Name : ....

Roll No. : ....

Invigilator's Signature : ....

CS / B.Tech(CSE-OLD) / SEM-4 / M(CS)-402 / 2012

2012

OPERATION RESEARCH & OPTIMIZATION TECHINIQUE

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) Saddle point is the point of intersection of pure strategies

      a) True b) False.

   ii) A two person game is said to be zero-sum if

      a) gain of one players is exactly matched by loss of the other, so that their sum is equal to zero

      b) gain of one player does not match the loss of the other

      c) both the player must have all equal number of strategies

      d) diagonal entries of the pay off matches are zero.

iii) The formula for finding the minimum inventory cost under the purchasing model without shortages is

a) $\left(2RC_1 C_3 \right)^{1/2}$ b) $\left(2C_3 R / C_3 \right)^{1/2}$

c) $\left(C_1 / 2C_3 R \right)^{1/2}$ d) None of these.

iv) An LPP having an artificial variable at positive level in the basis, when all $\left(Z_i - C_j \geq 0 \right)$ has

a) unbounded solution

b) infeasible solution

c) basic feaible solution

d) alternative optimal solution.

v) The dual of the dual of a LPP is the

a) primal b) dual

c) both primal and dual d) none of these.

vi) Transportation problem is a

a) maximization problem b) minimization problem.

vii) In a fair game the value of the game is

a) 1 b) 0

c) unbounded d) none of these.

viii) An assignment problem is a special type of

a) transportation problem

b) LPP

c) inventory problem

d) none of these.

ix) The number of basic variable in a transportation problem is at most

a) m + n – 1 b) m + n

c) mn d) mn + 1.

x) An assignment problem can be solved by

a) Hungarian method

b) VAM

c) Matrix minima method

d) None of these.

xi) If there are n workers & n jobs there would be

a) $n\,!$ solutions b) $(n+1)\,!$ solutions

c) $(n\,!)^n$ solutions d) n solutions.

xii) The set $S = \left\{ \left(x_1, x_2 \right) : 0 \le x_1, x_2 \le 1 \right\}$, is

a) a convex set

b) concave set

c) not a convex set

d) both convex and concave set.

xiii) For the following Linear Programming Problem :

Maximize $Z = 2x_1 - 3x_2$

Subject to $x_1 + x_2 \leq 2$

$2x_1 + 2x_2 \geq 8$

and $x_1, x_2 \geq 0$,

$x_1 = 2 \cdot 5, \; x_2 = 3 \cdot 5$

a) is a feasible solution but not a basic

b) is a basic feasible solution

c) is not a solution

d) is a degenerate basic feasible solution.

xiv) The maximum number of possible basic feasible solution of the following Linear programming problem :

Minimize $Z = x_1 - x_2$

Subject to $x_1 + x_2 \leq 3$

and $x_1, x_2 \geq 0$

is

a) 3 b) 2

c) 1 d) infinitely many.

xv) In traveling salesman problem, the sales man can visit a city twice until he has visited all the cities

a) True b) False.

GROUP – B

(Short Answer Type Questions)

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

2. Find the initial basic feasible solution of the following transportation problem by Vogel's Apprimation (VAM) method :

	W_1	W_2	W_3	W_4	***Capacity***
F_1	10	30	50	10	7
F_2	70	30	40	60	9
F_3	40	8	70	20	18
Requirement :	5	8	7	14	34

3. Determine EOQ in an inventory control problem having
   a) constant rate of demand
   b) instantaneous replenishment and
   c) finite rate of production.

4. Solve the game whose pay-off matrix is given by

$$\text{Player } A \quad \begin{array}{c} \\ A_1 \\ A_2 \\ A_3 \end{array} \overset{\text{Player } B}{\begin{bmatrix} B_1 & B_2 & B_3 \\ 1 & 3 & 1 \\ 0 & -4 & -3 \\ 1 & 5 & -1 \end{bmatrix}}$$

5, A TV repairman finds that the time spend on his jobs has an enponential distribution with a mean of 30 minutes. If he repair sets in the order in which they came in and if the arrival of sets follows a poisson distribution approximately with an average rate of 10 per 8 hour day. What is the repair man's expected ideal time each day ?

