

Exam CFEFD

AFTERNOON SESSION

Date: Tuesday, April 28, 2020

Time: 1:30 p.m. – 3:45 p.m.

INSTRUCTIONS TO CANDIDATES

General Instructions

1. This afternoon session consists of 4 questions numbered 8 through 11 for a total of 40 points. The points for each question are indicated at the beginning of the question. No questions pertain to the Case Study.
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 CFEFD.
6. Be sure your written-answer envelope is signed because if it is not, your examination will not be graded.

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****BEGINNING OF EXAMINATION****

Afternoon Session
Beginning with Question 8

8. (10 points) You are a credit analyst reviewing the quality of Tuque Bank's financial statements.

(a) (2 points) Outline the general steps to evaluate the quality of financial statements.

In your analysis, you are concerned with the following potential issues:

- I. Overstatement of cash flow from operations
- II. Overstatement of operating income
- III. Mis-statement of balance sheet items

(b) (2 points) Identify two warning signs for each of I-III that may indicate if there are significant concerns.

You analyze Tuque's solvency position by applying Altman's bankruptcy prediction model. You have the following results:

Calendar Year	2019	2018	2017	2016	2015
Tuque's Altman Z-score	2.4	2.2	2.0	1.8	1.6
Industry Average Altman Z-score	1.9	2.0	2.1	2.2	2.3

(c) (4 points)

- (i) Explain the significance of each component in the Altman's Z-score formula.
- (ii) Interpret the financial health of Tuque based on its Altman's Z-score.
- (iii) Hypothesize two reasons for the difference in Tuque's Altman's Z-score and that of the banking industry.
- (iv) Propose how to validate your hypotheses from (iii).

(d) (2 points)

- (i) Explain two drawbacks of the Altman's Z-Score.
- (ii) Describe two alternative credit ratios to supplement the Altman's Z-score for credit analysis.

9. (9 points) Jim Norton's Donuts is opening a new high-end coffee shop to attract an upscale clientele. You are using the classic Data Envelopment Analysis model to select the location for the new coffee shop.

You have calculated the Max Efficiency Ratio (MER) for locations A and B. You are given the following data to calculate the MER for location C.

Location C	Unit of resources	Weight
Input 1	8	X^2+2X
Input 2	4	$0.6-X^2-2X$
Input 3	4	0.4
Output 1	1	X
Output 2	8	$X+0.5$
Output 3	2	$0.5-2X$

- MER for location A = 0.4
- MER for location B = 0.8
- Expression of efficiency ratio for location A in solving for MER for location C: $3-8X$
- Expression of efficiency ratio for location B in solving for MER for location C: $6X-1$

- (a) (3 points) Recommend the best location for the coffee shop based on your MER analysis. Show your work.

You are considering adopting one of the following process architectures for the new coffee shop:

- Using a machine that automates the entire coffee process from grinding the beans to frothing the milk. Pre-making all the sandwiches to achieve consistency in quality.
- Hiring and training experienced staff to make customized coffee and sandwiches.

- (b) (2 points)

- Critique each of the two process architectures described in I-II.
- Recommend which process architecture is better for the coffee shop. Justify your recommendation.

9. Continued

The coffee shop has been in operation for a few months. You are looking for ways to measure the performance of the shop. The following two performance measures are being considered:

- Customer satisfaction scores measured by short surveys
- Volatility of acidity in each roast and type of coffee bean

- (c) (1 point) Explain an advantage and a disadvantage for each of the two performance measures.

The store's operations frontier is defined by quality " x " ($x > 0$) and variety " y " ($y > 0$). The store's strategic position in terms of quality and variety is given by (30, 20). The operations frontier is given by:

$$1 = \frac{x^2}{2025} + \frac{y^2}{1600}$$

- (d) (1 point) Sketch the operations frontier and the store's strategic position.

Jim Norton's wants to expand its high-end coffee shop business. It considers the following business strategies:

- A. Expand the drink menu.
 - B. Implement strict information technology policies to decrease operational risks.
 - C. Acquire state-of-the-art nitro coffee machines that are not yet used by competitors.
 - D. Acquire a local coffee shop known for inexpensive and fast-serve coffee.
- (e) (2 points) Explain how each strategy (A-D) could impact the store's strategic position in relation to the operations frontier.

- 10.** (9 points) Your company's investment management team has a long history of managing investment-grade bonds and is considering whether to invest in high-yield bonds. The team plans to develop a predictive analytics model to project bond defaults over a one-year period.

