MACHAKOS UNIVERSITY

University Examinations for 2020/20201Academic Year

SCHOOL OF BUSINESS AND ECONOMICS

DEPARTMENT OF BUSINESS ADMINISTRATION

FIRST YEAR SECOND SEMESTER EXAMINATION FOR

BACHELOR OF COMMERCE

BMS 102: MANAGEMENT MATHEMATICS II

DATE: 21/6/2021 **TIME: 11.00-1.00 PM**

INSTRUCTIONS:

Answer question one and any other two questions.

QUESTION ONE (30 MARKS)

a) Briefly explain the factors Characterizing Inventory Systems (2 marks)

b) Briefly explain the meaning of the following matrices giving an example for each

i. Rectangular Matrix. (2 marks)

ii. Column Matrix. (2 marks)

iii. Row Matrix. (2 marks)

iv. Transpose Matrix (2 marks)

c) Given Matrices A, B and C as below:

$$A=\begin{bmatrix}6 & 2 & -3\\ 5 & -3 & 4\\ 1 & 4 & 7\end{bmatrix}$$

$$B=\begin{bmatrix}6 & 2 & -1\\ 5 & -3 & -2\\ 1 & 4 & 0\end{bmatrix}$$

$$C=\begin{bmatrix}4 & 1 & 0\\ 1 & 6 & 3\\ 2 & 1 & 2\end{bmatrix}$$

Evaluate $(A+B+C)^{-1}$ (4 marks)

d) List the characteristics that a problem must possess to be amenable to Linear Programming formulation and solution approaches. (4 marks)

e) Consider the decision problem below with the given pay off table and states of nature probabilities:

State of Nature

Alternatives	S_1	S_2	S_3
A	-12	20	12
B	15	18	45
C	-13	34	12
D	25	21	28
E	10	-23	-24
F	-18	32	-35
G	21	15	25
H	24	-14	12

States of Nature	S_1	S_2	S_3
Probability	0.2	0.7	0.1

Identify the optimal decision using:-

a) Maximax Criterion (2 marks)

b) Maximin Criterion (2 marks)

c) Minimax Regret Criterion (2 marks)

d) EMV Criterion (3 marks)

e) Expected Regret Criterion (3 marks)

QUESTION TWO (20 MARKS)

a) XYZ produces 2 types of products denoted by Prod.X and Prod.Y requiring two inputs: raw material and man-hour. One unit of Prod.X requires 5 units and 8 units of raw material and man-hour respectively while one unit of Prod.Y requires 9 units and 6 units of raw material and man-hour respectively. Find the number of units of Prod.X and Prod.Y to produce to completely utilize 82 units and 114 units of raw material and man-hour respectively. (5 marks)

b) Derive the input-output Models for the following systems:-

i. Open Systems (2 marks)

ii. Closed Systems (2 marks)

c) Describe the four types of costs associated with inventory holding highlighting their components. (5 marks)

d) The demand for a given item is constant remaining at 200 units annually. The unit cost is Ksh.80 while the per order cost is Ksh.40 and the carrying cost Ksh.10 per unit per annum. Determine: -

i. The EOQ (2 marks)

ii. The optimal Number of orders. (2 marks)

iii. The cost associated with the optimal Order Quantity. (2 marks)

QUESTION THREE (20 MARKS)

a) A simple society economy consists of Wool Production, Butchery and Hides Tanning. 60% of each unit wool output goes towards wool production, 10% towards running of the butchery and the rest towards hides tanning. Each of output from the butchery is shared among the three sectors Wool, Butchery and Hide Tanning in the ration of 3:5:2. 20% of each of the hides tanning output goes towards Wool production, 10% towards running the Butchery and the rest towards hides tanning. Given that the external demand for the output from Wool Processing, Butchery and Hides Tanning are respectively 600Units, 1500 Units and 900 Units, Find:-

i. The total output from each sector. (3 marks)

ii. Distribute where possible the total output from each sector among its users. (3 marks)

b) Highlight the conditions that a Markov Chain must satisfy (4 marks)

c) Write short notes on: -Transition Probability, Equilibrium (Steady State) Position (2 marks)

d) Explain four categories of inventory that an organization may carry. (4 marks)

e) Solve the following system of equations using the crammers rule approach

$$2x_1 + 4x_2 + 6x_3 = 18$$
$$4x_1 + 5x_2 + 6x_3 = 24$$
$$3x_1 + x_2 - 2_{x3} = 4$$

(4 marks)

QUESTION FOUR (20 MARKS)

a) Given the Input – Output Table below:

Industry	P	Q	Final Demand
P	60	140	300
Q	110	90	150

Find the Technical Coefficient Matrix (3 marks)

b) Distinguish between the "Product Mix" and Blending" Linear Programming citing one example of each. (4 marks)

c) Discuss the reasons for carrying inventories despite the fact that is a costly undertaking. (3 marks)

d) A firm produces two types of cooking fat FAT1 AND FAT2. FAT1 raw materials costs Ksh. 20 while that for FAT2 costs Ksh.30. The raw materials passes through three machines Processor, 2 and 3. FAT1 requires 4 minutes of processor 1, 8 minutes of Processor 2 and 5 minutes of Processor 3.FAT2 requires 6 minutes of Processor 1, 10

Minutes of Processor 2 and 8 Minutes of Processor 3.The three Processors are available for a maximum of 12 hours a day. FAT1 and FAT2 sell at Ksh.45 and Ksh.50 respectively.

i. Define the Decision Variables and the Constraints for the above problem hence formulate the problem as a Linear Programming Model given the firms objective is to maximize profit. (3 marks)

ii. Solve the above problem graphically hence indicate the optimal solution and the optimal objective value. (3 marks)

a) A firm has three factors at Kisumu , Nakuru, and Kitale out of the total bulb output manufactured , 40%, 20% and 40% are from Kisumu, Nakuru and Kitale respectively. Given that 3% 2% and 8% are defective bulbs from Kisumu , Nakuru, and Kitale respectively, one bulb is selected at random and found to be defective . Find the probability that it is from :

i. Kisumu, Nakuru, or Kitale (2 marks)

ii. Kisumu, and Kitale (2 marks)

QUESTION FIVE (20 MARKS)

a) State the fundamental questions that inventory management attempts to answer. (6 marks)

b) Describe the process and the purpose of Pareto Analysis citing specific examples. (4 marks)

c) A supermarket has 8 categories of items having the following costs and yearly Demands:

ITEM	UNIT COST	YEARLY DEMAND
1	25	5
2	30	4
3	20	4
4	2	15
5	10	10
6	10	10
7	20	20
8	37	15

Perform a Pareto Analysis of the items indicating which should be subjected to minimal control. (6 marks)

d) Define the concept of Input – output Analysis. (4 marks)