How many jobs are ahead of the average set just brought in ?

6. Find the dual of the following LPP by simplex method :

Maximize $Z = 60x_1 + 50x_2$

Subject to $x_1 + 2x_2 \leq 40$

$3x_1 + 2x_2 \leq 60$

and $x_1, x_2 \geq 0$.

7. Find the dual of the following LPP

Maximize $Z_n = 2x_1 + 3x_2 - 4x_3$

Subject to $3x_1 + x_2 + x_3 \leq 2$

$-4x_1 + 3x_3 \geq 4$

$x_1 - 5x_2 + x_3 = 5$

& $x_1 \geq 0$, $x_2 \geq 0$ and $x_3 \geq 0$.

GROUP – C

(Long Answer Type Questions)

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

8. a) The annual requirement of a product is 3000 units. The ordering cost is Rs. 100 per order. The cost per unit is Rs. 10. The caring cost per unit per year is 30% of the unit cost.

   i) Find EOQ

   ii) By using better organizational method the ordering cost per order is brought down to Rs. 80 per order ; but the same quantity as determined above was ordered. If a new EOQ is found by using the order cost as Rs. 80, what would be the further savings in the cost ? 7

   b) Interpret the queueing model (M/M/1) : (∞/FIFO) literally.

   In a railway marshalling yard, goods trains are arrive at the rate of 30 trains per day. Assuming that the inter arrival time follows a exponential distribution and the service time (the time taken to hump a train) distribution is also exponential with an average 36 minutes. Calculate the following :

   i) the average number of train in the queue.

ii) the probability of the queue size exceeds 10.

iii) expected waiting time in the queue. 8

9. The following table shows the jobs of a network along with their time estimates. The time estimates are in days : 15

Jobs	1-2	1-6	2-9	2-4	3-5	4-5	5-8	6-7	7-8
t_o	3	2	6	2	5	3	1	3	4
t_m	6	5	12	5	11	6	4	9	9
t_b	15	14	30	8	17	15	7	27	28

Draw the project network :

i) Find the critical path.

ii) Find the probability that the project is completed in 31 days.

$[\, P\,(\, z \le -\, 2{\cdot}1667\,) = {\cdot}0114\,]$

10. a) Solve the game using L.P.P. methd of : 10

Player A

Player B $\begin{pmatrix} 2 & -2 & 3 \\ -3 & 5 & -1 \end{pmatrix}$

b) Solve the game using rule of dominance : 5

Player B

Player A $\begin{pmatrix} 5 & -10 & 9 & 0 \\ 6 & 7 & 8 & 1 \\ 8 & 7 & 15 & 1 \\ 3 & 4 & -1 & 4 \end{pmatrix}$

11. a) Solve the following LPP by simplex method : 10

Maximize $z = x_1 + x_2 + 3x_3$

Subject to $3x_1 + 2x_2 + x_3 <= 3$

$2x_1 + x_2 + 2x_3 <= 2$

and $x_1, x_2, x_3 >= 0$.

b) Find the dual of the following LPP : 5

Minimize $z = 23x_1 + 6x_2$

Subject to $9x_1 + 3x_2 + x_3 \le 5$

$-8x_1 + 6x_2 >= 20$

$2x_1 + 7x_2 = 40$

and $x_1, x_2 >= 0$.

12. a) Egg contain 6 units of vitamin *A* per gram and 7 units of vitamin *B* per gram and cost 12 paise per gram. Milk contains 8 units of vitamin *A* per gram and 12 units of vitamin *B* per gram and cost 20 paise per gram. The daily minimum requirements for vitamin *A* and vitamin *B* are 100 units and 120 units. Formulate the LPP and find the optimal solution by graphical method. 9

b) Solve by Penalty method (Big - M method) :

Maximize $Z = 2X_1 + X_2 - 3X_3$

Subject to $X_1 + X_2 + 2X_3 <= 5$

$2X_1 + 3X_2 + 4X_3 = 12$

$X_1, X_2, X_3 >= 0$. 6