**Roll No.** **Total No. of Pages : 03**

**Total No. of Questions : 07**

**B.Com. (2011 Batch) (Sem.–3rd)**

# OPERATION RESEARCH

**Subject Code : BCOP-304**

**Paper ID : [B1127]**

**Time : 3 Hrs.** **Max. Marks : 60**

**INSTRUCTION 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 has to attempt any FOUR questions.**

www.brpaper.com

www.brpaper.com

## SECTION-A

**1. Write briefly :**

(a) Prove that the dual of the given primal, is the primal.

(b) Write the dual of

$$\text{Maximize } Z = 5x_1 - 3x_2 + 4x_3$$

$$\text{s.t. } 2x_1 + 6x_2 - x_3 = 6$$

$$x_1 + 6x_2 - 4x_3 \geq 6$$

$$2x_1 - x_2 + x_3 = 7$$

$$x_1 \geq 0,\ x_2, x_3 - \text{unrestricted.}$$

(c) Explain the four elements that characterize sequencing problem.

(d) Explain the term, total float and independent float.

(e) Is the union of two convex set convex? Justify your answer.

(f) Find the range of values of $p$ and $q$ which will render entry (2, 2) a saddle point for the game :

| | Player B | | |
|---|---|---|---|
| | 2 | 4 | 5 |
| **Player A** | 10 | 7 | $q$ |
| | 4 | $p$ | 6 |

(g) What do you mean by degeneracy in transportation problem?

(h) In a transportation problem with $m$-sources and $n$-destination, how many basic feasible solutions are available and why? Give reasons for your answer.

(i) While solving an LPP, minimize $Z = CX$ s.t., $AX = b$, $X \geq 0$, what indicates "alternate solution".

(j) Solve graphically

$$\text{Minimize } Z = 2x_1 + x_2$$
$$\text{s.t. } x_1 - x_2 \leq 0$$
$$-x_1 + 2x_2 \geq 1$$
$$2x_1 - x_2 \leq 1;\ x_1, x_2 \geq 0.$$

## SECTION-B

2. Solve the following problem using Big-M method :

$$\text{Minimize } Z = 3x_1 + x_2 - 2x_3$$
$$\text{s.t. } 4x_1 + 2x_2 - x_3 \leq 1$$
$$x_1 + x_2 + x_3 = 5$$
$$2x_2 + 4x_3 = 3;\ x_1, x_2, x_3 \geq 0.$$

3. State and Prove Weak Duality Theorem.

4. A company has 4 machines on which 3 jobs are to be made. Each job can be assigned to one and only one machine. The cost of each job is given in following table. What is the job assignment which will minimise the cost ? Also write the dual of the problem

| | | **W** | **X** | **Y** | **Z** ← **machines** |
|---|---|---|---|---|---|
| | **A** | 5 | 9 | 8 | 1 |
| **Job** | **B** | 18 | 24 | 17 | 19 |
| | **C** | 10 | 15 | 19 | 20 |

5. 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 ?

6. M/s XYZ consultants have identified the following ten major activities in a project to promote a new product,

| **Activity** | A | B | C | D | E | F | G | H | I | J |
|---|---|---|---|---|---|---|---|---|---|---|
| **Predecessors** | – | A | A | A | B, C, D | A | D | A | H | G |
| **Duration (week)** | 3 | 6 | 4 | 3 | 1 | 4 | 5 | 5 | 1 | 2 |

(a) Draw a PERT network to represent this project.

(b) What is the earliest time to complete project?

(c) Give the early and late start schedule for each activity.

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

| | $D_1$ | $D_2$ | $D_3$ | $D_4$ | **Availability** |
|---|---|---|---|---|---|
| $O_1$ | 2 | 3 | 1 | 2 | 40 |
| $O_2$ | 5 | 4 | 2 | 6 | 60 |
| $O_3$ | 3 | 9 | 7 | 2 | 80 |
| **Demand** | 10 | 40 | 60 | 20 | |

www.brpaper.com