OR Pg1 v 24
Soln

4-A

1) What is a symbolic model?
A symbolic model in O.R. uses variables & equations to represent a problem abstractly without assigning specific numerical values. It provides a general framework for analyzing & solving optimization problems.

2) Define an optimal soln linear programming problems (LPP).
An optimal soln in LPP is the best possible soln that maximizes/minimizes the objective function while satisfying all constraints.

3) Give 2 examples of assignment problems.
i) Assigning workers to jobs to minimize total cost.
ii) Assigning tasks to machines to reduce processing time.

4) What is a dummy activity?
A dummy activity in project management (like CPM/PERT) is a placeholder used to show dependencies b/w tasks without consuming time/resources.

5) Compare mixed strategy & pure strategy in game theory.
In game theory, a pure strategy means choosing one action consistently, while a mixed strategy involves randomizing

b/w actions based on probabilities.

6) What are the main characteristics of O.R.?
i) Scientific approach to decision-making.
ii) mathematical modelling of real-life problems.
iii) Focus on optimization & resource allocation.
iv) Requires data driven analysis for best solns.
v) Interdisciplinary in nature (uses maths, stats etc.)

7) What are the limitations of LPP?
i) Assumes linear relationships, which may not hold in real life
ii) Can't handle uncertainty or dynamic changes easily.
iii) Requires all variables to be continuous.
iv) constraints must be clearly defined & finite.
v) may not work well with multiple conflicting objectives.

8) Write a short note on the Big M method / Penalty Cost method in linear Programming. Not in syllabus

It is used in LPP to handle ≥ or = constraints by introducing artificial variables with a large penalty (M) in the objective function.

9) Describe the North west Corner Rule method for solving transportation problem.

Step 1 - Start at the top-left (north-west) cell of the cost matrix.
Step 2 - Allocate the min. of the supply & demand in that cell.
Step 3 - Adjust supply & demand:
i) If supply is exhausted, move down to the next row.
ii) If demand is met, move right to the next col.
iii) If both are satisfied, move diagonally down-right.
Step 4 - Repeat steps 2 & 3 until all supplies & demands are allocated.
Step 5 - The resulting allocation is a basic feasible soln (not necessarily optimal).

10) How do you convert an unbalanced transportation problem into a balanced one? Explain using a suitable eg.

If total supply ≠ total demand, ~~add~~ we add a dummy row or col with zero cost to balance NOW,

i) If demand > supply $\Sigma b_j > \Sigma a_i$ ⟹ we add a dummy row with 0 & supply = demand − supply

ii) If demand < supply $\Sigma b_j < \Sigma a_i$ ⟹ we add a dummy col with 0 cost & demand = supply − demand

Eg—

	D_1	D_2	D_3	D_4	S
O_1	6	1	9	3	70
O_2	11	5	2	8	55
O_3	10	12	4	7	70
D	85	35	50	45	

total demand $\Sigma b_j = 215$
total supply, $\Sigma a_i = 195$
i.e, $\Sigma b_j > \Sigma a_i$

∴ supply = 215 − 195 = 20

& the modified mat.

	D_1	D_2	D_3	D_4	S
O_1	6	1	9	3	70
O_2	11	5	2	8	55
O_3	10	12	4	7	70
O_4	0	0	0	0	20
D	85	35	50	45	215

→ now balanced

11. Write down the different phases of a project. [not in syllabus]

i) Initiation - Define goals & feasibility.
ii) Planning - Develop schedules, budgets, & resources.
iii) Execution - Perform project work
iv) monitoring & control - Track progress & make adjustments.
v) closure - Finalize activities & evaluate outcomes.

12) What are the basic characteristics of queueing system? [not in syllabus]

i) Arrival process, ii) service mechanism, iii) queue discipline, iv) system capacity, v) no. of service channels.

13) Write down a short note on a two-person zero-sum game.

This is a competitive game involving 2 players. where one's gain is exactly the other's loss, so total payoff is always 0. Each players tries to maximize their gain / minimize their loss, using strategi - c decision-making under conflict.

G-C

14] Solve the following linear Programming graphically. maximize $Z = 5x + 7y$

subject to $4x + y \leq 4$
$3x + 8y \leq 24$
$10x + 7y \leq 35$
& $x, y \geq 0$

done (assignment)

15) Solve the following linear programming problem using the simplex method.

maximize $Z = 2x + y$

$x - y \leq 10$

$2x - y \leq 40$

$x, y \geq 0$.

NOT in SYLLABUS.

16) Determine the initial basic feasible soln for the following transportation problem. whose cost & rim requirement table is given below, using least cost method.

O	D_1	D_2	D_3	D_4	S	
O_1	11	13	17	14	250	500
O_2	16	18	14	10	300	50 0
O_3	21	24	13	10	400	125 0
D	200	225	275	250	950	
	0	175 0	0	0		
		125 0				

Transportation cost (min)

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

→ Balanced

O	D_1	D_2	D_3	D_4	S	
O_1	200	11 / 50	13	14	250	50 0
O_2		16 / 50	18 / 14	230 / 10	300	50 0
O_3		21	24 / 275	13 / 10	400	125 0
D	200	225	275	250	950	
	0	175 0	0	0		
		125 0				

∴ transportation (at cmin) $= 11 \times 200 + 13 \times 50 + 18 \times 50 + 24 \times 125 + 13 \times 275 + 10 \times 250$

$= 12825$

17. There are 4 jobs to be assigned to five machines. only one job can assigned to one machine. The amount of time in hrs required for the jobs per machine are given in the following matrix. Find an optimal assignment of jobs to the machine to minimize the total processing time & also find out for which machine no job is assigned. What is the total processing

time to complete all the jobs?

Jobs	Machines				
	A	B	C	D	E
1	4	3	6	2	7
2	10	12	11	14	16
3	4	3	2	1	5
4	8	7	6	5	6

Done

18) a) State the maximin-minimax Principle.

b) For what value of λ is the game with following pay-off matrix strictly determinable?

Player A \ Player B

	B_1	B_2	B_3
A_1	λ	6	2
A_2	-1	λ	-7
A_3	-2	4	λ

Done

maximin - minimax Principle (used in game theory)

maximin principle - (For player A) player A chooses the strategy that maximizes the minimum gain (i.e, be cautious & secure the best of the worst outcomes).

minimax principle (for player B) - player B chooses the strategy that minimizes the maximum loss (i.e, try to reduce the worst case loss as much as possible).

19) A project schedule has the following characteristics.

Activity	1-2	1-3	2-4	3-4	3-5	4-6	5-6	5-7	6-8	7-8	8-10	9-10
Time (days)	4	1	1	1	6	5	4	8	1	2	5	7

a) Construct a N/W diagram.

b) Compute the earliest time & latest even time.

c) Determine the critical path & total project duration.

Not in syllabus