relate them back to the question stem.

1. To determine which of the models constructed is most suited to the task at hand: First, we need to clarify the purpose of the model, which is to identify a limited number of prior donors based on their likelihood to make a sizeable donation. Then, we need to determine which model achieves this goal most effectively.

4. Continued

2. To estimate how the model will perform when deployed: by testing the model on a subset of the prior 5 years of data, the foundation can estimate how effectively the model will identify likely donors.
 3. To convince the business for whom the model is being developed that the model will meet their needs: Before the foundation contacts prior donors, they will need to be persuaded that the model selected will achieve the outlined goal. Metrics indicating performance, such as precision, recall, accuracy, or gain and lift could help with this.
- (b) Before evaluating the models, you need to train them. Your manager recommends that you use an out-of-time sampling method.

Critique your manager's recommendation.

Commentary on Question:

To receive full credit candidates needed to include both strengths and weaknesses of the manager's recommendation within the context of the question stem. Many candidates focused their response on either only the strengths or only the weaknesses of the recommendation. As a result, many candidates earned strong partial credit on this question, but few earned full credit.

Pros:

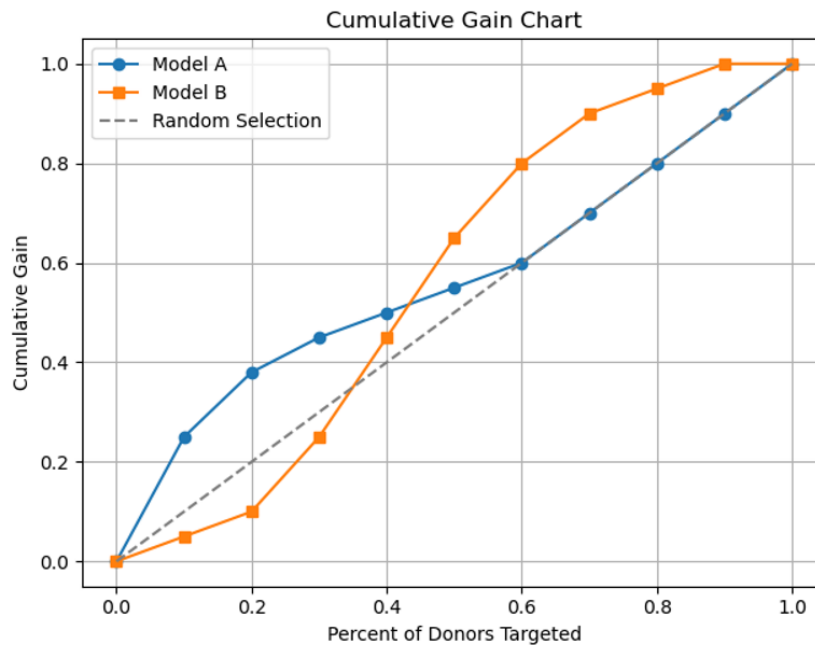
- Time is a natural underlying feature of the donation data. This can be used rather than random sampling from a large data set to more effectively build a test set based on chronological splits, such as calendar year.
- Helps to identify seasonal patterns without allowing them to become overweighted in the training data.
- This approach may be better aligned with the real-world application of the model, in which future donations may have natural variations from the past.

Cons:

- There may be significant differences between the underlying data distribution between the training and the test period, such as a constricted economy or a pandemic.
- Bias may arise from seasonality if the training and test sets cover different periods of the year. For example, donors may be more likely to give around the holidays.
- Training data may be limited by the need to hold out a test set to evaluate model performance.
- The model may fail to recognize overarching patterns over many years, such as demographic churn in a zip code.

4. Continued

- (c) You have trained the two models, Model A and Model B, and performed a gain & lift analysis, which is summarized in the following cumulative gain chart:



Recommend whether Model A or Model B should be used for the fundraiser analysis. Justify your recommendation.

