SOCIETY OF ACTUARIES

Strategic Decision Making Exam

Exam CFESDM

Date: Wednesday, October 27, 2021

INSTRUCTIONS TO CANDIDATES

General Instructions

1. This examination has 5 questions numbered 1 through 5 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. Prior to uploading your Word and Excel files, each file should be saved and renamed with your five-digit candidate number in the filename.

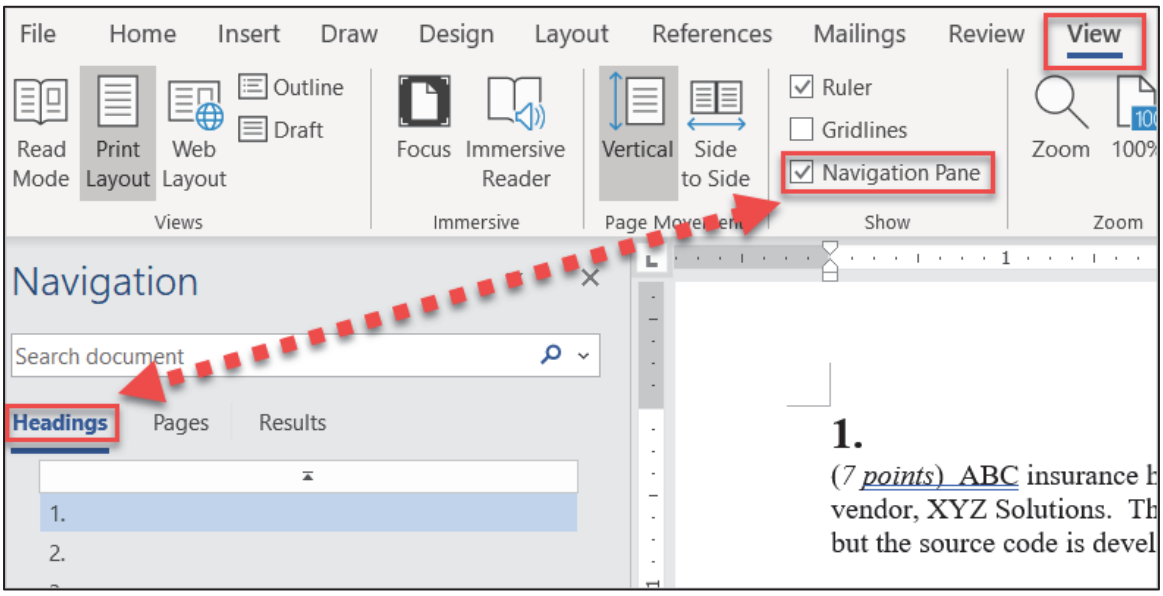
4. The Word and Excel files that contain your answers must be uploaded before the five-minute upload period expires.

Recognized by the Canadian Institute of Actuaries.

Navigation Instructions

Open the Navigation Pane to jump to questions.

Press Ctrl+F, or click View > Navigation Pane:

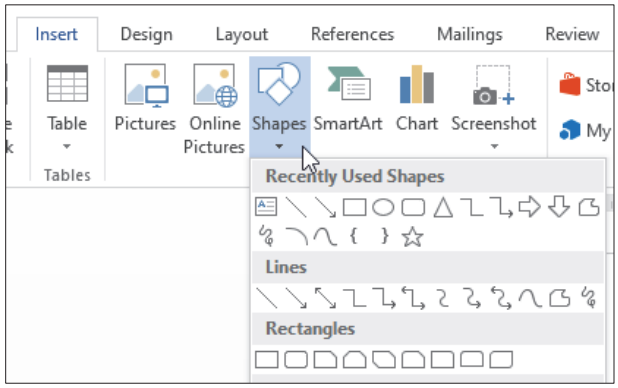


CASE STUDY INSTRUCTIONS

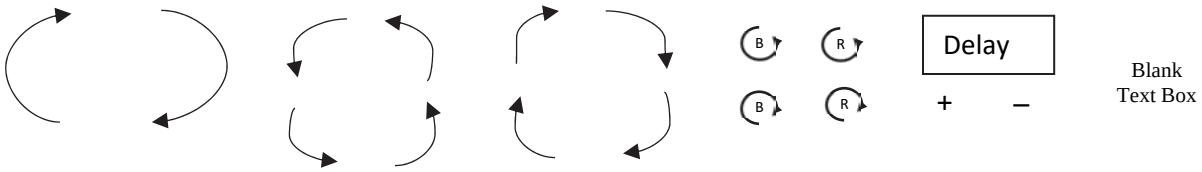
The case study will be used as a basis for some examination questions. Be sure to answer the question asked by referring to the case study. For example, when asked for advantages of a particular plan design to a company referenced in the case study, your response should be limited to that company. Other 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 Frenz can be found in section 4 of the case study.

