MACHAKOS UNIVERSITY

University Examinations for 2020/2021 Academic Year

SCHOOL OF BUSINESS AND ECONOMICS

DEPARTMENT OF ECONOMICS

THIRD YEAR SPECIAL/SUPPLEMENTARY EXAMINATION FOR

BACHELOR OF ECONOMICS AND FINANCE

EES 302: OPERATIONS RESEARCH I

DATE: 26/3/2021 **TIME: 8.30-10.30 AM**

INSTRUCTIONS:

(i) Answer Question **ONE (Compulsory)** and any other **TWO** questions
(ii) Show ALL your workings clearly

QUESTION ONE (COMPULSORY) (30 MARKS)

a) Briefly explain five applications of Operations Research (5 marks)

b) Explain briefly how a firm can use the following criteria to make a decision on how much of its output it should supply in the market.

i. Expected monetary value
ii. Maximax
iii. Minimax
iv. Maximin
v. Laplace (10 marks)

c) The following matrix represents the payoff table for player firms A and B.

		Firm B				
		B_1	B_2	B_3	B_4	B_5
	A_1	390	300	320	380	410
Firm A	A_2	230	240	260	320	560
	A_3	680	50	380	620	360
	A_4	230	230	310	260	200

Determine the optimal strategies for both Firm A and Firm B and the value of the game using the maximin-minimax principle (5 marks)

d) An electronic manufacturing company produces two types of gadgets labelled X and Y whose number should not exceed 11 every day. The company's daily budget for the production for the two gadgets is not more than $ 6000. The daily costs of production per unit of X and Y are $ 600 and $ 500 respectively. The prices per unit of X and Y are $ 1000 and $ 850 respectively.

i. Formulate a linear program using the above information (3 marks)

ii. Use the graphical method to determine the optimum number of the two types of gadgets, X and Y, that should be produced daily to maximize the revenue (7 marks)

QUESTION TWO (20 MARKS)

a) Briefly explain five techniques applied in operations research (5 marks)

b) In preparation to return back to his home country Joel Mathews has put several of his household goods on auction. During the auction several interested buyers gave the following bids in thousands of Kenya shillings for various goods.

Buyers/Items	Fridge	Cooker	Sofa set	Wall unit
Martha	34	40	33	40
Alice	46	55	35	40
Betty	24	28	25	30
Emma	34	40	33	28

If no bidder is allowed to buy more than one item and all the items are sold determine the following

i. The bid that the company should accept for each item to maximize revenue. (10 marks)

ii. The total revenue (5 marks)

QUESTION THREE (20 MARKS)

The following table shows details of a certain project

Activity	Activity Description	Duration in Weeks	Preceding Activities
A	Planning	4	-
B	Resource mobilization	10	A
C	Personnel recruitment	14	A&B
D	Purchase of land & materials	12	B
E	Transportation of materials	15	B
F	Approvals	2	A&B
G	Building	20	D&F
H	Landscaping	10	D&F
I	Fencing	8	C&G

a) Set up the project network diagram showing the various activities and durations (8 marks)

b) Determine the earliest and latest start and finish times for each activity (7 marks)

c) Find the critical path and project duration (5 marks)

QUESTION FOUR (20 MARKS)

A coffee processing company has three factories in a certain region, A, B and C whose daily supplies of coffee are 4,800, 14,400 and 16,800 kilograms of coffee respectively. The company has four processing plants P, Q, R and S whose daily demands are 7,200, 7,200, 9,600 and 12,000 kilograms of coffee respectively. The cost of transporting each kilogram of coffee from each depot to every warehouse in Kenya Shillings is given in the table below.

		Warehouse			
		P	Q	R	S
	A	130	110	150	200
Depot	B	170	140	120	130
	C	180	180	150	120

a) Find the initial feasible solution for the transportation problem using least cost method and the associated transport cost. (10 marks)

b) Find the optimum transportation schedule and the minimum total cost of transportation. (10 marks)

QUESTION FIVE (20 MARKS)

A linear program is defined as follows

$$Max \;\; Z = 30X + 20Y + 10Z$$

$$s.t$$

$$2X + Y + Z \leq 15$$

$$2X + 2Y + 8Z \leq 20$$

$$2X + 3Y + Z \leq 32$$

$$X; Y; Z \geq 0$$

a) Form the initial simplex tableau (5 marks)

b) Solve the linear program above to find the optimal solution (10 marks)

c) Find the dual price for each constraint (5 marks)