Reg. No. : ....

Name : ....

VI Semester B.Sc. Honours in Mathematics Degree (CBCSS – Regular/ Supplementary/Improvement – 2016 Syllabus) Examination, April 2022
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. **(4×1=4)**

1. Define artificial variables.
2. What is degeneracy in LP problem ?
3. What are changes effecting feasibility of optimal solution of an LPP ?
4. True or False : To balance a transportation model, it may be necessary to add both a dummy source and a dummy destination.
5. Define Network.

SECTION – B

Answer **any 6** questions out of **9** questions. **Each** question carries **2** marks. **(6×2=12)**

6. Convert the following LP model in the equation form

Maximize $z = 2x_1 + 3x_2 + 5x_3$
Subject to $-6x_1 + 7x_2 - 9x_3 \geq 4$
$x_1 + x_2 + 4x_3 = 10$
$x_1, x_3 \geq 0$, x_2 is unrestricted

7. Write the dual of the primal,

Maximize $z = -5x_1 + 2x_2$
Subject to $-x_1 + x_2 \leq -2$
$2x_1 + 3x_2 \leq 5$
$x_1, x_2 \geq 0$

8. Explain a general assignment model.
9. Write the scope of network models.
10. Explain Dijkstra's Algorithm.
11. Define cut and cut capacity in network.
12. Develop the first simple table for the LP model using M method, after substituting artificial variables.

Minimize $z = 4x_1 + x_2$
Subject to $3x_1 + x_3 = 3$
$4x_1 + 3x_2 \geq 6$
$x_1 + 2x_2 \leq 4$
$x_1, x_2 \geq 0$

13. Write the dual optimality condition in dual simplex algorithm.
14. Explain North-West Corner Method.

SECTION – C

Answer **any 8** questions out of **12** questions. **Each** question carries **4** marks. **(8×4=32)**

15. Solve graphically the following LP problem.

Minimize $z = 2x_1 + 3x_2$
Subject to $2x_1 + x_2 \leq 4$
$x_1 + 2x_2 \leq 5$
$x_1, x_2 \geq 0$

16. Write the steps in simplex method.

17. Determine algebraically all the basic solution of the problem and classify them as feasible and infeasible.

Maximize $z = x_1 + x_2$
Subject to $x_1 + 2x_2 \leq 6$
$2x_1 + x_2 \leq 16$
$x_1, x_2 \geq 0$

18. Write the formula, for any iteration of the entire simplex tableau, that can be generated from the original data of the problem, the inverse associated with the iteration and the dual problem.
19. Prove that dual of a dual is primal.
20. Find first basic feasible solution of the following transportation problem.

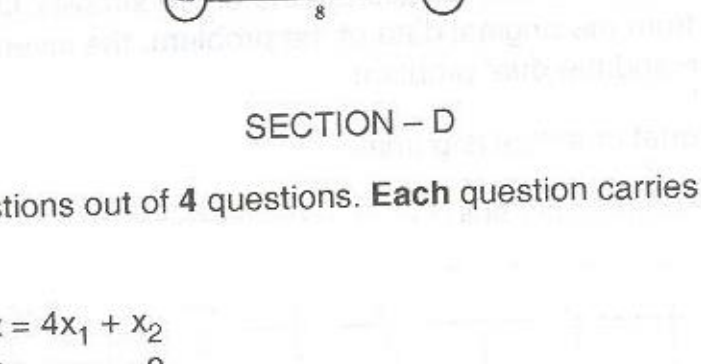
	D_1	D_2	D_3	D_4	Capacity
O_1	1	2	3	4	6
O_2	4	3	2	0	8
O_3	0	2	2	1	10
Demand	4	6	8	6	

21. Find the optimal solution of the following assignment problem by Hungarian method.

	A	B	C
1	15	10	9
2	9	15	10
3	10	12	8

22. Explain transhipment model.
23. Write the steps in minimal spanning tree algorithm.
24. Formulate the linear programming model for the shortest-route problem.
25. Explain CPM and PERT.

26. Determine the critical path for the project network in the figure given below. All the duration are in days.



SECTION – D

Answer **any 2** questions out of **4** questions. **Each** question carries **6** marks. **(2×6=12)**

27. Solve :

Minimize $z = 4x_1 + x_2$
Subject to $3x_1 + x_2 = 3$
$4x_1 + 3x_2 \geq 6$
$x_1 + 2x_2 \leq 4$
$x_1, x_2 \geq 0$

28. Solve by using dual simplex method.

Minimize $z = 3x_1 + 2x_2 + x_3$
Subject to $3x_1 + x_2 + x_3 \geq 3$
$-3x_1 + 3x_2 + x_3 \geq 6$
$x_1 + x_2 + x_3 \leq 3$
$x_1, x_2, x_3 \geq 0$

29. Find the optimal solution of the transportation problem.

	1	2	3	4	Supply
1	10	2	20	11	15
2	12	7	9	20	25
3	4	14	16	18	10
Demand	5	15	15	15	

30. What is maximum flow algorithm ? Write the steps of the algorithm.