Machakos University College

(*A Constituent College of Kenyatta University*)

University Examinations 2013/2014 Academic Year

SCHOOL OF BUSINESS AND ECONOMICS

DEPARTMENT OF BUSINESS ENTRERENUERSHIP AND MANAGEMENT STUDIES

EXAMINATION FOR THE DEGREE OF MASTERS IN BUSINESS ADMINISTRATION

BMS 500: QUANTITATIVE TECHNIQUES

APRIL BLOC EXAMS   **TIME: 11:30 - 1.30 Pm**

INSTRUCTIONS

Answer Question One and any two other Questions

QUESTION ONE (Compulsory)

(a)   A firm's total revenue is given by the function

$$R = Q^3 - 7.5Q^2 - 18Q + 700$$

      (i)   Determine the average revenue when the output Q is 20 units   (4 marks)

      (ii)   Work out the levels of the output Q at which the total revenue R is maximized.

                                                                (6 marks)

(b)   A sales manager of a certain company knows from experience that, the sales of the 500 company sales representatives are normally distributed with mean 80 million shillings and a standard deviation of 5 million shillings. If all the sales representatives with sales of 90 million and above were promoted to regional sales managers, determine how many sales representatives were promoted   (4 marks)

(c)   Determine the inverse of the 3x3 matrix $\begin{bmatrix} 1 & -2 & 0 \\ 0 & 3 & 2 \\ 1 & 0 & -1 \end{bmatrix}$ (6 marks)

(d)   The table below shows the scores awarded to two candidates by a panel of ten people

Candidate A	8	5	8	9	4	8	7	5	6	5
Candidate B	6	6	7	7	5	7	8	4	7	6

Compute the Spearman's rank correlation coefficient for the data   (6 marks)

(e)   Given a population of five members show that the mean of the sample mean $(\mu_{\bar{x}})$ is

        equal to the population mean (μ) by taking a sample of size 3.   (4 marks)

6	18	3	3	27

QUESTION TWO

(a)   Suppose that an economy is based on two sectors: Wheat and Oil. To produce 1 metric

        ton of wheat requires 0.3 metric tons of wheat and 0.1 metric tons of oil while to produce

        1 metric ton of oil requires 0.2 metric tons of wheat and 0.4 metric tons of oil.

        If in the month of June 2013 a total of 5000 metric tons of wheat and 2000 metric tons of

        oil were produced,

        (i)   Determine many metric tons of wheat and oil were consumed internally (used to

                produced wheat and oil) and how many metric tons of each was let for external

                consumption.   (4 marks)

        (ii)   Find the total production levels of wheat (x) and oil (y) required to satisfy external

                demand of 4500 and 1800 metric tons of wheat and oil respectively using the fact

                that

                $$P = (I - C)^{-1}D$$

                Where P is the production matrix expressed as $P = \begin{pmatrix} x \\ y \end{pmatrix}$, C is the consumption

                matrix given by $C = \begin{pmatrix} 0.3 & 0.2 \\ 0.1 & 0.4 \end{pmatrix}$, D is the demand matrix given by $D = \begin{pmatrix} 4500 \\ 1800 \end{pmatrix}$

                and I is a 2x2 Identity matrix   (8 marks)

(b)   A supplier of three items has established that, the quantities required by one of the client

        are related by the 3 systems of linear equations given below.

        $$8q_1 + 4q_2 + 4q_3 = 114$$
        $$4q_1 \qquad + q_3 = 48$$
        $$5q_1 + 3q_2 + 6q_3 = 77$$

        Using Cramer's method determine the values of $q_1, q_2, and\ q_3$ (8 marks)

QUESTION THREE

The marketing manager of Prime Roses Company wanted to establish whether there is any relationship between the amounts of money spend in adverting and income generated from the advertised product. To realize objective the manager picked the annual data on sales income (y) and advertising expenditure (x) for the last ten years (x, y) and computed the following quantities.

$$\sum x = 135 \quad \sum y = 110 \quad \sum xy = 1,700 \ \sum x^2 = 5,925 \text{ and } \sum y^2 = 3,050$$

Upon verification the manager later realized that the data for two yeas were wrongly copied as (5, 15) instead of (15, 10) and (10, 10) instead of (15, 5).

(a) (i) Re-compute the quantities using the correct values. (10 marks)

    (ii) Using the quantities computed in (i) above, determine the Pearson's correlation coefficient between Sales (x) and income (y). (4 marks)

(b) (i) In order to predict the expected income (y) for a specified adverting cost (x), the manager fitted a linear regression model of $y = a + bx$.

        Using the quantities obtained in (a (i)) above, determine the values of the constant (a) and the regression coefficient (b). (4 marks)

    (ii) Using your fitted regression model, advice the manager on how much he should spend to realize sales income of 25. (2 marks)

QUESTION FOUR

(a) (i) In testing a statistical hypothesis one is likely to commit two types of errors. State the errors and clearly explain when they are committed. (3 marks)

    (ii) Differentiate between a sample and a population. (3 marks)

(b) The Production manager with a packaging company running three shifts collected the data shown in the table below in a certain week.

Packet Condition	Shift		
	Morning	Afternoon	Night
Good	1500	1100	1450
Bad	300	400	250

(i)   Generate a marginal and joint probability table and compute the probability that an item picked at random will be bad given it comes from the night shift.

(6 marks)

(ii)   Generate the expected frequency table and use it to test whether the number of bad packets is independent of the shift at 1% level of significance.   (8 marks)

QUESTION FIVE

(a)   A manufacturing company can sell Q quantities of match boxes that company produce in a year. The average cost of producing Q match boxes in a year is given by the function

$$AC = \frac{1}{3}Q^2 + Q - 1$$

The demand function of the company match boxes is estimated as $P = \frac{2}{3}Q^2 - 0.5Q + 1$

(i)   Derive the total revenue function (TR)   (3 marks)

(ii)   Work out the total profit function   (4 marks)

(iii)   Determine how many match boxes should be produced in order to maximize profit?   (6 marks)

(b)   Given that $\frac{dC}{dx} = 21 + 4x - x^2$, where C is the total Cost (in millions) incurred in producing **x** items in a particular day

(i)   Determine the total cost function   (2 marks)

(ii)   Find the number of items **x** that should be produced in a day in order to minimize total cost   (4 marks)

(iii)   Work out the marginal cost when the total cost is at its minimum.   (1 marks)