BBA 5th Semester (Honours) Examination, 2024 (CBCS)

Subject : Operations Research

Course : BBA-5.2

Time: 4 Hours   Full Marks: 80

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Answer Question No. 1 *and* any five *questions from the rest.*

1. Answer *any ten* questions: 2×10=20

   (a) Define feasible solution and basic feasible solution.

   (b) How can you convert an unbalanced Transportation problem to a balanced Transportation problem?

   (c) What is Hungarian method?

   (d) What is Fulkerson's rule?

   (e) List out the different methods for finding feasible solution in Transportation problem. Also list out the methods of finding optimal solution in Transportation problem.

   (f) Define unbounded solution with an example.

   (g) What are the different types of floats in networking?

   (h) What is two-person-zero-sum game?

   (i) State the rules of dominance in Game Theory.

   (j) Why is VAM called Penalty method?

   (k) Why the corner points in feasible region in case of Linear Programming are taken to the candidate for optimal solution?

   (l) How will you convert a profit matrix to a cost matrix in Transportation problem?

   (m) State any four applications of Operations Research.

   (n) Define slack variable, surplus variable and artificial variable.

   (o) In the context of network analysis, what is meant by critical path?

2. Find an initial feasible solution of the following Transportation problem by applying North-West Corner method, Least Cost method and VAM method.

Origin	Destination			Supply
1	50	100	100	110
2	200	300	200	160
3	100	200	300	150
Demand	140	200	80	

3. Based on the following Transportation table, try to allocate in cells (1, 4), (2, 1), (2, 4), (3, 2) following Stepping Stone methodology and identify which of these four allocations are the best.

Plant	Warehouse				Supply/ Availability
	1	2	3	4	
1	5 19	2 30	50	10	7
2	70	6 30	3 40	60	9
3	40	8	4 70	14 20	18
Demand	5	8	7	14	

4. Solve the following Assignment problem.

		TASKS		
		E	F	G	H
	A	18	26	17	11
MACHINES	B	13	28	14	26
	C	38	19	18	15
	D	19	26	24	10

5. Based on the following activity-immediate predecessor relationship, draw a network. Also find the latest and earliest event times; identify critical path and determine project duration.

Activity	Immediate Predecessor	Duration
A	--	2
B	--	1
C	--	3
D	A, B	4
E	B	2
F	B, C	3
G	D, E	5
H	F	4
I	H	3
J	G	6
K	G, I	1

6. (a) State the difference between Stepping Stone method and MODI method of Transportation problem with suitable examples for both.

   (b) Write the Linear Programming formulation for Assignment problem.

7. Solve the following Game problem by applying Dominance rule.

Player B

$$\begin{array}{c} & \begin{array}{ccc} B_1 & B_2 & B_3 \end{array} \\ \text{Player } A \quad \begin{array}{c} A_1 \\ A_2 \\ A_3 \end{array} & \begin{bmatrix} 10 & 5 & -2 \\ 13 & 12 & 15 \\ 16 & 14 & 10 \end{bmatrix} \end{array}$$

8. Solve the following LP problem graphically.

Maximize z = x + y

Subject to the constraints:

$3x + 2y \leq 12$

$x + y \leq 5$

$x, y \geq 0$

State the conceptual interpretation of artificial variable.

9. A shop is considering 3 options for its facility in the coming year. It can expand its current shop or can shift to a new location or make no change at all. If the shop expands then the payoff would be ₹ 60,000; if the shop shifts to a different location, then the payoff would be ₹ 1,00,000; if no change is made then the usual payoff is ₹ 40,000. Under an average market, the payoffs would be ₹ 55,000, ₹ 80,000 and ₹ 30,000 and with an unfavourable market, the payoffs would be ₹ 50,000, ₹ 70,000 and ₹ 20,000. Which option should the shop choose based on the following criteria?

 (a) Maximin criterion

 (b) Laplace criterion

 (c) Maximax criterion

10. A ship is to carry 3 types of liquid cargo— A, B and C. There are 3,000 litres of X available, 2,000 litres of Y available and 1,500 litres of Z available. Each litre of X, Y and Z sold fetches a profit of ₹ 20, ₹ 35 and ₹ 40 respectively. The ship has 3 cargo holds— A, B and C, of capacities 2,000, 2,500 and 3,000 litres respectively. From stability considerations, it is required that each hold be filled in the same proportion. Formulate the problem of loading the ship as a Linear Programming Problem. State clearly all decision variables and constraints.

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