Name : ....

Roll No. : ....

Invigilator's Signature : ....

CS/B.Tech/IT (O)/SEM-5/M(CS)-511/2012-13

2012

OPERATION RESEARCH AND OPTIMIZATION TECHNIQUE

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.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : $10 \times 1 = 10$

   i) The solution of the dual LP problem
      - a) presents the marginal profits of each additional unit of resource
      - b) can always be derived by examining the Z_j row of the primal simplex tableau
      - c) is better than the solution to the primal
      - d) all of these.

   ii) Ana activity is said to be critical activity if
      - a) its free float is zero
      - b) its total float is zero
      - c) its independent float is zero
      - d) its time duration is zero.

iii) In an assignment problem involving four workers and three jobs, the total number of assignments possible is

a) 4 b) 3

c) 7 d) 6.

iv) The amount of time by which an activity can be delayed, if all its preceding activities take place at their earliest possible time and the following activities are allowed to wait until their latest permissible time, is called

a) activity float b) total float

c) free float d) independent float.

v) If there are n cities, then a travelling salesman, starting from a given city, w has before him

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

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

vi) If in the simplex algorithm, the basis column of the final simplex table contains an artificial variable, then the problem has .... solution.

a) degenerate solution b) infeasible solution

c) unbounded solution d) multiple solution.

vii) Intersection of two convex sets is also a convex set. Is the statement

a) True

b) False

viii) When the total supply is not equal to the total demand, that type of transportation problem is known as

a) balanced transportation problem

b) unbalanced transportation problem

c) degeneracy

d) non-degeneracy.

ix) Among all possible cuts in a transport network, the cut with the smallest capacity gives the maximum flow in the network. Is the statement

a) True

b) False

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

a) biased game b) zero sum game

c) fair game d) all of these.

xi) The number of basic variables in a transportation problem is

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

c) $n - 1$ d) none of these.

GROUP – B

(Short Answer Type Questions)

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

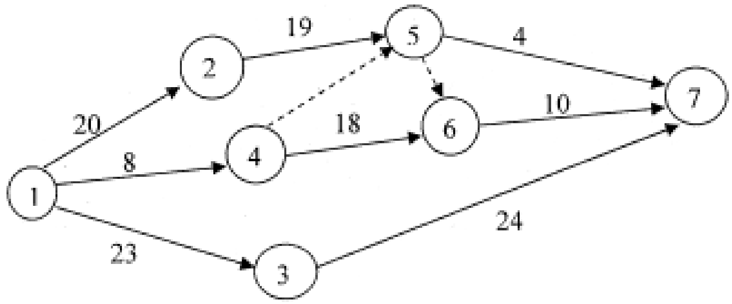
2. A research laboratory has two melts of Cu-Ni alloy to make up a new alloy. The composition of metals are as under

Melts	**Compositions**	
	Cu	Ni
I	2	1
II	1	1

To make up the new alloy, at least 10 kg of Cu and 6 kg of Ni is needed. Melt I and Melt II costs Rs. 25 and Rs. 30 per kg respectively. Write the LP model to determine the quantities of each melt.

3. Define the following in terms of game theory :
   a) Pay-off matrix
   b) Pure strategy
   c) Mixed strategy
   d) Saddle point
   e) Zero sum game

4. For the following network, find the critical path and minimum time to complete the project



5. Find the basic feasible solution of the following transportation problem by matrix minima method

	P	Q	R	S	Supply
A	3	5	7	6	50
B	2	5	8	3	75
C	3	6	9	2	25
Demand	20	20	50	60	

GROUP – C

(Long Answer Type Questions)

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

6. a) IBM produces two kinds of memory chips (chip I and chip II) for memory usage. The unit selling price is Rs. 1,500 and Rs. 2,500 for chip I and chip II respectively.

