



HALDIA INSTITUTE OF TECHNOLOGY

(AN AUTONOMOUS INSTITUTION UNDER MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL)

Paper Code: OEC-CS 701A

Paper Name: Operation Research

Time Allotted: 1 Hour 30 Minutes

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 from the followings:

30 x 1 = 30

(i) In linear programming, constraints can be represented by [CO-1]

- a) Equalities b) Inequalities c) Ratios d) Both 'a' and 'b'

(ii) To formulate a problem for solution by the simplex method, we must add artificial variable to [CO-2]

- a) Only equality constraints b) Only $\geq$ constraints
c) Both A & B d) No Need

(iii) Deficiency of solving LPP by graphical method is [CO-2]

- a) It cannot be used if number of variables is greater than 2
b) It cannot be used if number of variables is greater than 3
c) It cannot be used if number of variables is greater than 4
d) It cannot be used if number of variables is greater than 5

(iv) For maximization LPP, the simplex method is terminated when all values [CO-3]

- a) $z_j - c_j = 0$ b) $z_j - c_j \geq 0$ c) $z_j - c_j \leq 0$ d) $z_j - c_j < 0$

- c) Two variable, unrestricted in sign d) One constraints with equality sign

(xiv) The purpose of the transportation problem is to minimize [CO-2]

- a) Total costs b) Total shipping costs
c) Total variable costs d) Total fixed costs

(xv) For any primal problem contain two equality constraints, then its dual contain [CO-2]

- a) One variable unrestricted in sign b) Two variable unrestricted in sign
c) No variable unrestricted in sign d) No variable restricted in sign

(xvi) In a transportation problem, items are allocated from sources to destinations [CO-2]

- a) At a maximum cost b) At a minimum cost
c) At a minimum profit d) At a minimum revenue

(xvii) The full form of CPM is [CO-3]

- a) Crash project management b) Critical path management
c) Critical path method d) Crash path management

(xviii) An assignment problem can be solved by [CO-2]

- a) Hungarian method b) VAM c) Matrix minima method d) Graphically

(xix) The number of basic variables in a transportation problem is at most [CO-3]

- a) $m + n - 1$ b) $m + n$ c) mn d) $mn + 1$

(xx) The initial basic feasible solution of a transportation problem becomes non-optimal if the cell evolution $[\Delta_{ij} = c_{ij} - (u_{ij} + v_{ij})]$ has [CO-2]

- a) At least one negative value b) At most one negative value
c) All positive value d) All are zero

(xxi) In a travelling salesman problem, the salesman can visit a city twice, until he has visited all the cities [CO-2]

- a) Once b) Twice c) Thrice d) Many times

(xxii) Full form of 'PERT' is [CO-1]

- a) Project Evaluation and Research Technique
b) Project Estimation and Research Technique

- c) Project Estimation and Review Technique
- d) Project Evaluation and Review Technique

(xxiii) An assignment problem is a special type of [CO-2]

- a) Transportation problem b) LPP c) Inventory problem d) Game Problem

(xxiv) Inventory costs include [CO-2]

- a) Carrying b) Ordering c) Shortage costs d) All of the above

(xxv) A company that maintain a sufficient safety margin by having extra-inventory against certain situations are termed as _____ [CO-2]

- a) Inventory b) lot size c) safety stock d) lead

(xxvi) What can be defined as a useful idle resource which has economic value eg; raw materials, spare parts, finished items, etc? [CO-3]

- a) Inventory Control b) Inventory c) Inventory Planning d) None of these

(xxvii) In queuing theory, FCFS stand for..... [CO-3]

- a) First Cum First Served b) First Customer First Served
- c) Fast Channel First Served d) None of these

(xxviii) In queuing theory, stands for mean arrival rate of customers [CO-1]

- a) μ b) λ c) t d) none of these

(xxix) The value of the game whose pay-off matrix is $\begin{bmatrix} 1 & 3 \\ 7 & -5 \end{bmatrix}$ [CO-1]

- a) 0 b) 1 c) 13/7 d) 7/13

(xxx) . When maximin and minimax values of the game are same, then [CO-2]

- a) There is a saddle point b) Solution does not exist
- c) Strategies are mixed d) Many Solution

Group – B
(Multiple Choice Type Questions)

2. Choose the correct alternatives from the followings:

20 x 2 = 40

(i) $\text{Max}(Z) = 2x + 4y$, s.t. $x + 2y \leq 5$, $x + y \leq 4$, $x, y \geq 0$ This LPP has [CO-3]

