

Exam CFESDM

Date: Tuesday, October 27, 2020

INSTRUCTIONS TO CANDIDATES

General Instructions

1. This examination has 6 questions numbered 1 through 6 with a total of 100 points.

The points for each question are indicated at the beginning of the question. All questions pertain to the Case Study.

2. While every attempt is made to avoid defective questions, sometimes they do occur. If you believe a question is defective, the supervisor or proctor cannot give you any guidance beyond the instructions provided in this document.

Written-Answer Instructions

1. Each question part or subpart should be answered either in the Word document or the Excel file as directed. Graders will only look at work in the indicated file.
 - a) In the Word document, answers should be entered in the box marked ANSWER. The box will expand as lines of text are added. There is no need to use special characters or subscripts (though they may be used). For example, β_1 can be typed as beta_1 (and ^ used to indicate a superscript).
 - b) In the Excel document formulas should be entered. Performing calculations on scratch paper or with a calculator and then entering the answer in the cell will not earn full credit. Formatting of cells or rounding is not required for credit.
 - c) Individual exams may provide additional directions that apply throughout the exam or to individual items.
2. The answer should be confined to the question as set.
3. The Word and Excel files that contain your answers must be uploaded before time expires.

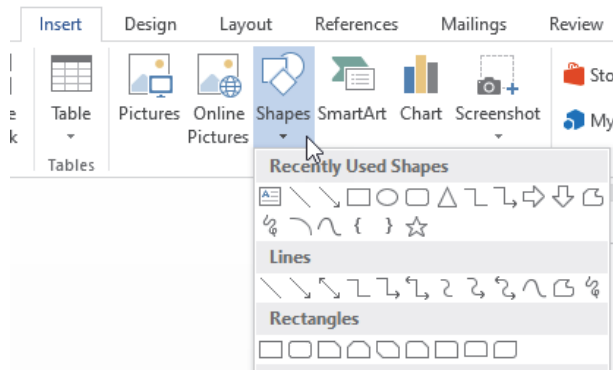
Recognized by the Canadian Institute of Actuaries.

CASE STUDY INSTRUCTIONS

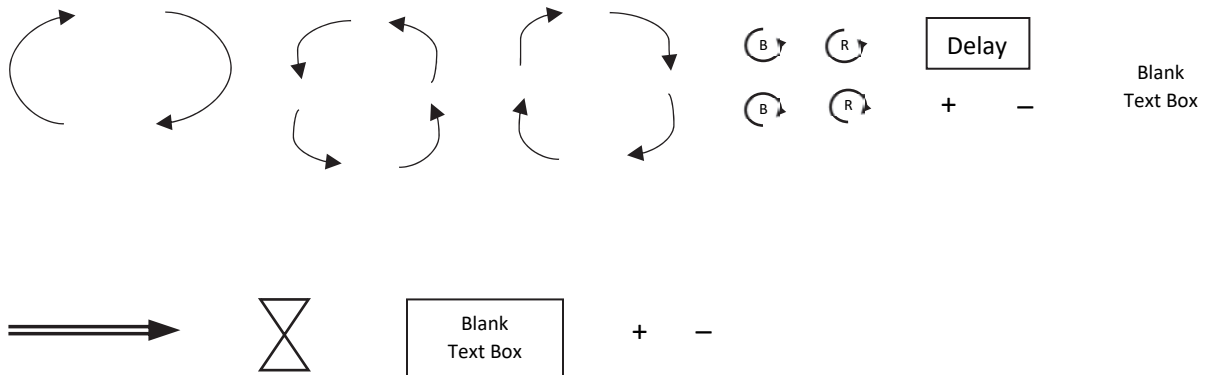
The case study will be used as a basis for some examination questions. Be sure to answer the question asked by referring to the case study. For example, when asked for advantages of a particular plan design to a company referenced in the case study, your response should be limited to that company. Other advantages should not be listed, as they are extraneous to the question and will result in no additional credit. Further, if they conflict with the applicable advantages, no credit will be given.