The team trains an algorithm based on the full dataset of bond investments. Below are the confusion matrices for the investment-grade and high-yield portfolios.

<i>Investment Grade</i>		Prediction	
		Non-Default	Default
Actual	Non-Default	8265	1370
	Default	17	32

<i>High Yield</i>		Prediction	
		Non-Default	Default
Actual	Non-Default	1031	71
	Default	26	8

- (a) (2 points) Describe the appropriateness of the team's approach for each of the following machine learning processes:
- (i) Hold-out testing
 - (ii) Profit and loss impact
- (b) (1 point) Define the following three performance measures:
- (i) Misclassification rate
 - (ii) True positive rate
 - (iii) True negative rate
- (c) (2 points) For each bond portfolio:
- (i) Calculate each of the performance measures from (b). Show your work.
 - (ii) Evaluate the quality of the predictive analytics models based on the performance measures calculated in (i).

10. Continued

Your team gives you the following information about the expectations for each bond portfolio over the next year:

	Investment- Grade Portfolio	High-Yield Portfolio
Annual Coupon Rate	5%	11%
Annual Default Rate	0.5%	3%
Loss Given Default	50%	60%

Assume that the typical bond in each portfolio has a \$1,000 par value.

- (d) (1 point) Calculate the profit matrices for each bond portfolio. Show your work.
- (e) (2 points) Calculate the total expected profit for each bond portfolio. Show your work.
- (f) (1 point) Recommend whether or not to invest in high-yield bonds. Justify your recommendation.

- 11.** (12 points) InNeed, a web-based analytical company, offers stochastic modeling that helps its e-commerce clients make outsourcing decisions. The table below is a simulation output of price distribution for a component to be outsourced from each vendor for a Canadian client, Bannuck Company (BC).

Vendor	Avg Cost	Min Cost	Max Cost	Probability of failure (including product, delivery, etc.)	Probability of being lowest cost alternative
A	0.6	0.05	1.58	0.3134	0.69
B	1.2	0.22	1.61	0.2971	0.31
C	2.8	2.5	3.5	0.0245	0
Current	2.5	2.1	3.8	0.1212	n/a, current vendor

- (a) (2 points) Compare and contrast each alternative vendor to BC's current vendor, using the simulation results.

BC's CEO realizes BC will be subject to new, international risks once it selects a vendor and she would like a careful analysis of BC's income using VaR(95).

- (b) (1 point) Evaluate the use of VaR as a risk measure to address the CEO's concerns.

A new simulation has been run to determine the severity of failure for each potential new vendor. The simulation results are in the table below.

Vendor	Measure given failure occurs		
	Average Loss	Conditional-Value-at-Risk	
		CVaR (60)	CVaR (95)
A	6	12	25
B	7	14	20
C	12	14	30
Current	11	12	30

- (c) (2 points) Recommend which vendor BC should select considering both simulations. Justify your recommendation.

After meeting with the CFO, you realize he is most concerned with CVaR(60) and the probability of failure. He is least concerned with average cost.

- (d) (2 points) Explain how you would use linear programming to recommend which vendor to select given both simulations and the CFO's preferences.

11. Continued

The CRO is concerned with dependency on a single vendor, but at the same time wants to maximize the expected profit margin while staying within budget. BC has an annual budget of 100,000 to allocate across vendors.

	A	B	C
Average Profit Margin	0.15	0.05	0.20
Covariance with A	0.025	0.000468	-0.0022
Covariance with B		0.0016	-0.00025
Covariance with C			0.10

With the objective of maximizing profit margin and staying within budget, InNeed produced the following table:

		Allocation of Vendor Budget		
Probability (profit margin > 0)	z-score	A	B	C
0.80	-0.842	32,090	0	67,910
0.90	-1.282	52,590	27,260	20,150
0.95	-1.645	19,880	72,870	7,250

- (e) (3 points) Assume a one-tailed normal distribution at a probability of 80%.
- Calculate the expected profit margin. Show your work.
 - Calculate the volatility of the profit margin. Show your work.
 - Verify the chance constrained is 0 based on your solutions in (i) and (ii).
- (f) (2 points) Describe the changes to the following if the new objective is to minimize the volatility:
- InNeed's vendor budget allocation
 - Expected profit margin
 - Volatility of profit margin

****END OF EXAMINATION****
Afternoon Session

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