NEW

2017

BCA

4th Semester Examination

OPERATIONS RESEARCH

PAPER—2203

Full Marks : 100

Time : 3 Hours

The figures in the right-hand margin indicate full marks.

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

Illustrate the answers wherever necessary.

Answer any *seven* questions : 7×10

1. (a) Define an extreme point of a convex set, can there be any convex set without any extreme point ? Prove that an extreme point of a convex set is a boundary point of the set. 1+1+5

(b) Prove that the dual of the dual is primal. 3

2. (a) Use Charnes M method to solve the following LPP

Maximize $Z = x_1 + 5x_2$

Subject to : $3x_1 + 4x_2 \leq 6$
$x_1 + 3x_2 \geq 3$
$x_1 \geq 0, x_2 \geq 0$ 6

(b) Prove that the feasible region of LPP is a convex set. 4

3. (a) Explain the term dominance in connection with game theory. Use the property of dominance to reduce the game where pay-off matrix is the following and hence solve the game.

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

(b) What is an artificial variable and why it is necessary to introduce in LPP. 3

4. (a) A manufacturer makes red and blue pen. A red pen takes twice as much as time to make a blue pen one. If the manufacturer makes only blue pens, 500 can be made in a day. A red pen sells for Rs. 8 and at most

150 can be sold in a day. A blue pen sells for Rs. 5 and at most 250 can be sold in a day. The manufacturer desires to maximize his revenue. Formulate the manufacturer's problem as a linear programming problem. 5

(b) Using graphical method to solve the following L.P.P.

Maximize $Z = 5x_1 + 3x_2$

Subject to : $2x_1 + 5x_2 \leq 10$
$5x_1 + 2x_2 \leq 10$
$2x_1 + 3x_2 \geq 6$
$x_1, x_2 \geq 0$ 5

5. (a) Define following terms :

Slack variable, Surplus variable 2

(b) Solve the following L.P.P. by Simplex method :

Maximize $Z = 3x_1 + 2x_2 + 2x_3$

Subject to : $2x_1 - x_2 + 3x_3 \leq 18$
$x_1 + x_2 + 2x_3 \leq 12$
$x_1, x_2, x_3 \geq 0$ 8

6. (a) Write down mathematical formulation of general Transportation problem. 3

(b) Find the initial basic feasible solution of the following balanced T.P. using VAM method : 7

	D_1	D_2	D_3	D_4	a_i
O_1	15	28	13	21	18
O_2	22	15	19	14	14
O_3	16	12	14	31	13
O_4	24	23	15	30	20
b_j	16	15	10	24	

7. (a) Write down the rules for constructing a network. 3

(b) A project consists of eight activities with the following time estimates : 7

Activity	Immediate Predecessor	Time (days)		
		t_o	t_m	t_p
A	—	1	1	7
B	—	1	4	7
C	—	2	2	8
D	A	1	1	1
E	B	2	5	14
F	C	2	5	8
G	D, E	3	6	15
H	F, G	1	2	3

(i) Draw the PERT Network.

(ii) Find the expected time for each activity.

(iii) Determine critical path.

8. (a) Define sequencing problem with its underlying assumptions. 3

(b) Find the optimal assignments for the assignment problem with the following cost matrix : 7

	M_1	M_2	M_3	M_4	M_5
J_1	3	8	2	10	3
J_2	8	7	2	9	7
J_3	6	4	2	7	5
J_4	8	4	2	3	5
J_5	9	10	6	9	10

9. (a) Write down advantages of Two-phase method in compare to Big-M method. 2

(b) Solve the following L.P.P. by Two-phase method :

Maximize $Z = 2x_1 + 3x_2$

Subject to : $2x_1 + x_2 \geq 1$

$x_1 + 2x_2 \geq 1$

$x_1, x_2 \geq 0.$ 8

10. (a) Define following terms (any *five*) : 5

(i) Strategy ;

(ii) Pure strategy ;

(iii) Mixed strategy ;

(iv) Pay off matrix ;

(v) Maximum criterion ;

(vi) Minimum criterion ;

(vii) Saddle point ;

(viii) Value of the game ;

(ix) Zero-sum game.

(b) Determine the solution of the following game :

Player B

$$\text{Player } A \quad \begin{matrix} & B_1 & B_2 \\ A_1 & 3 & 1 \\ A_2 & 2 & 4 \end{matrix}$$

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[*Internal Assessment — 30*]