Drawing Models in a CBT Setting

The following shapes are commonly used when modelling dynamic process and complex systems, such as those in *Business Dynamics* (Sterman, John D., 2000). Not all shapes may be needed, nor should this be considered an exhaustive list of possible shapes. Candidates may copy, paste, and manipulate shapes to answer questions where a sketch is required. For reference, candidates can also insert a variety of shapes using either Microsoft Excel or Microsoft Word under the insert menu:



Selected shapes used in Business Dynamics:



*Question 1 pertains to the Case Study.
Each question should be answered independently.*

- 1.** (14 points) Information on Blue Jay Tire (BJT) can be found in section 3 of the case study.
- (a) (4 points) Sketch a causal loop diagram to model the quality of BJT's tires. Your diagram must include, but not be limited to, the following nodes:
- Tire sale volume
 - BJT's risk culture

ANSWER:

- (b) (4 points) Due to the recent tire recall issues, BJT is investigating purchasing insurance to cover the risk of product liability and product recall.
- (i) Explain how this strategy might affect BJT's tire quality.

ANSWER:

- (ii) Sketch a causal loop diagram between tire quality and product recall insurance.

ANSWER:

1. Continued

Jack Tavares is proposing to use the future third plant to produce tires for electric cars, and presents his idea to the Production Expansion Committee (PEC):

“I did some research and electric car sales have been rising in the past few years. Plus, tires wear out much faster on electric vehicles, so demand for electric car tires should be higher per vehicle life. This is the way of the future, we must act fast!”

The PEC agreed without debate.

- (c) (1 point) Explain whether or not Jack’s decision is intendedly rational.

ANSWER:

- (d) (2 points) Critique Jack’s decision.

ANSWER:

- (e) (1 point) Identify the bias exhibited by the committee. Justify your answer.

ANSWER:

- (f) (2 points) Recommend two techniques to combat the bias identified in part (e).

ANSWER:

**Question 2 pertains to the Case Study.
Each question should be answered independently.**

- 2.** (17 points) Information on Blue Jay Tire (BJT) can be found in section 3 of the case study.

A week after sending his memo on September 9, 2017 regarding the inconsistent rubber density, Chris Carpenter departed BJT for another firm. He had planned this move more than a month in advance.

- (a) (1.5 points) Describe the agency problem with Chris Carpenter that occurred leading up to the tire recall crisis. Justify your answer.

ANSWER:

Several senior executives are expected to retire from BJT in the next few years. With the tire recall crisis in mind, BJT is considering changing its executive incentive compensation structure.

BJT is considering using increase in net income year-over-year (flat percentage) as an incentive compensation basis.

- (b) (2 points) Critique this basis for determining BJT's executive incentive compensation.

ANSWER:

- (c) (2 points) Explain how BJT's ownership structure restricts its choices for executive incentive compensation.

ANSWER:

2. Continued

BJT wants its incentive compensation basis to link to the performance of the warranty program.

- (d) (2.5 points) Recommend a change to the proposed incentive compensation basis. Justify your answer.

ANSWER:

BJT also wants to consider executive response to its external environment for executive incentive compensation.

- (e) (7 points)
- (i) Explain how the Industrial Organization Model (I/O Model) of Above-Average Returns applies to BJT. Justify your answer.

ANSWER:

- (ii) Explain how an agency problem may impact BJT's ability to earn Above-Average Returns under the I/O Model. Justify your answer.

ANSWER:

- (iii) Recommend a measurement for executive incentive compensation based on the I/O Model of Above-Average Returns without entering a new industry. Justify your answer.

ANSWER:

Following the implementation of the new executive incentive compensation structure, BJT makes changes to align incentives across all employees.

- (f) (2 points) Explain how this action will influence future negotiation tactics used when management is dealing with staff.

ANSWER:

*Question 3 pertains to the Case Study.
Each question should be answered independently.*

- 3.** (16 points) Information on Darwin Life Insurance Company (Darwin) and Snappy Life Insurance Company (Snappy) can be found in Sections 7 and 8 of the Case Study, respectively.

Brandon Kaladin, CEO of Darwin, has brought two new company initiatives to the Board:

- a digital distribution platform
- an innovation program to reduce Darwin's costs

Darwin has the resources to pursue only one of the initiatives in the coming year.

Darwin can pursue the digital distribution platform by either continuing to work with its current external start-up company or by acquiring Snappy.

Darwin has forecasted the following three profit scenarios if it continues to work with the start-up company:

Scenario	Probability	Net Profit (\$millions)
High profit	30%	4
Medium Profit	40%	1
Low Profit	30%	(2)

There are two equally likely outcomes if Darwin acquires Snappy, depending on the success of integration: net profit of \$10 million in the event of success or net loss of \$(6) million otherwise.

