K20U 0215

Reg. No. : .....

Name : .....

VI Semester B.Sc. Hon's (Mathematics) Degree (Reg./Supple./Improv.) Examination, April 2020
BHM 603 : OPERATIONS RESEARCH
(2016 Admissions Onwards)

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. In Simplex method what is meant by unbounded solution ?
3. What is the relationship between dual and primal objective value ?
4. What is meant by path in a graph ?
5. There exist only finite number of basic feasible solution to an LPP. (True/False). Justify. **(4×1=4)**

SECTION – B

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

6. Obtain all the basic solutions to the following system of linear equation :
   $x_1 + 2x_2 + x_3 = 4$ and $2x_1 + x_2 + 5x_3 = 5$
7. Write the LPP in the standard form :
   Maximize $f = 2x_1 + x_2 - x_3$,
   Subject to $2x_1 - 5x_2 + 3x_3 \leq 4$,
   $3x_1 + 6x_2 - x_3 \geq 2$,
   $x_1 + x_2 + x_3 = 4$, $x_1, x_2, x_3 \geq 0$.
8. Define optimal solution and basic feasible solution to an LPP.
9. What is the procedure to identify entering variable in case of dual simplex method ?
10. Define artificial variable along with an example.
11. Draw the network defined by N = {1, 2, 3, 4, 5, 6} A = {(1, 2) (1, 5) (2, 3) (2, 4) (3, 4) (3, 5) (4, 3) (4, 6) (5, 2) (5, 6)}.

P.T.O.

12. Explain 8-gallon jug puzzle.
13. Define critical and non-critical activity.
14. What are the three methods to obtain an initial feasible solution to a transportation problem ? **(6×2=12)**

SECTION – C

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

15. Explain critical path computation.
16. Describe maximum flow algorithm.
17. Find the maximum non negative flow in the network described below. Arc (V_j, V_k) being defined as (j, k), V_j is the source and V_k is the sink.

Arc :	(a, 1)	(a, 2)	(1,2)	(1,3)	(1,4)	(2,4)	(3,2)	(3,4)	(4,3)	(3,b)	(4,b)
Capacity :	8	10	3	4	2	8	3	4	2	10	9

18. Write the algorithm for Vogel's Approximation Method and Least Cost Method.
19. Mathematically represent Transportation and Assignment Model.
20. Solve the assignment problem.

	1	2	3	4
1	1	4	6	3
2	4	7	10	9
3	4	5	11	7
4	8	7	8	5

21. Define dual problem and explain its characteristics.
22. Check the optimality and feasibility of LPP with basic variable (x_2, x_4) and inverse = $\begin{pmatrix} 1/7 & 0 \\ -2/7 & 1 \end{pmatrix}$.
23. Compare CPM and PERT.
24. Explain the algorithm of Big M method.
25. Use Simplex method to solve the LPP.
    Maximize $f = x_1 + 2x_2$
    Subject to $-x_1 + 2x_2 \leq 8, x_1 + 2x_2 \leq 12, x_1 - x_2 \leq 3, x_1, x_2 \geq 0$.
26. Solve using dual simplex method
    Minimize $f = x_1 + 3x_2 + 2x_3$
    Subject to $4x_1 - 5x_2 + 7x_3 \leq 8, 2x_1 - 4x_2 + 2x_3 \geq 2, x_1, x_2, x_3 \geq 0$.

(8×4=32)

SECTION – D

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

27. Solve the LPP
    Maximize $f = 4x_1 + 5x_2$,
    Subject to $x_1 - 2x_2 \leq 2, 2x_1 + x_2 \leq 6, x_1 + 2x_2 \leq 5, -x_1 + x_2 \leq 2$;
    $x_1, x_2 \geq 0$.
28. Minimize $f = 4x_1 + 5x_2$,
    Subject to $2x_1 + x_2 \leq 6, x_1 + 2x_2 \leq 5, x_1 + 2x_2 \geq 1, x_1 + 4x_2 \geq 2$;
    $x_1, x_2 \geq 0$.
29. Find the minimum cost of transportation :

	A	B	C	
1	2	1	3	10
2	4	5	7	25
3	6	0	9	25
4	1	3	5	30
	20	20	15	

30. A project consist of 8 activities with the following relevant information :

Activity	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**
Predecessor	–	–	–	A	B	C	D,E	F,G
Optimistic time	1	1	2	1	2	2	3	1
Most likely time	1	4	2	1	5	5	6	2
Pessimistic time	7	7	8	1	14	8	15	

Draw the PERT network and find out the expected project completion time and the variance of project length. **(2×6=12)**