



MACHAKOS UNIVERSITY COLLEGE

(A Constituent College of Kenyatta University)
University Examinations for 2015/2016 Academic Year

SCHOOL OF BUSINESS AND ECONOMICS

DEPARTMENT OF BUSINESS ENTREPRENEURSHIP AND MANAGEMENT
SCIENCES

FIRST SEMESTER EXAMINATION FOR MASTER IN BUSINESS ADMINISTRATION

BMS 840: QUANTITATIVE TECHNIQUES

Date: 3/12/2015

Time: 3 HOURS

INSTRUCTIONS

Answer Question ONE and any other TWO Questions

QUESTION ONE

- (a) The marketing manager of a manufacturing company has established that the current market share for Brand S is 40%. After a year months of aggressive marketing campaign for the product, market analysis revealed that the chances of Brand S customers purchasing it again is 0.8 and 0.3 for customers of competing Brands switching to Brand S. Determine the market share of Brand S after the one year of aggressive campaign. **(6marks)**
- (b) The Revenue Manager has established that the company's total revenue can be defined by the function

$$R = 700 - 18Q - \frac{15}{2}Q^2 + Q^3$$

- (i) Work out the company's Average Revenue (AR) when the output Q stand at 10 units **(2marks)**

- (ii) Determine many units of Q should the company produce to maximize the total revenue R. **(6marks)**
- (c) The Quality Manager of a production company has established that out of every 100 items produced in a day 2 are defective. Work the probability that if five items are drawn at random from the daily production more than one item will be defective. **(6 marks)**
- (d) Two candidates competing for a Business Admin position rated as shown in the table below by a panelist of ten judges

Job	5	5	8	9	4	8	7	5	6	8
Joan	6	6	7	7	5	7	8	4	7	6

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

QUESTION TWO

The table below shows the price and the corresponding age of a car from various car yards.

Car Age in years (x)	4	12	6	16	8	10	5	18	21	14
Cost of the car (0'000) (y)	120	40	84	24	65	70	105	25	20	42

- (a) Workout the Karl Pearson's correlation coefficient between age and cost of the car. **(6 marks)**
- (b) (i) Estimate the simple linear regression line of cost of the car on the age of the car. **(5 marks)**
- (ii) Compute the coefficient of determination **(2 marks)**
- (iii) Using the fitted regression line, determine the age of the car Simon should buy with his money. **(2 marks)**
- (b) A firm's production function in terms of number of workers (L) is given by
- $$Q = 2L^2(3 - 0.1L)$$
- Determine the size of the workforce (L) that maximizes output and hence a graph of this production function **(5marks)**

QUESTION THREE

- (a) Market research puts the current market share of the three brands X, Y and Z at 10%, 25% and 60% respectively. The probabilities of the royal customers of three competing products X, Y and Z remaining in their respective brands are 0.2, 0.3 and 0.6. Market research has established that every year Brand X customers transit from X to brand Y or Z with probabilities 0.3 and 0.5 respectively, those in brand Y transit to X or Z with probabilities 0.6 and 0.1 respectively while brand Z customers move from Z to X and Y with probabilities 0.3 and 0.1 respectively.
- (i) Draw a transition diagram for this information **(4 marks)**
 - (ii) Formulate the transition probability matrix (P) and initial state matrix (S_0) **(3 marks)**
 - (iii) Work the market share of each brand on the third year **(6 marks)**
- (b) An economy is based on three sectors: Electricity, Water and Agriculture. The production of a dollar's worth of Electricity requires an input of 0.15 dollars from the electricity sector and 0.2 dollars from the water sector. The production of a dollar worth of water requires an input of 0.25 dollars from electricity sector and 0.4 dollars from the water sector while the production of a dollar worth of agriculture requires input of 0.3 dollars from the electricity sector, 0.1 dollars from water sector and 0.4 dollars from the agriculture sector.
- (i) If the Electricity and Agriculture sector each produced a total of 30 and 40 dollars' worth of electricity and agriculture respectively in 2014, determine how many dollars were available for external consumption for each sector after satisfying the internal demand. **(3 marks)**
 - (ii) Find the output required from each sector to meet an external demand of 200 billion dollars of electricity, 100 billion dollars of water and 300 billion dollars of agriculture. **(12 marks)**

QUESTION FOUR

- (a) The average revenue and average cost functions a production firms can be expressed as

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

Formulate the profit function of the firm; hence determine the levels of Price (P) and quantity (Q) for which the profit is at maximum **(10 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.

$$5q_1 + 3q_2 + 6q_3 = 26$$

$$3q_1 + 4q_2 = 15$$

$$4q_1 + q_3 = 6$$

Work out the values of q_1 , q_2 , and q_3 that satisfies the three equations **(10 marks)**

QUESTION FIVE

The Production manager with a production company uses three types of machine to produce product Q. The quality of the products produced by each machine is shown in the table below.

Item Quality	Machine		
	Chaines	Japanese	Korean
Good	1500	1100	1450
Defective	300	400	250

- (a) Generate a joint and marginal probability table and determine the probability
- (i) that a product picked at random is of good quality **(3 marks)**
 - (ii) that a product picked at random is produced by Japanese machine and is defective **(3 marks)**
 - (iii) that a product picked at random is defective given it is produced by Korean machine **(4 marks)**
- (b) Generate the expected frequency table and use it to test whether the number of rejects is independent of the machine model at 1% level of significance **(10 marks)**