

| | | | | | | | | | | | |
|--------------------|--|---|--|---|--|---|--|--|--|--|--|
| Student's Roll No. | | - | | - | | - | | | | | |
|--------------------|--|---|--|---|--|---|--|--|--|--|--|



ST. XAVIER'S COLLEGE

(AUTONOMOUS)

3rd SEMESTER EXAMINATION
B.B.A.
NOV - DEC 2010

OPERATIONS RESEARCH

OPRA3301

Friday, December 10, 2010 9:30 am to 11:30 am

Time allowed: **2 hours**

Full Marks: **50**

Instructions:

- Use fountain pen or ball-point pen of blue or black ink.
- Answer in your own words as far as practicable.
- Do not write anything on the Question paper other than your Roll No.

GROUP – A

1. Answer **ANY FIVE** questions:

(5x2=10)

(a) Find two B.F.S. of the system:

$$\begin{aligned} 2x_1 + x_2 + x_3 &= 3 \\ x_1 + 2x_2 + x_4 &= 3 \\ x_j &\geq 0, \quad (j = 1,2,3,4) \end{aligned}$$

(b) Draw feasible region for the following LPP

$$\begin{aligned} \max & (2x_1 + x_2) \\ \text{sub: } & x_1 + 2x_2 \leq 4 \\ & 5x_1 + 10x_2 \leq 15 \\ & x_1 \geq 0, \quad x_2 \geq 0. \end{aligned}$$

(c) Write the dual of the following LPP

$$\begin{aligned} \max & (x_1 + 2x_2 + x_3) \\ \text{subject to} & 2x_1 + x_2 - x_3 \leq 2 \\ & -2x_1 + x_2 - 5x_3 \geq -6 \\ & 4x_1 + x_2 + x_3 \leq 6 \\ & x_1, x_2, x_3 \geq 0 \end{aligned}$$

(d) Apply North West Corner Rule to obtain an initial BFS to the following Transportation Problem:

| | | | |
|----|----|---|----|
| 2 | 3 | 1 | 7 |
| 4 | 3 | 2 | 8 |
| 1 | 1 | 2 | 15 |
| 12 | 10 | 8 | |

(e) Solve the following 2x2 Game Problem:

| | | |
|-------|-------|---|
| | P_2 | |
| | 5 | 1 |
| P_1 | 3 | 4 |

(f) For a TV Repairman sets arrive at the rate 10 per day and he can dispose of at the rate 16 sets per day. Find the probability that he is idle at a particular point of time during the working hours.

(g) In a network define Total Float of an activity.

GROUP – B

Answer **ANY FOUR** questions.

(4x10=40)

1. (a) Food X contains 6 units of vitamin A and 7 units of vitamin B per gram and costs Rs.12/gm. Food Y contains 8 units and 12 units of A and B per gram respectively and costs Rs.20/gm. The daily requirements of vitamin A and B are at least 100 units and 120 units respectively. Formulate the above as an LPP to minimize the cost. (5)

(b) Solve graphically the following LPP:

$$\text{Minimize } Z = 3x_1 + 5x_2$$

$$\text{Subject to } 2x_1 + 3x_2 \geq 12$$

$$-x_1 + x_2 \leq 3$$

$$x_1 \leq 4 \text{ and } x_2 \geq 3$$

$$x_1 \geq 0, x_2 \geq 0$$

(5)

2. (a) Use Simplex method to solve the LPP:

$$\text{Max } Z = 3x_1 + 2x_2$$

$$\text{Subject to } x_1 + x_2 \leq 4$$

$$x_1 - x_2 \leq 2$$

$$x_1, x_2 \geq 0$$

(5)

(b) Solve the following LPP after solving its dual:

$$\text{Min } (x_1 + x_2)$$

$$\text{Sub. to: } 2x_1 + x_2 \geq 3$$

$$x_1 + 2x_2 \geq 3$$

$$x_1 \geq 0, x_2 \geq 0$$

(5)

3. (a) Solve the following transportation problem starting with Vogel Approximation Method.

| | D_1 | D_2 | D_3 | D_4 | a_i |
|-------|-------|-------|-------|-------|-------|
| O_1 | 10 | 7 | 3 | 6 | 3 |
| O_2 | 1 | 6 | 8 | 3 | 5 |
| O_3 | 7 | 4 | 5 | 3 | 7 |
| b_j | 3 | 2 | 6 | 4 | |

(5)

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

| | M_1 | M_2 | M_3 | M_4 |
|-------|-------|-------|-------|-------|
| J_1 | 10 | 12 | 19 | 11 |
| J_2 | 5 | 10 | 7 | 8 |
| J_3 | 12 | 14 | 13 | 11 |
| J_4 | 8 | 15 | 11 | 9 |

(5)

4. (a) Solve the following game problem graphically:

| | | Player B | | |
|----------|---|----------|---|----|
| Player A | 1 | 1 | 3 | 11 |
| | 2 | 8 | 5 | 2 |

(5)

(b) The annual demand of an item is 3200 units. The cost is Rs.6/unit and inventory carrying charges 25% of cost per annum per unit. If the cost of one procurement is Rs.150, determine

(i) Economic order quantity (EOQ).

(ii) Number of orders per year.

(iii) Optimal total cost per year.

(2+1+2)

5. (a) In a public telephone booth the arrivals are on the average 20 per hour. A call on the average takes 2 minutes. If there is just one phone, find (i) the expected number of callers (either waiting or making a call) in the booth at any time, (ii) the proportion of the time the telephone is expected to be idle? (2+3)

(b) A machine costs Rs.10,000. Its operating cost and resale values are given below:

| Year | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|----------------|------|------|------|------|------|------|------|------|
| Operating cost | 1000 | 1200 | 1400 | 1700 | 2000 | 2500 | 3000 | 3500 |
| Resale value | 6000 | 4000 | 3200 | 2600 | 2500 | 2400 | 2000 | 1600 |

Determine the time when it should be replaced.

(5)

6. The following table gives the activities and duration of a construction project:

| | | | | | | |
|-----------------|-------|-------|-------|-------|-------|-------|
| Activity | 1 – 2 | 1 – 3 | 2 – 3 | 2 – 4 | 3 – 4 | 4 – 5 |
| Duration (days) | 20 | 25 | 10 | 12 | 6 | 10 |

(a) Draw the network for the project.

(b) Obtain the critical path analytically.

(5+5)
