KAMARAJ COLLEGE (Autonomous)

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(9 Pages) **Reg. No:……**

Question Code:26E02616 **Course Code: 24UEBA41/24UESL41**

UG Degree - End Semester Examinations, April 2026

Fourth Semester

B.B.A/B.B.A Shipping and Logistics

Operations Research

(For those who joined in July 2024 onwards)

Time: 3Hours **Maximum: 75 Marks**

PART – A (10 × 1 = 10 Marks)

Answer ALL Questions

Choose the correct answer:

CO:1 K:2 1. Linear Programming is used to_____.

(a) Solve random problems (b) Optimize limited resources

(c) Calculate interest (d) Study statistics

CO:1 K:1 2. The objective functions and constraints are linear relationship between _____.

(a) Variables (b) Constraints

(c) Function (d) All the above

CO:2 K:2 3. When the total demand is not equal to total supply then it is said to be_____.

(a) Balanced (b) Unbalanced

(c) Maximization (d) Minimization

CO:2 K:1 4. To find the optimal solution, we apply_____.

(a) LPP (b) VAM

(c) MODI (d) NWCM

CO:3 5. The Hungarian Method is used to solve_____.

K:1

(a) Inventory problems (b) Assignment problems

(c) Game theory problems (d) Replacement problems

CO:3 6. The Traveling Salesman Problem focuses on _____.

K:2

(a) Maximizing travel distance (b) Minimizing travel cost or distance

(c) Increasing routes (d) Increasing profit

CO:4 7. In the PERT distribution, the optimistic time is 3 days, expected time is 4 days and the pessimistic time is 5 days. The duration of the network is_____.

K:2

(a) 4 (b) 6

(c) 5 (d) 8

CO:4 8. An activity is critical if its _____ float is Zero

K:1

(a) Total (b) Free

(c) Independent (d) Interference

CO:5 9. A saddle point occurs when_____.

K:1

(a) Maximin = Minimax (b) Maximin < Minimax

(c) Maximin > Minimax (d) No strategies exist

CO:5 10. The rule used by player B to minimize the maximum loss is

K:2

(a) Maximin criterion (b) Minimax criterion

(c) Dominance criterion (d) Graphical method

PART – B (5 X 5 = 25 Marks)

Answer ALL Questions choosing either (a) or (b).

Answer should not exceed 250 words.

CO:1 11. (a) A company manufactures two products A and B**.** Each

K:3 unit of A requires 2 hours of machining and 1 hour of assembly**.** Each unit of B requires 1 hour of machining and 3 hours of assembly. The firm has 100 machining hours and 90 assembly hours available per week**.**

Profit per unit is ₹40 for A and ₹30 for B. Formulate the Linear Programming Problem to determine the number of units of A and B to maximize profit.

(OR)

(b) Explain the steps involved in formulating a Linear Programming model.

CO:2 K:4 12. (a) Calculate the basic feasible solution to the following transportation problem using North West Corner Rule

	S_1	S_2	S_3	a_I
W_1	5	4	2	6
W_2	4	7	6	8
W_3	2	5	8	12
W_4	8	6	7	4
b_j	8	10	12	30

(OR)

(b) Solve the transportation problem by using Least cost method

	S_1	S_2	S_3	demand
W_1	5	4	3	6
W_2	4	7	6	8
W_3	2	5	8	12
W_4	8	6	7	4
Supply	8	10	12	30

CO:3 K:4 13. (a) Find the optimal solution for the assignment problem with the following cost matrix

		Area			
		W	X	Y	Z
Salesman	A	11	17	8	16
	B	9	7	12	6
	C	13	16	15	12
	D	14	10	12	11

(OR)

(b) Five jobs 1,2,3,4 and 5 are to be assigned to five persons A, B, C, D and E. The time taken (in minutes) by each of them on each job is given below:

	1	2	3	4	5
A	16	13	17	19	20
B	14	12	13	16	17
C	14	11	12	17	18
D	5	5	8	8	11
E	5	3	8	8	10

Determine the optimal assignment and the total minimum time taken.

CO:4 K:3 14. (a) The following table gives information on construction project and other relevant information

Activity	1-2	1-3	2-3	2-4	3-4	4-5
Duration	20	25	10	12	6	10

Draw the network for the project and deduce the critical path.

(OR)

(b) Outline the difference between CPM and PERT.

