MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

Paper Code : CS-605A

OPERATIONS RESEARCH

Time Allotted : 3 Hours *Full Marks* : 70

The figures in the margin indicate full marks.

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

GROUP – A

(Multiple Choice Type Questions)

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

   i) Give a system of m simultaneous linear equations in n unknown variables ($m < n$), the no. of basic variables will be

   a) m b) n

   c) $n-m$ d) $m-n$.

   ii) What is the method used to solve an LPP involving artificial variables ?

   a) Simplex method b) Charnes M-method

   c) VAM d) None of these.

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

a) a convex set

b) a concave set

c) not a convex set

d) both convex and concave set.

iv) If the dual has an unbounded solution, then primal has

a) an unbounded solution

b) an infeasible solution

c) a feasible solution

d) none of these.

v) Critical path is the path wherein all the

a) slack values are zero

b) slack values are more than zero

c) slack values are less than zero

d) none of these.

vi) Full form of PERT is

a) Program Estimation and Review Techniques

b) Project Evaluation and Review Techniques

c) Project Estimation and Research Techniques

d) Project Evaluation and Research Techniques.

vii) If the maxmin and minmax values of a game are equal then

a) there is a saddle point

b) solution does not exist

c) strategies are mixed

d) none of these.

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

a) 1 b) 0

c) unbounded d) none of these.

ix) The solution of a transportation problem with m-rows and n-columns is feasible if number of positive allocations are

a) $m + n$ b) $b.m \times n$

c) $m + n - 1$ d) $d.m + n + 1$.

x) An assignment problem can be solved by

a) Hungarian method

b) VAM

c) Matrix minima method

d) none of these.

xi) In (M/M/1) : (∞/FIFO), average length of a non-empty queue is

a) $\frac{\lambda^2}{\mu(\mu-\lambda)}$ b) $\frac{\mu}{(\mu-\lambda)}$

c) $\frac{\lambda\mu}{(\mu-\lambda)^2}$ d) none of these.

xii) In queueing theory, traffic intensity is

a) mean arrival rate/mean service rate

b) mean service rate/mean arrival rate

c) queue length/service rate

d) none of these.

GROUP – B

(Short Answer Type Questions)

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

2. Solve the following LPP by graphical method :

Maximize $Z = 3x - y$

subject to $2x + y \geq 2$,

$x + 3y \leq 2$,

$y \leq 4$,

$x, y \geq 0$

3. Find out the dual of the problem :

Maximize $Z = 3x_1 + 3x_2 - 4x_3$

subject to $3x_1 + x_2 + x_3 \leq 5$

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

$x_1 - 5x_2 + x_3 = 6$

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

4. Solve the following game graphically :

$$\text{Player A} \begin{bmatrix} 3 & -3 & 4 \\ -1 & 1 & -3 \end{bmatrix} \quad \text{Player B}$$

5. Find out the initial basic feasible solution of the following transportation problem by Vogel's Approximation method :

	D	E	F	G	Available
A	11	13	17	14	250
B	16	18	14	10	300
C	21	24	13	10	400
Demand	200	225	275	250	

6. What is Economic Order Quantity (EOQ) ? Derive an Economic Order Quantity (EOQ) model with uniform rate of demand, infinite production rate and having no shortage.

GROUP – C

(Long Answer Type Questions)

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

7. a) Find the optimal assignments to find the minimum cost for the assignment problem with the following cost matrix : 6

	A	B	C	D
1	18	26	17	11
2	13	28	14	26
3	38	19	18	15
4	19	26	24	10

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

Activity (*i-j*)	1-2	1-3	1-4	2-5	3-5	4-6	5-6
Optimistic Time	1	3	6	7	8	9	11
Most Likely Time	2	4	7	8	9	10	12
Permissible Time	3	5	8	9	10	11	13

i) Draw a project Network.

ii) Determine the expected project length.

iii) Calculate the standard deviation and variance of the project length. 2 + 4 + 3

8. a) The annual demand of an item is 3200 units. The unit cost is Rs. 6 and inventory carrying charges are 25 per cent per annum. If the cost of one procurement is Rs. 150, determine the,

i) EOQ

ii) number of orders per year

iii) time between two consecutive orders

iv) the optimal cost. 6

b) Solve the following problem using simplex method :

Maximise $Z = 45x_1 + 80x_2$ subject to the constraints

$$5x_1 + 20x_2 \leq 400$$

$$10x_1 + 15x_2 \leq 450$$

and $x_1, x_2 \geq 0$ 9

9. a) Solve the game using Dominance method whose pay-off matrix is given below : 6

		B			
		B1	B2	B3	B4
A	A1	2	1	4	0
	A2	3	4	2	4
	A3	4	2	4	0
	A4	0	4	0	8

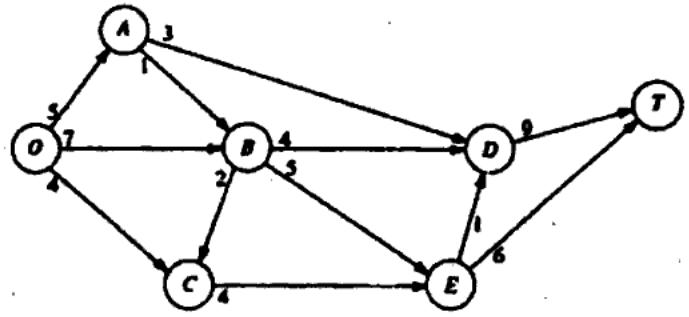
b) Find the optimal solution and the corresponding cost of transportation in the following transportation problem : 9

	D1	D2	D3	D4	Supply
01	19	20	50	10	7
02	70	30	40	60	9
03	40	8	70	20	18
Demand	5	8	7	14	

10. a) Construct a network for each of the projects whose activities and their precedence relationships are given below : 6

Activities	A	B	C	D	E	F	G	H	I	J	K
Predecessor	-	-	A	A	I,J,K	B,D	B,D	F	A	G,H	F

b) Find the maximum flow through the given network using for Fulkerson algorithm :



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CS/B.TECH/CSE/EVEN/SEM-6/CS-605A/2015-16

11. Arrival rate of telephone calls at a telephone booth is according to Poisson distribution, with an average time of 9 minutes between consecutive arrivals. The length of telephone call is exponentially distributed with a mean of 3 minutes.

i) Determine the probability that a person arriving at the booth will have to wait.

ii) Find the average queue length that forms from time to time.

iii) The telephone company will install a second booth when conveniences that an arrival would expect to have to wait at least four minutes for the phone. Find the increase in flow of arrivals, which will justify a second booth.

iv) What is the probability that an arrival will have to wait for more than 10 minutes before the phone is free ?

v) Explain the Kendall's notation used in the queuing theory ? 3 + 3 + 3 + 3 + 3