



The Co-operative University College of Kenya
(A Constituent College of Jomo Kenyatta University of Agriculture & Technology)

SUPPLEMENTARY/SPECIAL EXAMINATION -2016

**EXAMINATION FOR THE DEGREE OF BACHELOR OF CO-OPERATIVE
BUSINESS
UNIT CODE: HCOB 2201
UNIT TITLE: MANAGEMENT MATHEMATICS**

DATE:

TIME: 2 HOURS

INSTRUCTIONS:

- Answer question **ONE (compulsory)** and any other **TWO** questions

QUESTION ONE

- (a) Define the following terms are applied Maku analysis
- Transition matrix (2 marks)
 - Initial probability vector (2 marks)
 - Equilibrium (2 marks)
 - Absorbing state (2 marks)
- (b) A firm has estimated that their demand curve is represented by the curve $AR = 200 - 8Q$ where AR is average revenue in millions of shillings and Q is the output in units. The firms cost profile shows that its marginal cost is given by $MC = Q^2 - 28Q + 211$ in million shillings. When not producing anything the firm fixed cost is shs 10 million.
- Find an expression for profit (5 marks)
 - Find the level of output that maximizes profit (6 marks)
 - The equation of marginal revenue (3 marks)
- (c) Matrix X give the details of components parts used in the make – up of two products P₁ and P₂, matrix Y gives details of products made on each day of the week as follows
- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|----------------|----------------|---|---|----------------|---|---|---|----------------|---|---|---|---|--|----------------|----------------|-----|---|---|-----|---|---|-----|---|---|-------|---|---|-----|---|---|
| <p>Matrix X</p> <table border="0" style="width: 100%;"> <tr> <td style="width: 10%;"></td> <td style="width: 10%;">A</td> <td style="width: 10%;">B</td> <td style="width: 10%;">C</td> </tr> <tr> <td>P₁</td> <td>3</td> <td>4</td> <td>2</td> </tr> <tr> <td>P₂</td> <td>2</td> <td>5</td> <td>3</td> </tr> </table> | | A | B | C | P ₁ | 3 | 4 | 2 | P ₂ | 2 | 5 | 3 | <p>Matrix Y</p> <table border="0" style="width: 100%;"> <tr> <td style="width: 10%;"></td> <td style="width: 10%;">P₁</td> <td style="width: 10%;">P₂</td> </tr> <tr> <td>Mon</td> <td>1</td> <td>2</td> </tr> <tr> <td>Tue</td> <td>2</td> <td>3</td> </tr> <tr> <td>Wed</td> <td>3</td> <td>2</td> </tr> <tr> <td>Thurs</td> <td>2</td> <td>2</td> </tr> <tr> <td>Fri</td> <td>1</td> <td>1</td> </tr> </table> | | P ₁ | P ₂ | Mon | 1 | 2 | Tue | 2 | 3 | Wed | 3 | 2 | Thurs | 2 | 2 | Fri | 1 | 1 |
| | A | B | C | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| P ₁ | 3 | 4 | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| P ₂ | 2 | 5 | 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | P ₁ | P ₂ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Mon | 1 | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Tue | 2 | 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Wed | 3 | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Thurs | 2 | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Fri | 1 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
- Find the number of component parts used one each day (4 marks)
 - Total number of parts used on the week (4 marks)

QUESTION TWO

- (a) A firm input-output matrix for its three products A,B and C is

		A	B	C
Input-output matrix	A	0.3	0.2	0.1
	B	0.1	0.4	0.2
	C	0.2	0.3	0.4

Demand vector = 40
 50
 60

Determine its production vector (14 marks)

(b) If in (a) above the demand and charges as follows

A decreases by 10 units

B increases by 5 cents

C increases by 10 units

What should be the production levels (6 marks)

QUESTION THREE

A company employs four classes of employees A,B,C & D. All new employees are hired as class D and through a system of promotion workers rises to an upper class. Currently there are 200 class D, 150 classic, 90 class B and 60 class A employee. The company has assigned an agreement with the union specifying that 20 percent of all employees in each class to be promoted one class in each year. Statistics shows that each year 25% of the class D employees are separated from the company by reasons such as retirements, resignation and death similarly 15% of class C, 10% of class B and 5% of class A are also separated for each employee list the company hires a new class D employee

Find

- i. The transition matrix (4 marks)
- ii. The number of employees in each class two years after the agreement with union (6 marks)
- iii. The equilibrium state of the number of employees (10 marks)

QUESTION FOUR

(a) A company has invested in a particular project and its has been estimated that after X months of running, the cumulative profits in thousands from the project is given by the function $10x - x^2 - 5$ where x represents time in months. The project can run for eleven months at most.

Determine

- i. The initial cost of the project (3 marks)
 - ii. The best time to end the project (3 marks)
 - iii. The break-even time in months for the project (4 marks)
 - iv. The profit within the break even points (4 marks)
- (b) Demand functions for a firm is given by

$$P = 12 - 0.4Q$$

P is the price of the product, Q is the quantity demanded and the total cost (c) is given by $C = 5 + 4Q + 0.6Q^2$

- i. At what price and quality will be firm have maximum profit (4 marks)
- ii. If the firm aims at maximizing sales, what price should it charge (4 marks)

QUESTION FIVE

(a) A marketing division in a manufacturing company has worked out the following transition probability matrices concerning the behaviour of customers before and after an advertising campaign

Transition probability (after advertisement)

	To	
From	Out brand (state I)	Another brand state II
Our brand (state I)	0.9	0.1
Another brand (state II)	0.5	0.5
Before advertisement		

From	To	
	Out brand (state I)	Another brand state II
Our brand (state I)	0.8	0.2
Another brand (state II)	0.4	0.6

If the advertising campaign costs shs 20,000 per year, would it be worth while for the company to undertake the campaign? You may suppose there are 60,000 buyers in the market and for each customer average annual profit of the company is shs 250 (14 marks)

(b) The number of shoppers queuing at any given time in a certain shop can be approximately represented by the equation

$Y = X^3 - 14 X^2 + 50$ over the range $0 \leq x \leq 8.5$ where Y is the number queuing and X is the time in hours after the stores open

Required:

- i. The management wants to know when they should deploy more cashiers and the number queuing at the time
- ii. Determine the number of man hours spent per day by shoppers queuing