Commentary on Question:

Candidates performed well on this part of the question with many candidates receiving either full or strong partial credit. To get full credit a candidate needed to recommend Model A with strong justification given the business context. Candidates who recommended Model B with sound justification were given strong partial credit.

Model A is more suited to the task given that the gala venue has limited capacity. However, had this been for a broader reaching donation campaign, Model B may be more appropriate.

Model A captures a large proportion of donation potential quickly, surpassing 40% by the time only 30% of donors are contacted. However, Model A then weakens to no better than random chance.

Model B starts off weaker than random chance, but then becomes significantly stronger than Model A by the time 50% of donors are contacted.

4. Continued

- (d)
- (i) Compare and contrast the merits of using a generative vs. discriminative model to predict the total donations received.
 - (ii) Recommend whether to use a generative or descriptive model. Justify your answer.

Commentary on Question:

To receive full credit on part (i) candidates needed to describe both the merits and detriments of both types of models in the context of the problem. Candidates performed solidly on this part. Candidates that only adequately described the merits and detriments of one type of model or did not tie in the question stem received partial credit.

To receive full credit for part (ii) candidates needed to recommend a discriminative model with strong justification in the context of the question. Candidates who recommended a generative model with strong justification were able to receive partial credit.

- (i) A generative model learns the conditional class densities, or the distribution of the descriptive feature values for each target level (excess donor or minimum donor). It then uses Bayes Theorem to compute the class posterior probabilities and apply a decision rule over class posteriors to return a target.

A discriminative model learns the class posterior probability directly from the data and then applies a decision rule over class posteriors to return a target.

Generative models attempt to learn more complex solutions to the prediction problem than discriminative models, because the class conditional probabilities can be very complex, especially with a large number of descriptive features.

Additionally, as the amount of training data increases, the bias imposed on a generative model can become larger than the error of the trained model. After this tipping point, a discriminative model will perform better.

However, a generative model can also handle missing data better than a discriminative model, and we are given that attendees had the option to self-report features.

4. Continued

- (ii) Recommend a discriminative model given the large training data set and a desire to avoid computational complexity that could be costly for a non-profit. The only argument for a generative model would be if missing data was a significant risk or concern, and there is not any direct or implied reason why that would be a concern. In fact, there is incentive for donors to report donations (e.g., for tax benefits).

5. Learning Objectives:

4. The candidate will understand the appropriate application of evolving quantitative methods and technologies that help to manage the business.

Learning Outcomes:

- (4a) Evaluate the appropriateness of applying evolving methods and technologies to manage specific business issues.
- (4b) Apply evolving methods and technologies for quantifying and managing business risks and opportunities.

Sources:

CFE201-110-25 Artificial Intelligence Applications in Financial Services p 6-29

SOA: Peer-to-Peer Insurance: Blockchain Implications

Commentary on Question:

Commentary listed underneath question component.

Solution:

- (a)
 - (i) Describe each category of data above.
 - (ii) Identify one type of data for each category that applies to Big Ben Bank's commercial banking line.

Commentary on Question:

To receive full credit candidates needed to correctly describe all three types of data. Candidates who described some but not all of the types correctly were given partial credit. Overall, candidates performed very well on part (i). In most cases, those who lost points made mistakes in their descriptions of "known unknowns" or "unknown unknowns."

(i)

"Known knowns" are data that we know exist and that we know.

"Known unknowns" are data that arise from people's activities that is known to exist, but we don't know how it has been packaged or used.

"Unknown unknowns" are data that are created without our knowledge. People have few - or no - opportunities to validate such data and whether they accurately describe them and their behavior. It's inferred data such as profiling

5. Continued

(ii)

"Known-knowns" would be online commercial customer records Big Ben Bank has such as name, address, phone number, date of birth, etc.

"Known-unknowns" would be online shopping records, saved comparisons of large purchase items, etc

"Unknown unknowns" would be profiling-type data based on behavior that would not be apparent to the customer. Examples might be customer behavior that makes them a more likely target for fraud or more likely to be engaging in fraudulent behavior or behavior that makes a customer a worse credit risk.