After the discussion of overhead allocation between Jeff Bemowski and Kitty Dunn in Section 4A, Exhibit 3 of the case study, Frenz' accounting department is reviewing the current allocation approach.

(a) (*1 point*) Explain whether Frenz' current overhead allocation approach is insulating or non-insulating. Justify your answer.

ANSWER:

(b) (*2 points*)

(i) Define externality.

ANSWER:

(ii) Describe one positive externality that Jeff Bemowski's proposal would bring to Frenz store managers who have high sales of products with a high profit margin.

ANSWER:

(iii) Describe one negative externality that Jeff Bemowski's proposal may bring to Frenz store managers who have low sales of products with a high profit margin.

ANSWER:

1. Continued

Kitty is concerned that treating each store as a profit center may allow individual store managers to manipulate how a store's profitability is perceived through actions that may otherwise look like normal day-to-day business.

(c) (*6 points*)

(i) Describe the impact on a store's income statement and balance sheet if a store were to increase inventory of non-perishable, non-coffee products.

ANSWER:

(ii) Explain whether changing to Jeff Bemowski's proposed approach would create an incentive to over-produce.

ANSWER:

(iii) Explain whether changing to Jeff Bemowski's proposed approach would create an agency problem.

ANSWER:

(d) (*1 point*) Explain the negotiation tactics used by Jeff Bemowski during his conversation with Kitty Dunn.

ANSWER:

(e) (*1 point*) Explain the negotiation tactics used by Kitty Dunn during her conversation with Jeff Bemowski.

ANSWER:

(f) (*3 points*) Explain which model of above-average returns best fits Frenz' industry.

ANSWER:

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

2.

(*21 points*)

(a) (*0.5 points*) Define "collectively exhaustive" in the context of a Decision Tree Model.

ANSWER:

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

BJA management is concerned that continental and intercontinental flights pose more of a financial and health risk than their domestic flights in the event of a global pandemic.

Profit margins on BJA flights are on average approximately 15% on continental flights, 25% for intercontinental flights, and 10% on domestic flights.

BJA management estimates that the risk of a viral outbreak on one of BJA's flights is about 3% on continental flights, 5% on intercontinental flights, and 1% on domestic flights.

BJA management estimates that if there were to be an outbreak on a flight that the profit margin for all flights of that type would be impacted. The new profit margins would be -60% on continental flights, -80% on intercontinental flights, and -40% on domestic flights.

(b) (*1.5 points*) Construct a decision tree to illustrate BJA management's analysis for a given flight.

ANSWER:

2. Continued

BJA management determines that in the event of a pandemic intercontinental flights would be stopped and they would focus only on domestic and continental routes. There would be only 50 flights possible per day. Instead of minimizing the standard deviation of viral outbreaks on these flights, BJA management would like to maximize the expected profit margin per flight. BJA management determines they can tolerate a possibility of viral outbreaks on these flights to have a standard deviation of at most 0.9.

(c) (*4 points*) State the objective function and constraint functions.

ANSWER:

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

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

ANSWER:

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

ANSWER:

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

ANSWER:

(e) (*2 points*) Recommend two ways to improve the model. Justify your answer.

ANSWER:

2. Continued

BJA must provide an update to the Board regarding the completed analysis. Your colleague has suggested that sharing the work you have completed thus far without any additional edits followed up by a discussion at the meeting will suffice.

(f) (*4 points*) Critique your colleague's approach as it relates to creating and overcoming organizational barriers to effective communication.

ANSWER:

The Board would like to understand how BJA can respond in the event of a pandemic.

(g) (*2 points*) Explain the differences between a firm's general environment and a firm's industry environment.

ANSWER:

(h) (*3 points*) 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.

ANSWER:

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

ANSWER:

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

ANSWER:

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

3.

(*26 points*) Information on Frenz can be found in section 4 of the case study. As an analyst working for the chief risk officer (CRO) of Frenz Corporation, you are asked to examine the potential impact of a global pandemic on Frenz's business.

(a) (*3 point*) Assess Frenz's financial health using Stocks & Flows.

