Name : ....

Roll No. : ....

Invigilator's Signature : ....

CS/B.Tech(CT)(N)/SEM-5/CT-504A/2012-13

2012

OPERATION RESEARCH

Time Allotted : 3 Hours *Full Marks* : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Graph sheet (s) will be supplied by the institution.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for the following : $10 \times 1 = 10$

i) A transportation problem is a balanced transportation problem if

a) total demand and total supply are equal and number of sources equals to the number of destinations

b) total demand equals to total supply irrespective of the number of sources and destinations

c) number of sources matches with the number of destinations

d) the corresponding basic feasible solution is to be degenerate.

ii) In an assignment problem for assigning n jobs to n machines, the numbers of decision variables and constraints are respectively

a) n^2 and $2n$ b) $2n$ and $2n$

c) n^2 and n d) $2n$ and n.

iii) In an assignment problem, the minimum number of lines covering all zeros in the reduced cost matrix of order n can be

a) at most n b) $n + 1$

c) $n - 1$ d) at least n.

iv) Find the value of the game having the following Pay-off matrix :

		B			
		B_1	B_2	B_3	B_4
	A_1	1	7	3	4
A	A_2	5	6	4	5
	A_3	7	2	0	3

a) 7 b) 5

c) 3 d) 4.

v) Optimality criteria being satisfied, state, what is indicated by each of the following ?

a) One or more artificial vectors are in the basis at zero level.

b) One or more artificial vectors are in the basis at positive level.

vi) The name of the method used in getting the optimum assignment is

a) North-West Corner Rule

b) VAM

c) Hungarian method

d) none of these.

vii) In game theory players apply mixed strategy when there is no saddle point.

a) True

b) False.

viii) In case of 2 linear equations with 4 unknown variables, the maximum limit of basic solutions is

a) 4 b) 5

c) 6 d) 7.

ix) If there are n cities, then a travelling salesman, starting from a given city will have before him a total of

a) $(n-1)!$ choices b) $n!$ choices

c) n choices d) $(n+1)$ choices

x) When the sum of gains of one player is equal to the sum of losses to another player in a game, this situation is known as

a) biased game b) unbiased game

c) fair game d) none of these.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following $3 \times 5 = 15$

2. Solve graphically the L.P.P. :

Maximize $Z = 3x_1 + 2x_2$

subject to $2x_1 + x_2 \leq 2$

$3x_1 + 4x_2 \geq 12$

and $x_1, x_2 \geq 0$

3. Given the L.P.P.

Minimize $Z = x_1 + x_2 + x_3$

subject to $x_1 - 3x_2 + 4x_3 = 5$

$x_1 - 2x_2 \leq 3$

$2x_2 - x_3 \geq 4$

$x_1, x_2 \geq 0$ and x_3 is unrestricted in sign.

Formulate the dual of the L.P.P.

4. Use dominance to reduce the payoff matrix and solve the game with the following payoff matrix :

		B_1	B_2	B_3	B_4
A	A_1	3	2	4	0
	A_2	2	4	2	4
	A_3	4	2	4	0
	A_4	0	4	0	8

5. Write the dual of the following L.P.P. :

Minimize $Z = 2x_2 + 5x_3$

subject to $x_1 + x_2 \geq 2$

$2x_1 + x_2 + 6x_3 \leq 6$

$x_1 - x_2 + 3x_3 = 4$

$x_1, x_2, x_3 \geq 0$

Formulate the dual of the L.P.P.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

6. a) Solve the following transportation problem :

	D_1	D_2	D_3	D_4	a_i
O_1	1	2	1	4	30
O_2	3	3	2	1	50
O_3	4	2	5	9	20
b_j	20	40	30	10	

b) Solve the following game by graphical method :

Player B

Player A		B_1	B_2
	A_1	1	– 3
	A_2	3	5
	A_3	– 1	6
	A_4	4	1
	A_5	2	2
	A_6	– 5	0

9 + 6

7. a) Solve the following transportation problem :

	D_1	D_2	D_3	D_4	a_i
O_1	19	30	50	10	7
O_2	70	30	40	60	9
O_3	40	8	70	20	18
b_j	5	8	7	14	

b) Find the optimal assignment to find the minimum cost for the following assignment problem with the following cost matrix :

	M_1	M_2	M_3	M_4	M_5
J_1	1	3	2	3	6
J_2	2	4	3	1	5
J_3	5	6	3	4	6
J_4	3	1	4	2	2
J_5	1	5	6	5	4

9 + 6

8. a) Solve the following L.P.P. by Big M method :

Maximize $Z = 5x_1 + 2x_2 + 2x_3$

subject to $3x_1 - 2x_2 - 2x_3 = -8$

$3x_1 - 4x_2 - x_3 = -7$

and $x_1, x_2, x_3 \geq 0$

b) The time estimates (in weeks) for the activities of a PERT network are given below :

Activity	Optimistic time	Most likely time	Pessimistic time
1 - 2	1	1	7
1 - 3	1	4	7
1 - 4	2	2	8
2 - 5	1	1	1
3 - 5	2	5	14
4 - 6	2	5	8
5 - 6	3	6	15

i) Draw the project network and identify all paths through it.

ii) Determine the expected project length.

iii) Calculate the standard deviation of the project length. 8 + 7

9. a) Use Simplex method to solve the L.P.P. :

Maximize $Z = 4x_1 + 10x_2$

subject to $2x_1 + x_2 \leq 50$

$2x_1 + 5x_2 \leq 100$

$2x_1 + 3x_2 \leq 90$

and $x_1, x_2 \geq 0$

b) The following table shows the jobs of a network along with their time estimates :

Jobs	1-2	1-6	2-3	2-4	3-5	4-5	6-7	5-8	7-8
a (days)	1	2	2	2	7	5	5	3	8
m (days)	7	5	14	5	10	5	8	3	17
b (days)	13	14	26	8	19	17	29	9	32

Draw the project network and find the probability that the project is completed in 40 days. 8 + 7

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