



Name :

Roll No. :

Invigilator's Signature :

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

OPERATION RESEARCH & OPTIMIZATION TECHNIQUE

Time Allotted : 3 Hours

Full Marks : 70

The figures in the margin indicate full marks.

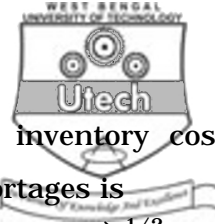
*Candidates are required to give their answers in their own words
as far as practicable.*

**GROUP – A
(Multiple Choice Type Questions)**

1. Choose the correct alternatives for any *ten* of the following :

$$10 \times 1 = 10$$

- i) 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) $(2RC_1C_3)^{1/2}$ b) $(2C_3R/C_3)^{1/2}$
c) $(C_1/2C_3R)^{1/2}$ d) None of these.
- iv) An LPP having an artificial variable at positive level in the basis, when all $(Z_i - C_j \geq 0)$ has
- a) unbounded solution
b) infeasible solution
c) basic feasible 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 $S = \left\{ (x_1, x_2) : 0 \leq x_1, x_2 \leq 1 \right\}$, 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 :

$$\text{Maximize } Z = 2x_1 - 3x_2$$

$$\text{Subject to } x_1 + x_2 \leq 2$$

$$2x_1 + 2x_2 \geq 8$$

$$\text{and } x_1, x_2 \geq 0,$$

$$x_1 = 2.5, x_2 = 3.5$$

- 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 :
- $$\text{Minimize } Z = x_1 - x_2$$
- $$\text{Subject to } x_1 + x_2 \leq 3$$
- $$\text{and } x_1, x_2 \geq 0$$
- 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
- constant rate of demand
 - instantaneous replenishment and
 - finite rate of production.
4. Solve the game whose pay-off matrix is given by

		Player B		
		B_1	B_2	B_3
Player A	A_1	1	3	1
	A_2	0	-4	-3
	A_3	1	5	-1

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 :

$$\text{Maximize } Z = 60x_1 + 50x_2$$

$$\text{Subject to } x_1 + 2x_2 \leq 40$$

$$3x_1 + 2x_2 \leq 60$$

$$\text{and } x_1, x_2 \geq 0.$$

7. Find the dual of the following LPP

$$\text{Maximize } Z_n = 2x_1 + 3x_2 - 4x_3$$

$$\text{Subject to } 3x_1 + x_2 + x_3 \leq 2$$

$$-4x_1 + 3x_3 \geq 4$$

$$x_1 - 5x_2 + x_3 = 5$$

$$\& x_1 \geq 0, x_2 \geq 0 \text{ and } x_3 \geq 0.$$

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

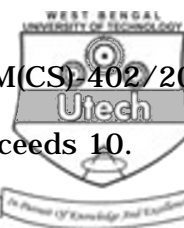
ii) By using better organizational method the ordering cost per order is brought down to Rs. 80 per order ; but the same quantity as determined above was ordered. If a new EOQ is found by using the order cost as Rs. 80, what would be the further savings in the cost ?

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- 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.

$$[P (z \leq - 2.1667) = .0114]$$

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

Player A

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

- b) Solve the game using rule of dominance : 5

Player B

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



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

$$\text{Maximize } z = x_1 + x_2 + 3x_3$$

$$\text{Subject to } 3x_1 + 2x_2 + x_3 \leq 3$$

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

$$\text{and } x_1, x_2, x_3 \geq 0.$$

- b) Find the dual of the following LPP : 5

$$\text{Minimize } z = 23x_1 + 6x_2$$

$$\text{Subject to } 9x_1 + 3x_2 + x_3 \leq 5$$

$$-8x_1 + 6x_2 \geq 20$$

$$2x_1 + 7x_2 = 40$$

$$\text{and } x_1, x_2 \geq 0.$$

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) :

$$\text{Maximize } Z = 2X_1 + X_2 - 3X_3$$

$$\text{Subject to } X_1 + X_2 + 2X_3 \leq 5$$

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

$$X_1, X_2, X_3 \geq 0. \quad 6$$

