



BRAINWARE UNIVERSITY

Term End Examination 2023-2024
Programme – B.Tech.(ME)-2021
Course Name – Operations Research
Course Code - PEC-ME602C
(Semester VI)

Full Marks : 60

Time : 2:30 Hours

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group-A

(Multiple Choice Type Question)

1 x 15=15

1. Choose the correct alternative from the following :

- (i) Identify the name of the first country to use Operations Research method to solve problems.
- | | |
|----------|-----------|
| a) India | b) China |
| c) U.K. | d) U.S.A. |
- (ii) Indicate from the following that is not associated with an LPP.
- | | |
|--------------------|-----------------|
| a) Proportionality | b) Uncertainty |
| c) Additivity | d) Divisibility |
- (iii) Identify the right option to satisfy, "Non-negativity condition is an important component of LPP"
- | | |
|---|--|
| a) variables are inter-related in terms of limited resources | b) value of variables make sense and correspond to real world problems |
| c) value of variables should remain under the control of decision-maker | d) none of these |
- (iv) A feasible solution of an LPP is classified as
- | | |
|---|---|
| a) must be a corner point of the feasible region | b) must optimize the value of the objective function |
| c) must satisfy all the constraints of the LPP simultaneously | d) need not satisfy all the constraints, only some of them. |
- (v) Identify the constrain that does not affect the feasible region is a
- | | |
|------------------------------|------------------------|
| a) non-negativity constraint | b) slack constraint |
| c) redundant constraint | d) standard constraint |
- (vi) In a minimization problem, a positive improvement index in a cell interprets that
- | | |
|---|---|
| a) the solution is optimal | b) the total cost will increase if units are reallocated to that cell |
| c) the total cost will decrease if units are reallocated to that cell | d) there is degeneracy |

- (vii) In case the cost elements of one or two cells are not given in the problem, it interprets:
- a) The given problem is wrong
 b) We can allocate zeros to those cells
 c) Allocate very high cost element to those cells
 d) To assume that the route connected by those cells are not available
- (viii) The opportunity cost of a row in a transportation problem is constructed by:
- a) Deducting the smallest element in the row from all other elements of the row
 b) Adding the smallest element in the row to all other elements of the row
 c) Deducting the smallest element in the row from the next highest element of the row
 d) Deducting the smallest element in the row from the highest element in that row.
- (ix) In transportation model, the opportunity cost is illustrated by
- a) Implied cost + Actual cost of the cell
 b) Actual cost of the cell – Implied cost
 c) Implied cost – Actual cost of the cell
 d) Implied cost × Actual cost of the cell
- (x) The Transportation problem developed for the transportation of
- a) a single product from several sources to a destinations
 b) a multi-product from several sources to a several destinations
 c) a single product from several sources to several destinations
 d) a single product from a source to several destinations.
- (xi) Identify the number of variables have in the formulation of 5*5 assignment problem
- a) 20
 b) 25
 c) 30
 d) 35
- (xii) The total opportunity cost matrix is observed by doing:
- a) Row operation on row opportunity cost matrix
 b) Column operation on row opportunity cost matrix
 c) Column operation on column opportunity cost matrix
 d) None of these
- (xiii) Identify the similarity in between Assignment Problem and Transportation Problem
- a) Both are rectangular matrices
 b) Both are square matrices
 c) Both can be solved by graphical method
 d) Both have objective function and non-negativity constraints
- (xiv) When there are more than one servers, customer behaviour in which he moves from one queue to another is named as
- a) balking
 b) jockeying
 c) reneging
 d) alternating
- (xv) As per queue discipline identify the following is not a negative behavior of a customer:
- a) Balking
 b) Reneging
 c) Boarding
 d) Collusion

Group-B

(Short Answer Type Questions)

3 x 5=15

2. Define Order Cycle. (3)

3. Identify the value of λ , of the game with the following payoff matrix so that the game is strictly determinable. (3)

	B		
	λ	6	2
A	-1	λ	-7
	-2	4	λ

4. Write the initial B.F.S of the transportation problem by North West corner method also find the cost (3)

	D1	D2	D3	D4	Availability
O1	2	1	3	4	30
O2	3	2	1	4	50
O3	5	2	3	8	20
Demand	20	40	30	10	

5. Calculate the minimum cost corresponding to the 4 x 4 assignment problem: (3)

8	26	17	11
13	28	4	26
38	19	18	15
19	26	24	10

6. Illustrate the L.P.P in standard maximization form: (3)

$$\begin{aligned} \text{Max } z &= 3x_1 + 4x_2 + 7x_3 \\ \text{Subject to} \\ 2x_1 + x_2 + 7x_3 &\leq 50 \\ x_1 + 9x_2 - 5x_3 &\geq 60 \\ 5x_1 + 3x_3 &= 100 \\ 3x_2 + 4x_3 &\leq 80 \\ \text{for } x_1, x_2, x_3 &\geq 0 \end{aligned}$$

OR

- Using Graphical method, evaluate that the following L.P.P (3)

$$\text{Max } z = 4x_1 + 3x_2$$

Subject to the constraints,

$$\begin{aligned} 2x_1 + x_2 &\leq 1000 \\ x_1 + x_2 &\leq 800 \\ x_1 &\leq 400 \\ x_2 &\leq 700 \\ x_1, x_2 &\geq 0 \end{aligned}$$

Group-C

(Long Answer Type Questions)

5 x 6=30

7. Evaluate the following Transportation problem. (5)

From	To			Availability
	A	B	C	
I	6	9	4	14
II	4	9	8	12
III	1	2	6	5
Requirement	6	10	15	

8. Define deterministic E.O.Q model, with uniform demand, infinite rate of production and having no shortage. (5)

9. (5)

Determine the optimum basic feasible solution to the following transportation problem:

	A	B	C	Available
I	50	30	220	1
II	90	45	170	3
III	250	200	50	4
Required	4	2	2	

10. Explain the concept of queue discipline. (5)

11. Apply simplex methods to estimate the optimal solution of the following L.P.P (5)

$$\text{Max } z = 3x_1 + x_2 + 3x_3$$

Subject to the constraint

$$2x_1 + x_2 + x_3 \leq 2$$

$$x_1 + 2x_2 + 3x_3 \leq 5$$

$$2x_1 + 2x_2 + x_3 \leq 6$$

$$\text{for } x_1, x_2, x_3 \geq 0$$

12. The Head of the department has five jobs A, B, C, D, E and five sub-ordinates V, W, X, Y, and Z. The number of hours each sub-ordinate would take to perform each job is as follows: (5)

	V	W	X	Y	Z
A	3	5	10	15	8
B	4	7	15	18	8
C	8	12	20	20	12
D	5	5	8	10	6
E	10	10	15	25	10

Predict how would the jobs be allocated to minimize the total time?

OR

Four persons A, B, C and D are to be assigned four jobs I, II, III and IV. The cost matrix is given below. Deduce the proper assignment. (5)

Man/ Jobs	A	B	C	D
I	18	26	17	11
II	13	28	14	26
III	38	19	18	15
IV	19	26	24	10