# STRATHMORE BUSINESS SCHOOL

MASTER OF SCIENCE IN DEVELOPMENT FINANCE

**END OF SEMESTER EXAMINATION**

**MDF 8103: QUANTITATIVE METHODS IN DEVELOPMENT FINANCE**

**Date:** Friday 17th December 2021 **Time: 3** Hours

**Instructions**

1. This examination consists of **SIX** questions.
2. Answer any **THREE** questions.
3. You are expected to work independently
4. All the questions carry equal marks
5. Marks may be awarded for neatness of work
6. This formular may be useful from

$$\hat{y} = b_0 + b_1 x$$

$$b_1 = \frac{n\sum xy - \sum x \sum y}{n\sum x^2 - (\sum x)^2}$$

$$b_0 = \frac{\sum y}{n} - b_1 \frac{\sum x}{n}$$

**Question 1 (25 marks)**

(a) Explain the **four (4)** elements of **Decision Analysis**. **[6 *marks*]**

(b) Discuss the **difference** among **decision making under certainty**, **decision making under risk**, and **decision making under uncertainty**. **[6 *marks*]**

(c) Dorothy is considering the possibility of opening a small dress shop at Madaraka Estate, a few blocks from Strathmore University – Nairobi. She has located a good mall that attracts students. Her options are to open a small shop, a medium-sized shop, or no shop at all. The market for a dress shop can be good, average or bad. The probabilities for these three possibilities are 0.2 for a good market, 0.5 for an average market and 0.3 for a bad market. The net profit or loss for the medium-sized and small shops for the various

market conditions are given in the following table: building no shop at all yields no loss and no gain.

| ALTERNATIVE | Good Market KSh | Average Market KSh | Bad Market KSh |
|---|---|---|---|
| **Small Shop** | 75,000 | 25,000 | - 40,000 |
| **Medium-sized Shop** | 100,000 | 35,000 | - 60,000 |
| **No Shop** | 0 | 0 | 0 |

i) What advice would you give to Dorothy to help in her decision to open a shop. **[6 *marks*]**

ii) Calculate the *Expected Value of Perfect Information* (**EVPI**) and interpret the result. **[7 *marks*]**

**Question 2 (25 marks)**

The manager of the Goil Service Station wants to forecast the demand for unleaded gasoline next month so that the proper number of gallons can be ordered from the distributor. The owner has accumulated the following data on demand for unleaded gasoline from sales during the past 10 months:

| Months | Gasoline Demanded (gal.) |
|---|---|
| October | 800 |
| November | 725 |
| December | 630 |
| January | 500 |
| February | 645 |
| March | 690 |
| April | 730 |
| May | 810 |
| June | 1,200 |
| July | 980 |

(a) Compute a 3-month moving average forecast for months 4 through 11.

**[4 *marks*]**

(b) Compute a weighted 3-month moving average forecast for months 4 through 11. Assign weights 0.5, 0.3, and 0.2 to the months in sequence, starting with the most recent month. **[4 *marks*]**

(c) Compute an exponentially smoothed forecast, using an $\alpha$ value of 0.30

**[5 *marks*]**

(d) Compare the three forecasts by using MAD and determine which forecast appears to be more accurate? **[12 *marks*]**

**Question 3 (25 marks)**

(a) *Decision tree* approach can be used to solve **Decision Analysis** problems with *Pay-off tables*. However, *Pay-off tables* cannot be created for certain *Decision Analysis* problems. **Comment**. **[5 *marks*]**

(b) **Klever Logistics** is about to install a new machine for making parts for domestic appliances. Three suppliers have made bids to supply the machine. The first supplier offers the **Basicor** machine, which automatically produces parts of acceptable, but not outstanding quality. The output from the machine varies (depending on the materials used and a variety of settings) and might be 1,000 a week (with probability 0.1), 2,000 a week (with probability 0.7) or 3,000 a week. The notional profit for this machine is KSh 4.00 a unit. The second supplier offers a **Superstamp** machine, which makes higher quality parts. The output from this might be 700 a week (with probability 0.4) or 1,000 a week, with a notional profit of KSh 10.00 a unit. The third supplier offers the **Switchover** machine, which managers can set to produce either 1,300 higher-quality parts a week at a profit of KSh 6.00 a unit, or 1,600 medium-quality parts a week with a profit of KSh 5.00 a unit.

If the machine produces 2,000 or more units a week, Clever can export all production as a single bulk order. Then there is a 60% chance of selling this order for 50% more

profit, and a 40% chance of selling for 50% less profit. What should Klever do to maximize the expected profit? **[20 *marks*]**

**Question 4 (25 marks)**

(a) What does regression analysis do? **[2 *marks*]**

(b) Explain what is meant by *Simple Linear Regression* and *Multiple Linear Regression* given an example in each case to support your explanation. **[3 *marks*]**

(c) Management of Armand's Pizza Parlor has collected data from a sample of 10 Armand's Pizza Parlor restaurants located near college campuses.

| **Restaurant** $i$ | **Student Population (1000s)** $x_i$ | **Quarterly Sales ($1000s)** $y_i$ |
|---|---|---|
| 1 | 2 | 58 |
| 2 | 6 | 105 |
| 3 | 8 | 88 |
| 4 | 8 | 118 |
| 5 | 12 | 117 |
| 6 | 16 | 137 |
| 7 | 20 | 157 |
| 8 | 20 | 169 |
| 9 | 22 | 149 |
| 10 | 26 | 202 |

***Required:***

i) Using the ***least squares*** techniques, calculate the values of $a$ and $b$ in the equation $y = a + bx$, to allow management to ***forecast*** sales for a new restaurant they were considering opening near a college campus. **[15 *marks*]**

ii) using the estimated regression equation, forecast quarterly sales for a new restaurant to be located near a campus with 16,000 students. **[5 *marks*]**

**Question 5 (25 marks)**

A shoe store's records show that 30% of customers making purchase use a credit card to make payment. This morning, 20 customers purchased shoes from the store.

(a) Find the probability that at least 12 of the customers used a credit card.

**[6 *marks*]**

(b) What is the probability that at least 3 customers, but not more than 6, used a credit card? **[5 *marks*]**

(c) What is the expected number of customers who used a credit card?

**[4 *marks*]**

(d) Find the probability that exactly 14 customers did not use a credit card.

**[6 *marks*]**

(e) Find the probability that at least 9 customers did not use a credit card.

**[4 *marks*]**

**Question 6 (25 marks)**

(a) A tollbooth operator has observed that cars arrive randomly at an average rate of 360 cars per hour.

i) Using the formula, calculate the probability that only two cars will arrive during a specified 1-minute period. **[7 marks]**

ii) Find the probability that only two cars will arrive during a specified 1-minute period. **[5 marks]**

iii) Find the probability that at least four cars will arrive during a specified 1-minute period. **[4 marks]**

(b) Records show that there is an average of three accidents each day in Nairobi (the capital city of Kenya) between 2 and 3 P.M.

i) Use the Poisson probability formula to find the probability that there will be exactly one accident between 2 and 3 P.M. on a particular day. **[3 marks]**

ii) Find the probability that there will be at least three accidents between 2 and 3 P.M. on a particular day. **[3 marks]**

iii) Find the probability that there will be at least three accidents between 2 and 2:30 P.M. on a particular day. **[3 marks]**