To make one chip I, IBM has to invest 3 hour of skilled labour, 2 hour of unskilled labour and 1 unit of raw material. To make one chip II, it takes 4 hour of skilled labour, 3 hour of unskilled labour and 2 unit of raw material. The company has 120 hour of skilled labour, 60 hour of unskilled labour and 30 unit of raw material available. IBM requires that at least 3 unit of chip II have to be produced as per sale contract signed by IBM. Formulate the problem as an LPP and solve it graphically.

b) Use simplex algorithm to solve the following LPP

Maximize $z = 4x_1 + 7x_2$

Subject to $2x_1 + x_2 \leq 1000$

$10x_1 + 10x_2 \leq 6000$

$2x_1 + 4x_2 \leq 2000$

$x_1, \ x_2 \geq 0$ 8 + 7

7. a) Consider the following 4 × 4 game played by players A and B :

Player B

Player A	I	II	III	IV
I	6	2	4	8
II	2	−1	1	12
III	2	3	3	9
IV	5	2	6	10

Find the value of the game by applying dominance theory.

b) The personal manager of a company wants to assign Mr. X, Mr. Y, and Mr. Z to regional offices at Delhi, Mumbai, Kolkata and Chennai. The costs of relocation (in rupee) for the three officers at the four regional offices are given below :

	Delhi	Mumbai	Kolkata	Chennai
Mr. X	16000	22000	24000	20000
Mr. Y	10000	32000	26000	16000
Mr. Z	10000	20000	46000	30000

Find the assignment of officers to offices and the total cost of assignment. 7 + 8

8. a) Visitors' parking at a campus is limited to five spaces only. Cars making use of this space arrive accordingly to a Poisson distribution at the rate of six cars per hour. Parking time is exponentially distributed with a mean of 30 minutes. Visitors who cannot find an empty space immediately on arrival may temporarily wait inside the lot until a parked car leaves. The temporary space can hold only three cars. Others cars that cannot park or temporary waiting space must go else where.

Determine the following :

i) The probability p_n of having n cars in the system.

ii) The effective arrival rate for cars that actually use the lot.

iii) The average time a car waits for a parking space inside the lot.

iv) The average number of occupied parking spaces.

v) The average utilization of the parking lot.

b) A salesman has to visit five cities A, B, C, D and E. The distances (in hundred miles) between the five cities are as follows :

	A	B	C	D	E
A	—	7	6	8	4
B	7	—	8	5	6
C	6	8	—	9	7
D	8	5	9	—	8
E	4	6	7	8	—

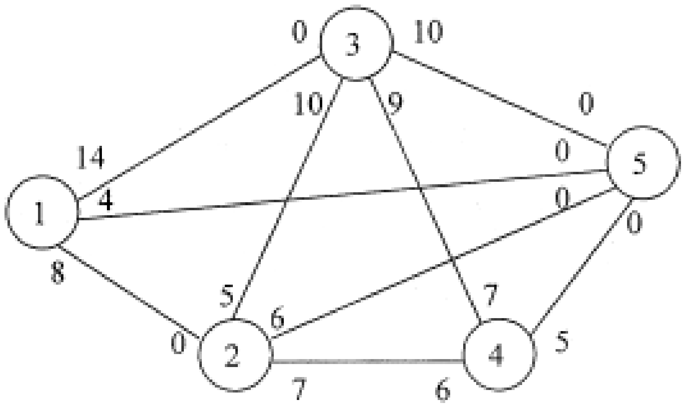
If the salesman starts from city A and has to come back to city A, which route should he select so that the total distance travelled is minimum ? 10 + 5

9. a) Determine the initial basic feasible solution of the following transportation problem by Vogel's Approximation method

	P	Q	R	S	Supply
A	19	30	50	10	7
B	70	30	40	60	9
C	40	8	70	20	18
Demand	5	8	7	14	

Also, verify whether the solution is optimal or not.

b) Find the maximum flow in the network shown in the following using Ford Fulkerson algorithm.



8 + 7