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**3rd SEMESTER EXAMINATION – BBA  
NOV – DEC 2009**

**OPERATIONS RESEARCH  
(HONOURS)**

**OPRA3301**

Wednesday, December 16, 2009

09:30 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 own words as far as practicable.
- Do not write anything on the Question paper other than Roll No.

**GROUP - A**

1. Answer **any five** questions: (5 x 2 = 10)
- (a) For the game with the following pay off matrix, determine the optimum strategies and the value of the game:

$$P_1 \begin{matrix} & P_2 \\ \begin{bmatrix} 5 & 1 \\ 3 & 4 \end{bmatrix} \end{matrix}$$

- (b) Define an optimal solution of a linear programming problem.
- (c) In a Network define critical activity.
- (d) Write down the dual of the following LPP :
- Max (2x - 3y + z)  
Sub: x - y + z ≤ 5  
2x + 3y - 2z ≥ -6  
x ≥ 0, y ≥ 0, z ≥ 0.
- (e) Apply North-West Corner Rule to obtain an initial B.F. S. of the following Transportation problem:

	a <sub>i</sub> (availability)			
	2	3	5	20
	1	4	8	15
	2	2	5	12
b <sub>j</sub> (requirement)	11	13	23	

- (f) Solve graphically the LPP:
- max (x<sub>1</sub> + x<sub>2</sub>)  
sub : x<sub>1</sub> + x<sub>2</sub> ≤ 1  
-3x<sub>1</sub> + x<sub>2</sub> ≥ 3  
x<sub>1</sub> ≥ 0, x<sub>2</sub> ≥ 0.
- (g) At a telephone booth arrival rate is 0.1 arrival per minute and disposal rate is 0.33 service per minute .Find the probability that a person arriving will have to wait.

**GROUP - B**

Answer **any four** questions:

1. (a) A company produces two types of hats.  
Each hat of the first type requires twice as much labour time as required by the second type.  
If all hats are of the second type only, the company can produce a total of 500 hats a day.  
The market limits daily sales of the first and second type of hats to 150 and 250 respectively. Assuming that the profits per hat are Rs.5 for type A and Rs.8 for type B, formulate the problem of maximizing profit as a linear programming problem. (5)

- (b) Solve graphically the following problem:
- Max (x<sub>1</sub> + x<sub>2</sub>)  
Sub: 2x<sub>1</sub> + 3x<sub>2</sub> ≤ 6  
x<sub>1</sub> - x<sub>2</sub> ≤ 1.  
x<sub>1</sub> ≥ 0, x<sub>2</sub> ≥ 0. (5)

2. (a) Use simplex method to solve the LPP:
- Max (3x<sub>1</sub> + 2x<sub>2</sub>)  
Sub x<sub>1</sub> + x<sub>2</sub> ≤ 4  
x<sub>1</sub> - x<sub>2</sub> ≤ 2.  
x<sub>1</sub> ≥ 0, x<sub>2</sub> ≥ 0. (5)

(b) Solve the following game problem graphically:

$$\begin{array}{c} \text{Player B} \\ \text{Player A} \begin{bmatrix} 3 & -3 & 4 \\ -1 & 1 & -3 \end{bmatrix} \end{array} \quad (5)$$

3. (a) Solve the following assignment problem :

		Men				
		A	B	C	D	E
Tasks	I	1	3	2	8	8
	II	2	4	3	1	5
	III	5	6	3	4	6
	IV	3	1	4	2	2
	V	1	5	6	5	4

(b) Solve the following transportation problem:

	D1	D2	D3	
S1	4	3	2	10
S2	1	5	0	13
S3	3	8	6	14
	18	15	4	

4. (a) In a project the following data are given –

<u>Activity</u>	<u>Immediate predecessor</u>	<u>Duration (day)</u>
A	–	5
B	A	8
C	B	10
D	B	5
E	B	4
F	E	6
G	C, F	3

Draw the project network and find the critical path by calculating total float of each activity. (5)

(b) The annual demand of an item is 3200 units. The cost per unit is Rs.6/-, inventory carrying charges per unit is 25% of unit cost per annum. If the cost of ordering one procurement is Rs.150/-, determine (i) Economic order quantity (EOQ i.e. optimal order quantity) (ii) number of orders per year (iii) Optimal cost per year. (5)

5. (a) In a public telephone booth arrivals are on the average 15 per hour. A call on the average takes 3 minutes. If there is just one phone, find  
 (i) the expected number of callers in the booth at any time (waiting or phoning).  
 (ii) the proportion of the time the booth is expected to be idle (3+2)

(b) Draw the network in which there are 6 Nodes and distance between the nodes in kilometer are as follows:

Node 1	to	Node 2	: 4
Node 1	to	Node 3	: 3
Node 2	to	Node 4	: 3
Node 2	to	Node 5	: 2
Node 4	to	Node 6	: 2
Node 5	to	Node 6	: 2

Find the shortest path from Node (1) to Node (6) analytically (not graphically). (5)

6. (a) A machine costs Rs 10,000. The operating costs and resale value 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 at what point of time it should be replaced. (5)

- (b) A company keeps stock of a special product. Previous experience indicates the daily demand is as given below:

Daily Demand	5	10	15	20	25	30
Probability	0.01	0.20	0.15	0.50	0.12	0.02

Simulate the demand for the next 10 days. Also find daily average demand for that product on the basis of simulated data. (5)

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