

Exam CFESDM

MORNING SESSION

Date: Wednesday, April 29, 2020

Time: 8:30 a.m. – 11:45 a.m.

INSTRUCTIONS TO CANDIDATES

General Instructions

1. This examination has a total of 100 points. It consists of a morning session (worth 60 points) and an afternoon session (worth 40 points).
 - a) The morning session consists of 4 questions numbered 1 through 4.
 - b) The afternoon session consists of 2 questions numbered 5 and 6.

The points for each question are indicated at the beginning of the question. Questions 1 - 3 pertain to the Case Study, which is enclosed inside the front cover of this exam booklet.

2. Failure to stop writing after time is called will result in the disqualification of your answers or further disciplinary action.
3. 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 on the exam booklet.

Written-Answer Instructions

1. Write your candidate number at the top of each sheet. Your name must not appear.
2. Write on only one side of a sheet. Start each question on a fresh sheet. On each sheet, write the number of the question that you are answering. Do not answer more than one question on a single sheet.
3. The answer should be confined to the question as set.
4. When you are asked to calculate, show all your work including any applicable formulas.
5. When you finish, insert all your written-answer sheets into the Essay Answer Envelope. Be sure to hand in all your answer sheets because they cannot be accepted later. Seal the envelope and write your candidate number in the space provided on the outside of the envelope. Check the appropriate box to indicate morning or afternoon session for Exam CFESDM.
6. Be sure your written-answer envelope is signed because if it is not, your examination will not be graded.

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Tournez le cahier d'examen pour la version française.

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.

****BEGINNING OF EXAMINATION****
Morning Session

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

1. (15 points)

- (a) (1 point) Describe how decision trees are used in decision analysis.
- (b) (2 points) Describe two benefits of using a decision tree.

Information on Blue Jay Tire (BJT) can be found in Section 3 of the Case Study.

BJT owns a plot of vacant land with market value of \$5 million. BJT management wants to maximize the Expected Monetary Value (EMV) of this land, by either building a plant or selling the land. A new plant built on this land may either process synthetic raw rubber or produce aviation tires.

Vacant land may be designated a Commercial Opportunity Zone (COZ) if used to implement new technologies such as synthetic rubber production; companies will be refunded a portion of construction costs for development within a COZ. BJT has already spent \$10 million lobbying to have their land designated as a COZ. There is a 25% chance that vacant land owned by BJT will be designated a COZ, in which case they will only process synthetic rubber. Otherwise, BJT will only produce aviation tires.

The Production Expansion Committee (PEC) has prepared future profit scenarios in the below table, considering only future expenses and revenues, and associated probabilities for producing aviation tires and for successfully processing synthetic rubber.

Scenario	Product Lines	Probability	Net Profit (\$m)
Low Demand	Aviation	30%	(\$50)
Medium Demand	Aviation	50%	\$10
High Demand	Aviation	20%	\$50
No Demand	Synthetic	20%	\$0
Low Demand	Synthetic	40%	\$80
High Demand	Synthetic	40%	\$480

1. Continued

(c) (6 points)

- (i) Construct a decision tree for BJT.
- (ii) Calculate the EMV for each node. Show your work.

(d) (1 point) Explain whether or not EMV should be used as the sole quantitative criterion for BJT's decision. Justify your answer.

The PEC has had a strong track record of success with several projects. Due to this success, BJT management has historically implemented any recommendation the PEC puts forward. However, their last two proposals have had very poor results.

BJT management is required to review and approve each scenario considered by the PEC prior to implementing any recommendations. After the first review, BJT management team approved the analysis.

(e) (5 points)

- (i) (1 point) Identify a cognitive bias to which BJT management may be prone. Justify your answer.
- (ii) (2 points) Describe how the bias identified in (i) may lead to a suboptimal decision on the use of the vacant land.
- (iii) (2 points) Recommend two debiasing techniques that BJT management could implement to improve on their ability to assess the analysis and recommendation from the PEC. Justify your answer.

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

2. (12 points) Information on Blue Jay Tire (BJT) can be found in section 3 of the Case Study.

(a) (1 point)

- (i) Identify three risks that impact how many tires BJT supplies.
- (ii) Identify one risk that impacts demand for tires produced by BJT.

You are asked to expand a supply-and-demand model to explain how oil price and number of tire recalls affect the price of tires produced by BJT.

(b) (3 points) Sketch a causal loop diagram of the model.

(c) (1 point) Recommend a way to mitigate risk based on the dynamic model developed in part (b). Justify your answer.

BJT plans to build additional production capacity to support its growth.