- a) No solution b) Many solution c) Unbounded solution d) Unique solution

(ii) A firm manufacture headache pills in two size A and B. Size A contains 2 grains of aspirin, 5 grains of bicarbonate, 1 grains of codeine. Size B contains 1 grains of aspirin, 8 grains of bicarbonate, 6 grains of codeine. It is found by user that it requires at least 12 grains of aspirin, 74 grains of bicarbonate, 24 grains of codeine for providing immediate effect. It is required to determine the least number of pills a patient should take to get immediate relief. Then the LPP is [CO-3]

- a) Maximize $W = x + y$ subject to $2x + y \geq 12$, $5x + 8y \geq 47$, $x + 6y \geq 24$, $x, y \geq 0$
b) Minimize $W = x + y$ subject to $2x + 2y \geq 12$, $5x + 8y \leq 74$, $x + 6y \geq 24$, $x, y \geq 0$
c) Maximize $W = x + y$ subject to $2x + y \geq 12$, $5x + 8y \geq 74$, $x + 6y \geq 24$, $x, y \geq 0$
d) Minimize $W = x + y$ subject to $2x + y \geq 12$, $5x + 8y \geq 74$, $x + 6y \geq 24$, $x, y \geq 0$

(iii) In a public telephone booth the arrivals are on average 15 per hour. A call on the average takes 3 minute. If there is just one phone, find the expected number of callers in the booth at any time [CO-3]

- a) 1 b) 2 c) 3 d) 4

(iv) $\text{Max}(Z) = 6x + y$, s.t. $2x + y \geq 3$, $y - x \geq 0$, $x, y \geq 0$ This LPP has [CO- 3]

- a) No solution b) Many solution c) Unbounded solution d) Unique solution

(v) The dual of the LPP, $\text{Max}(Z) = 2x + 3y$, st. $x + y \geq -2$, $x + 2y \geq 3$, $x, y \geq 0$ is [CO- 3]

- a) $\text{Max}(W) = -2x + 3y$, st. $x + y \geq 2$, $x - 2y \geq 3$, $x, y \geq 0$
b) $\text{Max}(W) = 2x + 3y$, st. $x + y \leq 2$, $x + 2y \leq 3$, $x, y \geq 0$
c) $\text{Min}(W) = 2x - 3y$, st. $x + y \leq -2$, $-x - 2y \geq 3$, $x, y \geq 0$
d) $\text{Min}(W) = -2x + 3y$, st. $x - y \leq 2$, $x + 2y \leq 3$, $x, y \geq 0$

(vi) $\text{Max}(Z) = x + y$, s.t. $x + y \leq 1$, $y - 3x \geq 3$, $x, y \geq 0$ This LPP has [CO- 3]

- a) No solution b) Many solution c) Unbounded solution d) Unique solution

(vii) Solution of the Assignment Problem [CO-2]

Jobs Machine	J ₁	J ₂	J ₃	J ₄	J ₅
M ₁	6	5	8	11	16
M ₂	1	13	16	1	10
M ₃	16	11	8	8	8
M ₄	9	14	12	10	16
M ₅	10	13	11	8	16

- a) $M_1 \rightarrow J_2, M_2 \rightarrow J_4, M_3 \rightarrow J_5, M_4 \rightarrow J_1, M_5 \rightarrow J_3$ and
Minimum assignment Cost = Rs. 34
- b) $M_1 \rightarrow J_1, M_2 \rightarrow J_4, M_3 \rightarrow J_5, M_4 \rightarrow J_1, M_5 \rightarrow J_3$ and
Minimum assignment Cost = Rs. 34
- c) $M_1 \rightarrow J_2, M_2 \rightarrow J_4, M_3 \rightarrow J_4, M_4 \rightarrow J_1, M_5 \rightarrow J_3$ and
Minimum assignment Cost = Rs. 34
- d) $M_1 \rightarrow J_2, M_2 \rightarrow J_4, M_3 \rightarrow J_5, M_4 \rightarrow J_3, M_5 \rightarrow J_3$ and
Minimum assignment Cost = Rs. 34

(viii) Find the critical path of the network consists of the following activities: [CO-2]

Activity:	1-2	1-3	2-3	2-5	3-4	3-6	4-5	4-6	5-6	6-7
Duration :	15	15	3	5	8	12	1	14	3	14

- a) 1 – 3 – 2 – 4 – 6 – 7
- b) 1 – 2 – 3 – 4 – 6 – 7
- c) 1 – 2 – 4 – 3 – 6 – 7
- d) 1 – 2 – 3 – 6 – 4 – 7

(ix) At a ticket counter, customers arrive at a rate of 10 per hour. Assuming that the arrival time follows an exponential distribution and the service time distribution is also exponential with an average of 4 minute. Then the average number of the customers in the system is [CO-2]

