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Total No. of Pages : 03

Total No. of Questions : 07

B.Com. (2011 & Onward) (Sem.-3)

OPERATION RESEARCH

Subject Code : BCOP-304

Paper ID : [B1127]

Time : 3 Hrs.

Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. **SECTION-A is COMPULSORY** consisting of TEN questions carrying TWO marks each.
2. **SECTION-B** contains SIX questions carrying TEN marks each and students have to attempt any FOUR questions.

SECTION-A

1. Write briefly :

- a) Is the set $S = \{(x_1, x_2) : 0 < x_1^2 + x_2^2 \leq 4\}$ convex? Justify your answer.
- b) What is the necessary and sufficient condition for the existence of a feasible solution to an $m \times n$ transportation problem?
- c) Find all basic solutions for the system

$$x_1 + 2x_2 \leq 6$$

$$3x_1 - x_2 \leq 7; \quad x_1, x_2 \geq 0$$

- d) While solving an LPP, maximize $Z = CX$, s.t. $AX = b$, $X \geq 0$, $b \geq 0$, what indicates "unbounded solution".
- e) Explain the following terms.
 - (i) Total float
 - (ii) Independent float.
- f) Explain the meaning of 'Crashing' in network techniques.
- g) Explain the four elements that characterize sequencing problem.
- h) Prove that the dual of the given primal, is the primal.
- i) Write the dual of

$$\text{Minimize } Z = 4x_1 - 8x_2$$

$$\text{s.t. } 2x_1 + 6x_2 = 3$$

$$x_1 + 4x_2 \leq 6; \quad x_1, x_2 - \text{unrestricted.}$$

- j) Write three major limitations of Operation Research.

SECTION-B

2. Solve the following problem using two-phase method :

$$\text{Minimize } Z = 3x_1 + x_2 - 2x_3$$

$$\text{s.t. } 4x_1 + 2x_2 - x_3 \leq 1$$

$$x_1 + x_2 + x_3 = 5$$

$$2x_2 + 4x_3 = 3; \quad x_1, x_2, x_3 \geq 0$$

3. Write the dual of given primal problem. Solve the dual problem using simplex methods and then write the solution of primal problem.

$$\text{Maximize } Z = 8x_1 + x_2$$

$$\text{s.t. } 8x_1 + x_2 \leq 8$$

$$2x_1 + x_2 \leq 6$$

$$3x_1 + x_2 \leq 6$$

$$x_1 + 6x_2 \leq 8; \quad x_1, x_2, \geq 0$$

4. Reduce the following game by dominance property and solve it :

	1	2	3	4	5
I	1	2	7	3	4
II	3	4	1	6	5
III	5	6	7	5	6
IV	0	2	1	3	2

5. Solve the following transportation problem to get an optimum solution :

	D₁	D₂	D₃	D₄	Available
O₁	2	3	1	2	40
O₂	5	4	2	6	60
O₃	3	9	7	2	80
Demand	10	40	60	20	

6. A small workshop undertaking repair of damaged cars has one denter and one painter. Presently there are 6 cars needing repair. The following estimates in hours of time needed for denting and painting on the cars are available.

Car	–	1	2	3	4	5	6
Denting time	–	4	7	3	12	11	9
Painting time	–	11	7	10	8	10	13

What is the sequence that completes all the jobs in minimum time? What is the corresponding schedule of jobs?

7. Consider the network given in following data :

Activity	–	A	B	C	D	E	F	G	H	I	J
Immediate Predecessor	–	–	A	A	A	B	C,D	D	B	E,F,G	G
Activity Duration (days)	–	2	3	4	5	6	3	4	7	2	3

- Draw the network
- Find critical path
- Find free floats and Total floats of each activity.