(d) (3 points) Sketch a causal loop diagram to illustrate how adding additional capacity will impact BJT's profit, by at least including the following nodes:

- Units Sold
- Profit
- Production Capacity

(e) (2 points) Evaluate the impact on sustainability and stability of the model due to adding production capacity. Justify your answer using the model in part (d).

(f) (2 points) Recommend a strategy to mitigate the risk of instability and improve sustainability. Justify your answer.

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

3. (14 points) Information on Darwin Life can be found in Section 7 of the Case Study.

Anne Kofsky, VP Life Insurance Division, would like to set the per-unit costs for the indexed universal life (IUL) equal to a multiple of those for the existing universal life product. She is most concerned about ensuring that the new product is priced competitively, so she doesn't want the per-unit expenses to be too high, nor does she want to invest too much time on the estimates. She will allocate expenses for the other product lines based on a total annual expense set by the Darwin Life CEO.

(a) (4 points) Critique Anne's approach to allocating expenses for the IUL product.

The IUL product was launched using Anne's per-unit expense assumptions, and a year later the following data was collected regarding planned and actual sales and new business profit.

\$ (millions)	Indexed Universal Life	Existing Universal Life	High Cash Value Trad Life
Planned Face Amount Sold	200	400	150
Actual Face Amount Sold	400	250	100
Planned Profit on Sales	5.5	10	3
Actual Profit on Sales	12	5	2

Anne says, "Based on this information, Darwin Life should focus on selling even more of the IUL product. It's doing even better than expected!"

(b) (2 points) Critique Anne's statement with respect to the performance of the products.

Darwin decides to follow Anne's recommendation and sells more of the IUL product. Darwin will hire additional staff dedicated to marketing and servicing the IUL within Darwin's existing facilities.

(c) (2 points) Propose a revised cost allocation method for Darwin that will improve the accuracy of the profitability for each line. Justify your answer.

3. Continued

Following a review of the expense assumptions, it is determined that expenses have been under-allocated to IUL. Darwin is considering re-allocating costs more equitably across the three product lines. Darwin has identified three stakeholders (A to C) that may be impacted by this change.

- A. Brandon Kaladin, CEO of Darwin
- B. Sales agents
- C. Current IUL Customers

(d) (6 points)

- (i) (1 point) Define power.
- (ii) (2 points) Explain which individual bases of power apply to each stakeholder (A to C) listed above.
- (iii) (3 points) Recommend the order of prioritization, from most to least important stakeholder (A to C) for Darwin to satisfy. Justify your answer.

4. (19 points) XYZ Insurance Company must purchase \$100 million of reinsurance cover annually to meet their risk appetite.

Ruth Brown, Chief Actuary, is only considering three reinsurance companies: Dinosaur, Sloth and Mammoth. Dinosaur is not willing to write coverage unless their share of the \$100 million cover is at least 30%.

The credit ratings and pricing offers of the three reinsurers are provided below.

Reinsurer	Internal Credit Score	Reinsurance Price (% of Cover)
Dinosaur	6	10%
Sloth	3	8%
Mammoth	2	6%

Geoff Pepper, Chief Risk Officer, has stated that the dollar-weighted-average Credit Rating on the reinsurance program needs to be above the internal company credit score of 5. He also would like to limit Mammoth's share of the program to be no more than 25% of Sloth's share.

Geoff wants to use linear optimization to determine the lowest feasible reinsurance price.

- (a) (5 points)
- (i) State the objective function.
 - (ii) State the constraint functions.
 - (iii) Sketch the feasible region.
 - (iv) Determine the optimal price. Show your work.
- (b) (3 points) Critique the program structure with respect to the Bargaining Power of Suppliers.
- (c) (2 points) Propose two changes to the linear optimization problem based on your critique in (b).

4. Continued

You are asked to evaluate the following scenarios in order to perform Sensitivity Analysis on the optimal solution:

- A. The prices for Sloth and Mammoth increase by +1%.
- B. Tolerance for weighted-average reinsurance counterparty risk decreases.
- C. More reinsurance cover is required. Assume that the additional reinsurance has the same risk profile as the originally proposed \$100 million.

(d) (4 points)

- (i) Determine the shadow price of each constraint in the optimization problem defined in part (a). Show your work.
- (ii) Describe the implications of your answer to part (i) with respect to the above scenarios (A to C).

(e) (5 points) The following conversation was held between Ruth and Edward Pink, Chief Executive Officer.

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

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

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

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

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

- (i) (2 points) Describe two barriers to effective communication that are exhibited in the above communication.
- (ii) (3 points) Recommend three interpersonal communication skills Ruth should rely upon when presenting at the Board meeting. Justify your answer.

****END OF EXAMINATION****

Morning Session

USE THIS PAGE FOR YOUR SCRATCH WORK