(i) (*1 point*) Identify the stocks on Frenz's financial statements. Justify your answer.

ANSWER:

(ii) (*1 point*) Identify the flows on Frenz's financial statements. Justify your answer.

ANSWER:

(iii) (*1 point*) Describe the change in two of the flows over the last 5 years.

ANSWER:

The CRO gives you direction regarding modelling the impact of the pandemic:

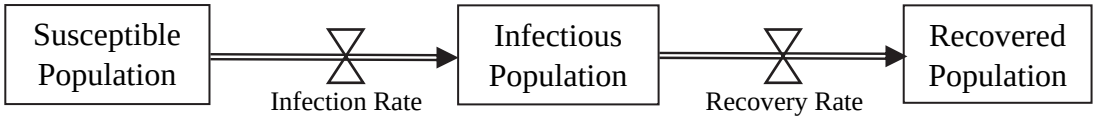
> "There are many moving parts, let's just focus on sales at our store locations. Let's assume that any impacts on the supply chain will not materially affect our ability to sell coffee. We can also assume the size of our customer base will not change during a pandemic. Keep it simple: infected people will buy nothing, for everyone else it will be business as usual. We will assume static rates and then calibrate until we get a result that looks reasonable."

(b) (*3 points*) Critique the CRO's direction based on the Modelling Process. Justify your answer.

ANSWER:

3. Continued

The CRO has proposed using the following SIR model.



(c) (*1 point*) Identify one variable referenced in the CRO's original statement that has been explicitly excluded from the SIR model.

ANSWER:

Past pandemics have illustrated phenomena (I to IV):

I. Once a pandemic is declared, governments take action to limit contact between people.
II. As the infectious population increases, the infection rate increases.
III. As the susceptible population decreases, the infection rate decreases.
IV. Following a medical breakthrough, the time to recover from the infection decreases greatly.

(d) (*4 points*) Explain whether each phenomenon (I to IV) is endogenous or exogenous. Justify your answer.

ANSWER:

(e) (*6 points*) Sketch causal loops for each phenomenon (I to IV), including how they fit into the existing SIR model.

ANSWER:

3. Continued

You use the following base assumptions to form your scenario as at the time a pandemic is first declared…

- Total Population = 10,000
- The entire initial population is considered susceptible to a new disease.
- Infected individuals have contact with 25 people each week.
- Infectivity is 10%.
- Infectious people take 2 weeks to recover.

(f) (*2 points*) Possible government actions (phenomenon I) include stay-at-home orders and mandatory transition to remote work rather than in-office.

(i) (*1 point*) Explain how these orders may affect Frenz's competitive environment.

ANSWER:

(ii) (*1 point*) Recommend an enhancement to the CRO's model based on your answer in (i).

ANSWER:

The model clearly indicates that Frenz will have lower revenue in the event of a pandemic, but does not give a complete picture of Frenz's operations. Of particular concern is whether or not Frenz will be able to meet its financial obligations.

(g) (*2 points*) Propose a way to integrate the SIR model and the Stock & Flow model used for Frenz's finances.

ANSWER:

3. Continued

Frenz will make a capital investment budget of $1 million with a specific goal to minimize the number of infections at Frenz stores in the event of a pandemic. Three initiatives have been identified that could be implemented, each independent of the other.

Option	Cost ($)	Number of Customers Impacted	Infection Rate Reduction (Impacted Customers Only)	Management Desirability Rating
1	500,000	100,000	15%	A
2	700,000	90,000	25%	C
3	350,000	50,000	10%	B

(h) (*5 points*)

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

ANSWER:

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

ANSWER:

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

ANSWER:

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

4.

(*27 points*) Information on Darwin Life Insurance Company (Darwin) can be found in Section 7 of the Case Study.

QRS Life (QRS) has approached RPPC with a proposal to acquire Darwin. QRS is a mature, well-capitalized firm seeking an opportunity to invest excess cash flows. QRS only operates in select European markets. It is seeking a distribution network to sell products in North America.

Alexis Marino, Darwin's CFO, has been asked to prepare financial information on Darwin.

(a) (*6 points*)

(i) (*0.5 points*) Explain the benefits of a Cross-Border Acquisition for an acquiring firm.

ANSWER:

(ii) (*0.5 points*) Explain why Cross-Border Acquisitions are subject to more risk than those within a firm's home country.

ANSWER:

(iii) (*3 points*) Describe three pitfalls QRS may encounter with the acquisition of Darwin. Justify your answer.