(b) Recommend one way Big Ben can use AI to improve each of the following aspects of its business portfolio. Justify each recommendation.

(i) Asset Management

(ii) Commercial banking

Commentary on Question:

To receive full credit for b(i) and b(ii) candidates needed to provide one AI use case that would be relevant for Big Ben Bank and show understanding of how what impact it may have. Candidates performed very well on both parts.

i. Asset Management:

Algorithmic Training: BBB offers its own ETFs, mutual funds and separately managed accounts. Algorithmic trading allows for better execution, increased accuracy and fewer mistakes due to psychological or emotional causes that would allow BBB to trade more accurately.

Risk Management Stress Testing/ESG: BBB uses historical stress testing scenarios and best fit techniques to determine market risk, which assumes the market will behave as before. AI can be used to test beyond business as usual and historical scenarios (instead testing extreme scenarios where typical relationships might break down).

5. Continued

Alpha Generation: BBB offers its own ETFs, mutual funds and separately managed accounts. AI can be used to sift through large amounts of research data on company value and various indicators such as company blogs or industry studies to get better insight on which companies will have higher returns. Short term investments will benefit from AI cause/effect analysis on catalysts that can change the environment for an investment. Long term investments will benefit from AI providing a more complete view of a company.

ii. Commercial Banking:

Chatbots: BBB's commercial banking services are primarily online. The use of chatbots to take care of customer needs online is a natural fit. Customer service reps can better focus on difficult situations and customers feel a touch of more normal interaction with an AI chatbot than searching a FAQ page.

Underwriting for loans: BBB offers credit cards, personal loans, and mortgages. AI can provide a 360 view of applicants, drawing together big and traditional data to better assess customers' credit risk vs just using historical data.

Fraud detection: BBB could have potential fraudulent transactions occur either with its credit/debit cards or in applications to open new accounts or take new loans. AI helps better determine whether a transaction flagged as fraudulent is likely to be truly fraud or a false positive. This frees resources to investigate the most likely fraudulent transactions.

Relationship augmentation: BBB's private banking for high-net-worth customers relies on personal banking relationships to help them with investment, tax and estate planning needs in addition to traditional banking. AI can help anticipate these customers' unaddressed needs and recommend additional products. AI can help determine how and when to do so.

(c)

- (i) Contrast private, public, and consortium blockchain structures.
- (ii) Recommend a blockchain structure for Big Ben. Justify your recommendation.

5. Continued

Commentary on Question:

To receive full credit for part (i) candidates needed to correctly contrast all three types of blockchains. Most candidates were able to contrast public and private blockchains but many had a more difficult time contrasting consortium blockchains with the other two.

To receive full credit for part (ii) candidates needed to recommend consortium blockchains with adequate justification. Candidates who recommended private blockchains with adequate justification received strong partial credit. Candidates who recommended public blockchains received minimal credit.

- (i) Private: one needs the approval of all other parties to join. Importantly, permitted actions for all approved parties are clearly specified. In this way, private permissioned blockchain is generally better suited to business applications.

Public: anyone can join without asking for permission; hence, we call public blockchain permissionless. Many options exist in the market.

Consortium: A consortium blockchain is a blockchain where a pre-selected group of nodes governs the consensus process. For example, there may be a consortium of 15 financial institutions, each of which operates a node, and of which ten must sign each block in order for the block to be considered valid.

- (ii) Consortium blockchains are in use today for banks (e.g., R3), so this is a logical and strong choice for Big Ben Bank. This way of managing permissions and transacting reduces processing costs and data redundancies and helps to upgrade legacy systems, simplify document handling, and get rid of semi-manual processes of enforcement. A public structure would never work, as the bank needs to manage and control access to customers private accounts. A private structure would likely work well for the Cryptocurrency Savings Account product, where there are essentially just two parties (the account holder and Big Ben), but not for the Cryptocurrency Exchange Traded Fund (ETF) where there are likely other (external) financial services parties and functions needed to facilitate such an investment structure.