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Total No. of Pages: 05
Total No. of Questions: 07

B.Com Professional (Sem.-3rd)

OPERATION RESEARCH

Subject Code: BCOP-304
Paper ID: [B1127]

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

INSTRUCTIONS TO CANDIDATE:

(i) Section –A, is Compulsory.
(ii)Attempt any four questions from Section-B.

Section –A

Q.1.(a) Define artificial variables and explain their significance.

(b) Write the condition to determine the existence of unbounded solution of linear programming problem in simplex method.

(c) Write the dual of the following LPP.

$$\text{Min } z = 4x_2 + 5x_3$$
$$2x_1 - x_2 + 4x_3 \le 3$$
$$2x_2 - 5x_3 \ge 7$$
$$x_1, x_3 \ge 0$$

(d) In a balanced transportation problem with m sources and n destinations what is the number of nonbasic variables?

(e) Define degeneracy in transportation problem. Explain briefly how the degeneracy occurs in intermediate stages.

(f) Check whether the following game possesses saddle point. If so, what is the value of the game?

B

A	8	5	8
	8	3	5
	7	4	5
	6	5	6

(g) Solve the following game using Odds method:

B

A	-1	3
	2	-1

(h) Write the Fulkerson's rule to number the nodes in a network diagram.

(i) Define all the costs associated with the inventories.

(j) A manufacturer has to supply his customer with 600 units of his product per year. Shortages are not allowed and the storage cost amounts to Rs. 0.60 per unit per year. The setup cost per run is Rs. 80. Find the optimum run size and the minimum average yearly cost.

10 × 2 = 20 marks

Section –B

Q.2.(a). The manager of an oil refinery must decide on the optimum mix of two possible blending processes of which the input and output production runs are a follows.

Process	Input		Output	
	Crude A	Crude B	Gasoline X	Gasoline Y
1	6	4	6	9
2	5	6	5	5

The maximum amounts available of crude A and crude B are 250 units and 200 units respectively. Market demand shows that atleast 150 units of gasoline X and gasoline Y must be produced. The profits per production run from process 1 and process 2 are Rs. 4 and Rs. 5 respectively. Formulate the problem to maximize the profit.

(b) Write the mathematical formulation of transportation problem.

(5,5)

Q.3. Solve the following linear programming problem by simplex method.

$$\text{Maximize } z = 4x_1 + 3x_2 + 4x_3 + 6x_4$$
$$x_1 + 2x_2 + 2x_3 + 4x_4 \le 80$$
$$2x_1 + 2x_3 + x_4 \le 60$$
$$3x_1 + 3x_2 + x_3 + x_4 \le 80$$
$$x_1, x_2, x_3, x_4 \ge 0$$

(10)

Q.4. Find the optimal solution of the transportation problem where the costs, the capacities of the sources and the demands of the destinations are given in the table below:

Destination → Source ↓	1	2	3	4	Supply
1	23	27	16	18	30
2	12	17	20	51	40
3	22	28	12	32	53
Demand	23	27	16	18	

(10)

Q.5.(a). Given the following data, determine the least cost allocation of the available workers to the five jobs.

	J_1	J_2	J_3	J_4	J_5
W_1	8	4	2	6	1
W_2	0	9	5	5	4
W_3	3	8	9	2	6
W_4	4	3	1	0	3
W_5	9	5	8	9	5

(b). Solve the following problem for the salesman to determine the route covering the areas A, B, C,D and E so that the total cost is minimum

	A	B	C	D	E
A	-	2	5	7	1
B	6	-	3	8	2
C	8	7	-	4	7
D	12	4	6	-	5
E	1	3	2	8	-

(5,5)

Q.6.(a). Solve the following game using the dominance rule

B

A						
	4	2	0	2	1	1
	4	3	1	3	2	2
	4	3	7	-5	1	2
	4	3	4	-1	2	2
	4	3	3	-2	2	2

(b). Determine the optimal sequence of jobs that minimizes the total time required in performing the following jobs on three machines in the order ABC:

Processing time	Jobs						
(in hours)	J_1	J_2	J_3	J_4	J_5	J_6	J_7
Machine A	10	8	12	6	9	11	9
Machine B	6	4	6	5	3	4	2
Machine C	8	7	5	9	10	6	5

Also determine the total elapsed time and idle time for each machine. (5,5)

Q.7. The information about a project is give in the following table.

Activity	**Predecessor Activity**	**Duration (weeks)**
A	-	8
B	-	10
C	-	8
D	A	10
E	A	16
F	B,D	17
G	C	18
H	C	14
I	F,G	9

(i). Draw the network for the above project.

(ii). Determine the critical path and the duration of the project.

(iii). Find all three types of floats. (10)

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