ANSWER:

(iv) (*2 points*) Describe two ways QRS can mitigate the pitfalls mentioned in (ii). Justify your answer.

ANSWER:

4. Continued

(b) (*5 points*) Alexis asks you to determine Darwin's current Fair Market Value as of year-end 2020.

(i) (*1 point*) Explain the difference between Firm Value and Enterprise Value.

ANSWER:

(ii) (*1.5 points*) Explain why Darwin's Enterprise Value may look low relative to Darwin's Firm Value.

ANSWER:

(iii) (*2 points*) Calculate a range and midpoint for Darwin's valuation using industry P/B and Forward P/E multiples in Exhibit 1 of Section 7A in the Case Study. Show your work.

ANSWER:

(iv) (*0.5 points*) Identify what values you have calculated in part (iii).

ANSWER:

4. Continued

(c) (*10 points*) QRS proposes to acquire Darwin for $1.6 billion.

(i) (*1 point*) Explain the implication of a 0% control premium.

ANSWER:

(ii) (*3 points*) Describe two changes QRS could make at Darwin that would increase Firm Value. Justify your answer.

ANSWER:

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

(iii) (*1 point*) Calculate the control premium using the midpoint value from part (b-iii). Show your work.

ANSWER:

(iv) (*2 points*) Interpret the difference between the purchase price QRS is willing to pay and the optimal value. Justify your answer.

ANSWER:

(v) (*3 points*) Explain how Darwin's activities and performance over the last 10 years have affected firm value. Justify your answer.

ANSWER:

4. Continued

Brandon Kaladin, CEO, sent you an email regarding the acquisition, but some of the statements are concerning.

(d) (*4 points*) 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!"

ANSWER:

(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."

ANSWER:

(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."

ANSWER:

(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!"

ANSWER:

(e) (*2 points*) Explain how an email from an assigned devil's advocate could help combat the bias in the email sent by Brandon.

ANSWER:

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

5.

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

Darwin Life Insurance Company has recently completed an acquisition of Snappy Life Insurance Company. Brandon Kaladin, CEO of Darwin Life, is determining how to best sell each product on Darwin's forthcoming digital distribution platform.

Brandon has identified two distinct customer groups and their probability of buying Snappy's or Darwin's products, respectively, when shown a particular product on the platform (the "Close Ratio"):

Customer Group	**Snappy Close Ratio**	**Darwin Close Ratio**
A	80%	20%
B	40%	60%

The after-tax margin for Snappy products is 15% and the after-tax margin on Darwin products is 12%. Brandon's objective is to maximize the unit after-tax margin per potential customer interacting with the platform. The platform workflow is as follows:

- Each potential customer responds to a lifestyle questionnaire.
- Based on the responses, an algorithm predicts whether the potential customer is in group A or group B. Denote the probability of a correct prediction as P.
- If the algorithm predicts the customer is in group A, it shows the customer the Snappy product; otherwise, the customer is shown the Darwin product.

(a) (*3 points*) Construct a decision tree describing the after-tax margin per potential customer.

ANSWER:

(b) (*2 points*) Calculate the Expected Monetary Value (EMV) for each possible algorithm outcome, as a function of P. Show your work.

ANSWER:

5. Continued

Assume an equal number of actual A and B customers interact with the platform.

(c) (*1 point*) Determine the minimum value of P the algorithm needs to achieve in order to produce an overall EMV of at least 8.00%. Show your work.

ANSWER:

(d) (*2 points*) Recommend two enhancements to the algorithm in the platform workflow that can help improve the EMV. Justify your answer.

ANSWER:

5. Continued

Brandon sent out a short email to all employees at Snappy and Darwin to inform them of the acquisition. Attached to the email were company profiles, very similar in size and nature to the Darwin Background in Section 7 and the Snappy Company Profile in Section 8.1 of the Case Study.

A small group of employees at Snappy feel that the merged company will no longer be an innovative, first-mover company. The email did not ease their concerns. A few employees have met with leaders at Darwin and feel encouraged, but their comments were dismissed by those in the small group. The group is now considering whether or not they should resign.

(e) (*4 points*)

(i) Identify two pitfalls of group decision making exhibited by the small group of Snappy employees. Justify your answer.

ANSWER:

(ii) Identify the type of conflict occurring. Justify your answer.

ANSWER:

(iii) Recommend a response and negotiating tactic for management. Justify your answer.

ANSWER:

****END OF EXAMINATION****