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5 SEM TDC DSE STS (CBCS) 1 (H/NH) (N/O)

2024

(November)

STATISTICS

(Discipline Specific Elective)

(For Honours/Non-Honours)

Paper : DSE-1

(Operations Research)

*The figures in the margin indicate full marks
for the questions*

(New Course)

Full Marks : 55

Pass Marks : 22

Time : 3 hours

1. Choose the correct answer from the following alternatives : 1×6=6

(a) Operations research approach is

(i) multi-disciplinary

(ii) scientific

(iii) intuitive

(iv) All of the above

(b) For a maximization problem, the objective function coefficient for an artificial variable is

(i) $+M$

(ii) $-M$

(iii) zero

(iv) None of the above

(c) The occurrence of degeneracy while solving a transportation problem means that

(i) total supply equals total demand

(ii) the solution so obtained is not feasible

(iii) the few allocations become negative

(iv) None of the above

(d) The number of non-negative variables in a basic feasible solution to an $m \times n$ transportation problem is

(i) mn

(ii) $m+n$

(iii) $m+n+1$

(iv) $m+n-1$

- (e) The size of the pay off matrix of a game can be reduced by using the principle of
- (i) game inversion
 - (ii) rotation reduction
 - (iii) dominance
 - (iv) game transpose
- (f) If orders are placed with size determined by the EOQ, then the re-order costs component is
- (i) equal to the holding cost component
 - (ii) greater than the holding cost component
 - (iii) less than the holding cost component
 - (iv) either greater than or less than the holding cost component

2. Answer the following questions in brief : $2 \times 6 = 12$

- (a) State the main characteristics of operations research.
- (b) What are the limitations of linear programming problem?
- (c) What do you mean by a non-degenerate basic feasible solution of a transportation problem?

- (d) Give the mathematical formulation of an assignment problem.
- (e) State the difference between pure strategy and mixed strategy.
- (f) What is set-up cost in inventory problem?

3. Answer any *two* questions from the following :

- (a) What are the various phases of operations research problems? Discuss in brief the role of OR models in decision making. 2+5=7
- (b) Explain briefly the graphical method of solving the linear programming problems. State its advantages and limitations. 5+2=7
- (c) In the course of simplex table calculations, describe how you will detect a degenerate, an unbounded and a non-existing feasible solution. Obtain the dual of the following LPP : 3+4=7

Minimize $Z = 2x_2 + 5x_3$
subject to

$$\begin{aligned}x_1 + x_2 &\geq 2 \\2x_1 + x_2 + 6x_3 &\leq 6 \\x_1 - x_2 + 3x_3 &= 4 \\ \text{and } x_1, x_2, x_3 &\geq 0\end{aligned}$$

4. (a) (i) Give a mathematical formulation of a transportation problem.

Prove that the transportation problem always possess a feasible solution.

2+4=6

- (ii) Determine an initial basic feasible solution to the following transportation problem using the north-west corner rule, where O_i and D_j represent i th origin and j th destination respectively :

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	D_1	D_2	D_3	D_4	Supply
O_1	6	4	1	5	14
O_2	8	9	2	7	16
O_3	4	3	6	2	5
	6	10	15	4	35

Or

- (b) (i) Explain what is meant by optimality test of a transportation problem.

Describe the computational procedure of optimality test in a transportation problem.

2+4=6

(6)

(ii) Solve the minimal assignment problem whose effectiveness matrix is

	I	II	III	IV
A	2	3	4	5
B	4	5	6	7
C	7	8	9	8
D	3	5	8	4

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5. (a) When is the competitive situation called a game? Explain maxi-min and mini-max principle used in game theory. State the rules for detecting a saddle point.

2+3+2=7

Or

(b) Solve the following 2×4 game graphically :

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		Player B			
		B_1	B_2	B_3	B_4
Player A	A_1	2	1	0	-2
	A_2	1	0	3	2

6. (a) Describe the different norms used for controlling inventories classified by ABC analysis.

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Or

(b) What is economic order quantity? Find the EOQ for the following data : $2+3=5$

Annual usage = 1000 pieces

Cost per piece = ₹ 250

Expediting cost = ₹ 4 per order

Ordering cost = ₹ 6 per order

Inventory holding cost = 20% of
average inventory

Material holding cost = ₹ 1 per piece

(Old Course)

Full Marks : 50

Pass Marks : 20

Time : 2 hours

1. Choose the correct answer from the following alternatives : 1×5=5

- (a) Operations research approach is
- (i) multi-disciplinary
 - (ii) scientific
 - (iii) intuitive
 - (iv) All of the above
- (b) For a maximization problem, the objective function coefficient for an artificial variable is
- (i) + M
 - (ii) - M
 - (iii) zero
 - (iv) None of the above
- (c) The number of non-negative variables in a basic feasible solution to an $m \times n$ transportation problem is
- (i) mn
 - (ii) $m+n$
 - (iii) $m+n+1$
 - (iv) $m+n-1$

(d) The size of the pay off matrix of a game can be reduced by using the principle of

- (i) game inversion
- (ii) rotation reduction
- (iii) dominance
- (iv) game transpose

(e) If orders are placed with size determined by the *EOQ*, then the re-order costs component is

- (i) equal to the holding cost component
- (ii) greater than the holding cost component
- (iii) less than the holding cost component
- (iv) either greater than or less than the holding cost component

2. Answer the following questions in brief : $2 \times 5 = 10$

- (a) State the main characteristics of operations research.
- (b) What are the limitations of linear programming problem?
- (c) What do you mean by a non-degenerate basic feasible solution of a transportation problem?
- (d) State the difference between pure strategy and mixed strategy.
- (e) What is set-up cost in inventory problem?

3. Answer any *two* questions from the following :

(a) What are the various phases of operations research problems? Discuss in brief the role of OR models in decision-making. 2+4=6

(b) Explain briefly the graphical method of solving the linear programming problems. State its advantages and limitations. 4+2=6

(c) In the course of simplex table calculation, describe how you will detect a degenerate, an unbounded and a non-existing feasible solution. Obtain the dual of the following LPP : 3+3=6

Minimize $Z = 2x_2 + 5x_3$
subject to

$$x_1 + x_2 \geq 2$$

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

$$x_1 - x_2 + 3x_3 = 4$$

and $x_1, x_2, x_3 \geq 0$

4. (a) (i) Give a mathematical formulation of a transportation problem.

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- (ii) Determine an initial basic feasible solution to the following transportation problem using the north-west corner rule, where O_i and D_j represent i th origin and j th destination respectively. 5

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Or

- (b) (i) Explain what is meant by optimality test of a transportation problem.

Describe the computational procedure of optimality test in a transportation problem. 2+4=6

- (ii) Solve the minimal assignment problem whose effectiveness matrix is

	I	II	III	IV
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Or

- (b) Solve the following 2×4 game graphically : 7

		Player B			
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