



Machakos University College

(A Constituent College of Kenyatta University)

University Examinations 2013/2014 Academic Year

SCHOOL OF BUSINESS AND ECONOMICS

DEPARTMENT OF BUSINESS ENTREPRENEURSHIP AND MANAGEMENT STUDIES

**EXAMINATION FOR THE DEGREE OF MASTERS IN BUSINESS
ADMINISTRATION**

BMS 500: QUANTITATIVE TECHNIQUES

TIME: 11:30 - 1.30 Pm

INSTRUCTIONS:

Answer Question One and any two other Questions

QUESTION ONE (Compulsory)

- (a) The total production cost of a certain firm for producing Q units is given by the function.

$$TC = \frac{Q^3}{3} - 1.5Q^2 - 10Q + 30$$

- (i) Determine the average cost of producing 12 units (3 marks)
(ii) Determine the levels of Q at which the cost of production is at its lowest (5 marks)

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

- (c) John was studying the relationship between three variables in his MBA project. After computing the Spearman Rank Correlation coefficient between the variables he got the following results $r'_{xy} = -0.79$, $r'_{xz} = 0$ and $r'_{yz} = 1$ which he was unable to make an interpretation of its findings. With aid of a graphical sketch explain the relationship between xy, xz and yz (6 marks)

- (d) The purchasing manager of a certain business firm has established that the probability of securing a tender when the firm applies is 0.45. If the firm has applied for 5 such tenders, work out the probability that the firm will get more than one tender. (5 marks)
- (e) The Production manager with a certain company using three machine models collected the data shown in the table below in a certain week.

Performance	Model		
	Chaina	Japan	India
Good	1500	1100	1450
Defective	300	400	250

At 1% level of significance test whether the number of defective units are independent of the machine model at 1% level of significance (5 marks)

QUESTION TWO

- (a) The cost of building an office block with x floors is made up of three components namely 10 million for land, 0.25 million cost per floor and a specialized cost of $1000x$ per floor.
- (i) How many floors should the block contain if the average cost per floor is to be minimized? (7 marks)
- (ii) Compute the average cost per floor in millions of shillings (2 marks)
- (iii) Determine the total cost of putting up the block (4 marks)
- (c) Given that $\frac{dC}{dx} = 21 - 10x + x^2$, 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 mark)

QUESTION THREE

- (a) The prices of three interdependent commodities in a certain country were found to have the relationship given below, using Cramer's method find the values for p_1 , p_2 and p_3

$$5p_1 + 3p_2 + 6p_3 = 77$$

$$8p_1 + 4p_2 + 4p_3 = 114$$

$$4p_1 + p_3 = 48$$

(8 marks)

- (b) Suppose that an economy is based on two industries: Electricity and Water. To produce one dollar worth of electricity the electricity company requires 0.3 dollars of electricity and 0.1 dollars of water while to produce one dollar worth of water the water company requires 0.2 dollars of electricity and 0.4 dollars of water.

- (i) If in the year 2013, the electricity company produced a total of 5000 dollars worth of electricity and the water company produced a total of 2000 dollars worth of water, determine how much worth of dollars of electricity and water was available for external needs after internal consumption. (4 marks)

- (ii) If the external demand is actually 4500 and 1800 dollars worth of electricity and water respectively, determine how much should each sector produce to meet both internal and external (8 marks)

QUESTION FOUR

- (a) The following quantities were computed from data on supply (in thousands units - x) and price (hundreds -y) of a certain Item.

$$n = 5 \quad \sum x = 135 \quad \sum y = 110 \quad \sum xy = 1,750 \quad \sum x^2 = 5,875 \quad \text{and} \quad \sum y^2 = 3,050$$

Upon verification the manager later realized that the data for one year was found to have been wrongly copied as (5, 15) instead of (20,5).

- (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 price and supply (4 marks)
- (b) (i) In order to predict the expected price (y) for a specified supply (x), the linear regression model of $y = a + bx$ was fitted on the data

- Using the quantities obtained in (a (i)) above, determine the values of the constant (a) and the regression coefficient (b). (4 marks)
- (iii) Using the regression model in b(i) predict the price of the item when supply is 8,000 units (2 marks)

QUESTION FIVE

- (a) The production manager of a production firm gave the average cost function of the firm as
- $$AC = -1 + Q + \frac{1}{3}Q^2$$

while the revenue director stated the average revenue function of the firm as

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

- (i) Determine the profit function of the firm (4 marks)
- (ii) Work out the levels of Q for which the profit at maximum and minimum (6 marks)
- (b) A firm's short-run production function is given by

$$Q = 6L^2 - 0.2L^3$$

where L denotes the numbers of workers.

Find the size of the workforce that minimizes output and hence a graph of this production function (10 marks)