Optionally, Darwin's consultants, CRS, can conduct due diligence on Snappy at a cost of \$500K to predict the success of the integration. A CRS prediction of success is accurate 95% of the time, while their prediction of failure is accurate 80% of the time.

If Darwin selects the innovation program, it would result in net profit of \$1.5 million.

3. Continued

(a) (9 points)

(i) (6 points) Construct a decision tree for Darwin.

ANSWER:

(ii) (3 points) Calculate the Expected Monetary Value (EMV) of the optimal decision. Show your work.

Recall:

$$P(A|B) = \frac{P(A \text{ and } B)}{P(B)}$$

ANSWER:

(b) (3 points)

(i) (1 point) Critique the general use of decision trees in determining which initiative to pursue.

ANSWER:

(ii) (2 points) Describe two additional considerations specific to Darwin.

ANSWER:

3. Continued

Brandon must recommend one of the two initiatives to the board and provide justification. He will also need to ensure the Board understands the recommendation.

(c) (4 points)

(i) (1 point) Describe the steps in a two-way communication model.

ANSWER:

(ii) (3 points) Propose a strategy for Brandon to communicate the recommendation to the Board using a two-way communication model. Justify your answer.

ANSWER:

Question 4 pertains to the Case Study.
Each question should be answered independently.

4. (13 points)

- (a) (2 points) Describe the feedback structure associated with each of the three fundamental modes of behavior in dynamic systems.

ANSWER:

Information on Frenz can be found in Section 4 of the case study.

Frenz is proceeding with the Asian expansion strategy by entering Shanghai, China. Frenz-Shanghai stores will only sell coffee. The first store opened last month.

Tea is the preferred beverage in China. However, coffee consumption in China is growing and there are several small fast-growing coffee companies that have entered the market. Additionally, people in Shanghai drink more coffee than people in broader China.

- (b) (3 points) Predict Frenz-Shanghai's mode of behavior during the following time periods:
- (i) During the first five years following the opening of the first Frenz-Shanghai. Justify your answer.

ANSWER:

- (ii) After the first five years. Justify your answer.

ANSWER:

4. Continued

(c) (3 points) Sketch a causal loop diagram by including at least the following nodes:

- Competition from local coffee companies
- Frenz-Shanghai coffee sales
- Total coffee demand in Shanghai
- Price of Frenz-Shanghai coffee

ANSWER:

(d) (3 points) Explain whether or not each of the below scenarios create a negative feedback loop for Frenz-Shanghai's growth. Justify your answer.

(i) Financial crisis

ANSWER:

(ii) New competitors

ANSWER:

The first Frenz-Shanghai store has been a great success. As more stores open, growth in Frenz-Shanghai's sales has slowed. In fear of failure, Frenz-Shanghai decides to hire a motivational speaker.

(e) (2 points) Describe the impact of the motivational speaker on the model from (c) based on the market growth model. Justify your answer.

ANSWER:

*Question 5 pertains to the Case Study.
Each question should be answered independently.*

5. (23 points) Information on Blue Jay Air (BJA) can be found in Section 2 of the case study.

(a) (2 points) Determine which of the five business-level strategies is used by BJA. Justify your answer.

ANSWER:

(b) (4 points) Describe two reasons why BJA would vertically integrate with an aircraft manufacturer based on BJA's business-level strategy. Justify your answer.

ANSWER:

5. Continued

Rebecca Gibbs, VP of Operations for BJA, has asked you to take a closer look at Xolar and Skylite using relative valuation principles.

Company	Price-to-Book Value Ratio	Enterprise Value / Invested Capital	Return on Invested Capital	Enterprise Value (\$M)	Invested Capital (\$M)
Xolar	8.0	1.5	19%	185	123
Skylite	5.9	1.0	14%	204	198
Industry Average (Mean)	13.3	1.7	15%		
Industry Median	7.8	1.6	15%		

(c) (2 points) Your coworker notes that the price-to-book value ratio is low for Skylite, and concludes that Skylite must be a better price than Xolar.

(i) List the four fundamental determinants of price-to-book value ratio.

ANSWER:

(ii) Explain two potential reasons why Skylite may not be cheaper than Xolar even though Skylite has a lower price-to-book value ratio.

