K24U 0233

Reg. No. : .....

Name : .....

Sixth Semester B.Sc. Honours in Mathematics Degree
(CBCSS – Improvement/Supplementary/One Time Mercy Chance)
Examination, April 2024
(2016 to 2020 Admissions)
Core Course
BHM 603 : OPERATIONS RESEARCH

Time : 3 Hours Max. Marks : 60

SECTION – A

Answer **any 4** questions out of 5 questions. **Each** question carries **1** mark.

1. Define surplus variable.
2. Explain alternative optima in simplex method.
3. What is the meaning of balancing a transportation model ?
4. Define a cycle in a graph.
5. Difference between CPM and PERT. **(4x1=4)**

SECTION – B

Answer **any 6** questions out of 9 questions. **Each** question carries **2** marks.

6. Obtain the optimum solution of LPP using graphical method :
   Maximize $f = 3x_1 + 2x_2$
   Subject to $-2x_1 + x_2 \leq 1$
   $x_1 \leq 2$
   $x_1 + x_2 \leq 3$
   $x_1, x_2 \geq 0$
7. Explain Two Phase method.
8. Explain dual optimality condition and dual feasibility condition in a dual simplex method.

P.T.O.

9. Write the dual problem of the primal :
   Minimize $f = 15x_1 + 12x_2$
   Subject to $x_1 + 2x_2 \geq 3$
   $2x_1 - 4x_2 \leq 5$
   $x_1, x_2 \geq 0$
10. Write a note on economic interpretation of dual constraints.
11. Use Vogel approximation method to find the initial basic solution of

	Destination				
	A	B	C	D	Supply
Source I	10	2	20	11	15
Source II	12	7	9	20	25
Source III	4	14	16	18	10
Demand	5	15	15	15	

12. Obtain a spanning tree from the network defined by (N, A) where
    N = {a, b, c, d, e}, A = {(a, b), (a, c), (b, c), (b, e), (c, d), (c, e), (d, b), (d, e)}.
13. Explain the earliest start time and latest completion time.
14. Explain the Three jug puzzle. **(6x2=12)**

SECTION – C

Answer **any 8** questions out of 12 questions. **Each** question carries **4** marks.

15. Illustrate the forward pass and backward pass in CPM computations.
16. Describe PERT network.
17. Explain Maximal Flow Algorithm.
18. Write the algorithm for least cost method and Vogel approximation method.
19. Distinguish assignment problem and transportation problem. Write the mathematical formulation of each one.

20. The cost of assigning five jobs to five persons are given in the table.

	Jobs				
	1	2	3	4	5
Person A	8	4	2	6	1
Person B	0	9	5	5	4
Person C	3	8	9	2	6
Person D	4	3	1	0	3
Person E	9	5	8	9	5

    Determine optimum assignment schedule.
21. Explain how the dual problem is constructed from the primal.
22. Describe how to solve an LPP using Two-Phase method.
23. Solve using simplex method :
    Minimize $f = 8x_1 - 2x_2$
    Subject to $-4x_1 + 2x_2 \leq 1$
    $5x_1 - 4x_2 \leq 3$
    $x_1, x_2 \geq 0$
24. Use dual simplex method to solve the LPP :
    Maximize $f = -3x_1 - 2x_2$
    Subject to $x_1 + x_2 \geq 1$
    $x_1 + x_2 \leq 7$
    $x_1 + 2x_2 \geq 10$
    $x_2 \leq 3$
    $x_1, x_2 \geq 0$
25. Check the optimality and feasibility with basic variables (x_2, x_4) and inverse $= \begin{pmatrix} \frac{1}{7} & 0 \\ \frac{-2}{7} & 1 \end{pmatrix}$ for the LPP.
    Maximize $f = 4x_1 + 14x_2$
    Subject to $2x_1 + 7x_2 + x_3 = 21$
    $7x_1 + 2x_2 + x_4 = 21$
    $x_1, x_2, x_3, x_4 \geq 0$
26. Explain post optimal analysis and what are the changes affecting optimality. **(8x4=32)**

SECTION – D

Answer **any 2** questions out of 4 questions. **Each** question carries **6** marks.

27. Use the principle of duality to solve the LPP.
    Minimize $f = 2x_1 + 2x_2$
    Subject to $2x_1 + 4x_2 \geq 1$
    $-x_1 - 2x_2 \leq -1$
    $2x_1 + x_2 \geq 1$
    $x_1, x_2 \geq 0$
28. Solve the LPP using Two-Phase method to solve the LPP.
    Minimize $f = -2x_1 - x_2$
    Subject to $x_1 + x_2 \geq 2$
    $x_1 + x_2 \leq 4$
    $x_1, x_2 \geq 0$
29. Obtain the optimum transportation cost for the following transportation problem :

	Market					
	P	Q	R	S	T	Available
Factory A	4	1	2	6	9	100
Factory B	6	4	3	5	7	120
Factory C	5	2	6	4	8	120
Demand	40	50	70	90	90	

30. A project consists of following activities and time estimates (in days) are given below :

Activity	Optimistic Time	Most likely Time	Pessimistic Time
1 – 2	3	6	15
2 – 3	2	5	14
1 – 4	6	12	30
2 – 5	2	5	8
2 – 6	5	11	17
3 – 6	3	6	15
4 – 7	3	9	27
5 – 7	1	4	7
6 – 7	2	5	8

    a) Draw the PERT network.
    b) Compute expected project completion time.
    c) Find expected variance of the project length. **(2x6=12)**