CO:5 K:4 15. (a) Solve the following game whose pay-off matrix is given below:

$$\begin{bmatrix} 9 & 3 & 1 & 8 & 0 \\ 6 & 5 & 4 & 6 & 7 \\ 2 & 4 & 3 & 3 & 8 \\ 5 & 6 & 2 & 2 & 1 \end{bmatrix}$$

(OR)

(b) The following is the payoff matrix for player A

	Player B					
		B_1	B_2	B_3	B_4	B_5
Player A	A_1	2	4	3	8	4
	A_2	5	6	3	7	8
	A_3	6	7	9	8	7
	A_4	4	2	8	4	2

Using the dominance property, obtain the optimum strategies for both players and determine the value of the game.

PART – C (5 X 8 = 40 Marks)

Answer ALL Questions choosing either (a) or (b).

Answer should not exceed 500 words.

CO:1 K:4 16. (a) A company produces 2 types of hates A and B. Every hat A requires twice as much labour time as the second hat B. if the company produces only hat B then it can produce a total of 500 hats per day. The market limits

daily sales of hat A and B to 150 and 250 respectively. The profits on hat A and B are Rs.8 and Rs. 5 respectively. Solve graphically to get the optimal solution.

(OR)

(b) A company manufactures 3 types of products which use precious metals platinum and gold. Due to the shortage of these precious metals, the government regulates the amount that may be used per day. The relevant data with respect to supply, requirements and profit are summarized in the table below.

Product	Platinum required per unit(gm)	Gold required per unit(gm)	Profit (Rs)
A	2	3	500
B	4	2	600
C	6	4	1200

The daily allotment of platinum and gold are 160gm and 120gm respectively. How should the company divide the supply of scarce precious resources for optimum profit? Formulate the mathematical model.

CO:2 K:5 17. (a) Find the optimal transportation plan for the following information given below using Vogel's Approximation method

	D_1	D_2	D_3	D_4	Supply
O_1	11	13	17	14	250
O_2	16	18	14	10	300
O_3	21	24	13	10	400
Demand	200	225	275	250	950

(OR)

(b) Solve the transportation problem

	1	2	3	4	Supply
I	21	16	25	13	11
II	17	18	14	23	13
III	32	27	18	41	19
Demand	6	10	12	15	43

CO:4 K:5 18. (a) A Project work consists of four major jobs for which four major constructors have submitted tenders. The tender documents quoted in thousands of rupees are given with the matrix as

	J_1	J_2	J_3	J_4
C_1	15	27	35	20
C_2	21	29	33	17
C_3	17	25	37	15
C_4	14	31	39	21

Find the assignment which minimizes the total of the project cost. Each contractor has to be assigned one job.

(OR)

(b) Four different jobs can be done on four different machines. The set up and take down time costs are assumed to be prohibitively high for change over. The

matrix below gives the cost in rupees of processing job i on machine j.

	M_1	M_2	M_3	M_4
J_1	5	7	11	6
J_2	8	5	9	6
J_3	4	7	10	7
J_4	10	4	8	3

How should the jobs be assigned to the various machines so that the total cost is minimized?

CO:5 K:6 19. (a) Consider the following project whose activities along with PERT time estimates, the optimistic time (a) most likely time(m) and the pessimistic time(b) and given as follows

Activity	a(days)	m (days)	b(days)
1-2	3	6	15
1-6	2	5	14
2-3	6	12	30
2-4	2	5	8
3-5	5	11	17
4-5	3	6	15
6-7	3	9	27
5-8	1	4	7
7-8	4	19	28

Construct the network diagram and find the critical path. Determine the project completion time and its variance.

(OR)

(b) Construct the network for each of the projects whose activities and their precedence relationships are as given below:

Activity	A	B	C	D	E	F	G	H	I	J	K
Immediate Predecessor	-	-	-	A	B	B	C	D	E	H,I	F,G

CO:5 K:6 20. (a) Solve the following game using graphical method

	B_1	B_2	B_3	B_4	B_5
A_1	2	-2	3	7	6
A_2	6	5	1	4	0

(OR)

(b) Following is the payoff matrix for player A

	B_1	B_2	B_3	B_4
A_1	8	10	9	14
A_2	10	11	8	12
A_3	13	12	14	13

Using dominance property, Predict the optimum strategies for both the players and formulate the value of the game.