ANSWER:

5. Continued

- (d) (5.5 points) Jim Peters, head of the risk management committee at BJA, sees the table above. You are copied on the following email he sends in reply:

“Here’s some advice from someone that has done a lot of valuation work. This isn’t middle school—no one at my level cares about medians. All you need for this analysis is the average for the industry.”

- (i) (1 point) Identify the cognitive bias that Jim is exhibiting in this email. Justify your response.

ANSWER:

- (ii) (2 points) Propose a strategy to overcome the bias identified in part (i). Justify your answer.

ANSWER:

- (iii) (1 point) Identify the base of individual power to which Jim is appealing in his email. Justify your response.

ANSWER:

- (iv) (1.5 points) Critique Jim’s recommendation.

ANSWER:

5. Continued

(e) (2.5 points)

- (i) Explain whether firm value or equity value should be used to compare Xolar and Skylite.

ANSWER:

- (ii) Determine if Skylite is undervalued relative to the comparable firms in the aircraft industry.

ANSWER:

- (iii) Determine if Xolar is undervalued relative to the comparable firms in the aircraft industry.

ANSWER:

BJA is evaluating Xolar and Skylite with respect to the following capabilities (A to F):

- A. Engineering & Technology
- B. Corporate Social Responsibility
- C. Quality Assurance
- D. Parts & Services
- E. Product Customization
- F. Human Resources

- (f) (3 points) Determine whether BJA should downsize each of the manufacturer's capabilities (A to F) following acquisition. Justify your answer.

ANSWER:

5. Continued

It has been determined that BJA's hurdle rate can be achieved by acquiring either Xolar or Skylite if they are acquired at their respective enterprise value.

- (g) (2 points) Recommend which company BJA should acquire. Justify your answer.

ANSWER:

BJA has determined that the company they acquire will make aircraft solely for BJA and BJA will not purchase aircraft from any other supplier.

- (h) (2 points) Describe the effects of BJA's acquisition on the following two Forces of Competition, from the perspective of the aircraft manufacturer.

- (i) Rivalry of existing competitors

ANSWER:

- (ii) Bargaining power of customers

ANSWER:

*Question 6 pertains to the Case Study.
Each question should be answered independently.*

6. (17 points)

(a) (1 point)

(i) Define discrete optimization.

ANSWER:

(ii) Explain how linear optimization can be used to approximate solutions to discrete optimization problems.

ANSWER:

6. Continued

Information on Blue Jay Air (BJA) can be found in Section 2 of the Case Study.

Analysis on BJA flight attendance shows that, on average for any given flight, 5% of customers do not show up. BJA does not issue refunds to customers who do not show up for flights.

BJA is considering implementing an intentional overbooking strategy in an effort to maximize revenue. Customers are considered overbooked when they are asked to give up their seat. As part of this strategy, overbooked customers will be given a \$1200 voucher.

Under this strategy, senior management would like to ensure that the total expected value of vouchers issued is no more than 2% of total revenue.

Additionally, because BJA is mindful of its reputation, senior management would like to expect no more than 1% of customers are overbooked on any given flight.

BJA flight tickets cost \$900 per person and plane capacity is 300 customers per flight.

You are asked to build a linear optimization model to analyze this strategy.

(b) (2 points)

(i) State the objective function.

ANSWER:

(ii) State the constraint functions.

ANSWER:

6. Continued

(c) (4 points) For the optimization problem defined in part (b):

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

ANSWER:

(ii) Critique the inclusion of both constraint functions in the model.

ANSWER:

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.

(d) (0.5 points) State the new constraint functions.

ANSWER:

(e) (1.5 points)

(i) Calculate the optimal solution for the optimization model defined in part (d). Show your work.

ANSWER:

(ii) Explain how the relationship between the constraint functions has changed compared to how they were defined in part (b).

ANSWER:

6. Continued

Further legislation requires airlines to offer overbooked customers the option to receive the value of the voucher in the form of a full cash refund.

(f) (2 points) Assuming all overbooked customers elect to take the cash refund option:

(i) Explain how this new legislation changes the model.

ANSWER:

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

ANSWER:

(g) (4 points) Critique the optimization model's representation of:

(i) The overbooking strategy. Justify your answer.

ANSWER:

(ii) BJA's business strategy. Justify your answer.

ANSWER:

(h) (2 points) Design a solution to incentivize overbooked customers to choose the voucher over the full cash refund equivalent to the voucher value. Justify using choice architecture.

ANSWER:

****END OF EXAMINATION****