- a) 2 b) 3 c) 5 d) 7

(x) Solution of the Travelling Salesman problem [CO- 3]

Player A	Player B			
		B ₁	B ₂	B ₃
	A ₁	10	5	-2
	A ₂	6	7	3
	A ₃	4	8	4

a) $S_0 = (A_2, B_1) ; v = 2$

b) $S_0 = (A_1, B_1) ; v = -2$

c) $S_0 = (A_1, B_2) ; v = 3$

d) $S_0 = (A_3, B_3) ; v = 4$

(xiv) Solution of the game problem is [CO-2]

Player A	Player B				
		B ₁	B ₂	B ₃	B ₄
	A ₁	2	1	0	-2
	A ₂	1	0	3	2

a) $A(3/5, 2/5), B(0, 4/5, 0, 1/5), v = 3/5$

b) $A(2/5, 3/5), B(4/5, 0, 1/5, 0), v = 4/5$

c) $A(2/5, 3/5), B(0, 4/5, 0, 1/5), v = 2/5$

d) $A(2/5, 1/5), B(0, 3/5, 0, 1/5), v = 2/7$

(xv) Solve the Transportation Problem by VAM method is [CO-4]

Retail Shop Company	R ₁	R ₂	R ₃	Supply
P ₁	10	7	8	45
P ₂	15	12	9	15
P ₃	7	8	12	40
Demand	25	55	20	

a) $x_{12} = 40, x_{13} = 5, x_{23} = 15, x_{31} = 25, x_{32} = 15$, Transportation Cost = Rs. 750.

b) $x_{12} = 10, x_{13} = 15, x_{23} = 15, x_{31} = 25, x_{32} = 15$, Transportation Cost = Rs. 750.

c) $x_{12} = 40, x_{13} = 5, x_{23} = 5, x_{31} = 35, x_{32} = 15$, Transportation Cost = Rs. 750.

d) $x_{12} = 40, x_{13} = 5, x_{23} = 15, x_{31} = 25, x_{32} = 15$, Transportation Cost = Rs. 850.

(xvi) The time estimate (in weeks) for the activities of a PERT network are given below. Find the expected project length [CO-3]

Activity	t_0	t_m	t_p
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

- a) 15 weeks b) 17 weeks c) 19 weeks d) 16 weeks

(xvii) For what value of “ μ ”, the game with following payoff matrix is strictly determinable? [CO- 3]

		Player B		
		B_1	B_2	B_3
Player A	A_1	μ	6	2
	A_2	-1	μ	-7
	A_3	-2	4	μ

- a) $-1 \leq \mu \leq -2$ b) $-1 \leq \mu \leq 2$ c) $1 \leq \mu \leq -2$ d) $1 \leq \mu \leq 2$

(xviii) If purchase order lead time is 35 minutes and number of units sold per time is 400 units, then reorder point will be [CO-2]

- a) 14000 units b) 14500 units c) 15000 units d) 15500 units

(xix) A company has an annual demand of 1000 unit, ordering cost of 100/order and carrying cost of Rs. 100 unit/year. If the stock-out costs are estimated to be nearly Rs 400 each time the company runs out-of stock, then safety stock justified by the carrying cost will be [CO-3]

- a) 4 day b) 20 day c) 40 day d) 100 day

(xx) The rate of use of particular raw material from stores is 20 unit per year. The cost of placing and receiving an order is Rs. 40. The cost of each unit is Rs. 100. The cost of carrying inventory in percent per year is 0.16 and it depends upon the average stock. Then the value of the economic order quantity is [CO-3]

- a) 10 unit b) 11 unit c) 12 unit d) 13 unit

Mihir Baran Bera.

Signature of the Paper Setter/Moderator

Answer Key:

Group – A

<u>1.</u> (i) d	(ii) c	(iii) a	(iv) b	(v) a	(vi) b
(vii) a	(viii) c	(ix) a	(x) b	(xi) c	(xii) d
(xiii) a	(xiv) b	(xv) b	(xvi) b	(xvii) c	(xviii) a
(xix) a	(xx) a	(xxi) a	(xxii) d	(xxiii) a	(xxiv) d
(xxv) c	(xxvi) b	(xxvii) a	(xxviii) b	(xxix) c	(xxx) a

Group – B

<u>2.</u> (i) b	(ii) d	(iii) c	(iv) c	(v) c	(vi) a
(vii) a	(viii) b	(ix) a	(x) a	(xi) b	(xii) a
(xiii) d	(xiv) c	(xv) a	(xvi) b	(xvii) b	(xviii) a
(xix) d	(xx) a				