Reg. No ..... Name **25INT105**

END SEMESTER EXAMINATION - NOVEMBER 2025

SEMESTER 1 : INTEGRATED M.Sc. PROGRAMME COMPUTER SCIENCE - DATA SCIENCE

COURSE : **21UP1CPCMT1 : GRAPH THEORY AND OPERATION RESERCH**

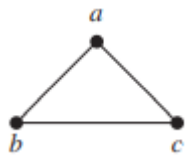
(For Regular 2025 Admission and Improvement/ Supplementary 2024/2023/2022/ 2021 Admissions)

Time : Three Hours Max. Weights: 30

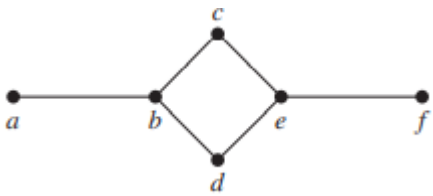
PART A

Answer any 8 questions **Weight: 1**

1. Convert the following LP problem in to a standard LP problem by adding Slack,Surplus Or Artificial variables.
   maximize: $z = 3x_1 + 9x_2$
   subject to: $x_1 + 4x_2 \leq 8$
   $x_1 + 2x_2 \leq 4$
   $x_1 , x_2 \geq 0$
   .
2. Define connected components in a graph.
3. What is the value of the postfix expression723 ∗ − 4 ↑ 9 3/+?
4. Draw all the spanning trees of the given simple graph.



5. Define isomorphism in graphs.
6. Draw all the spanning trees of the given simple graphs.



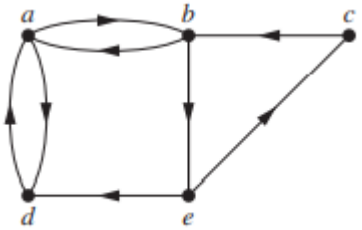
7. Define Euler circuit and Euler paths in a graph.
8. Explain graphical method of solving an LP Problem.
9. How to identify the solution obtained in MODI method is optimal or not?
10. Define occupied cells and non-occupied cells.

(1 x 8 = 8 weight)

PART B

Answer any 6 questions **Weights: 2**

11. Prove that a full m-ary tree with i internal vertices contain *n = mi+1* vertices.
12. Does each of these lists of vertices form a path in the following graph?Which paths are simple?Which are circuits?What are the lenghts of these paths?
    a) a,e,b,c,b b) a,e,a,d,b,c,a
    c) e,b,a,d,b,e d) c,b,d,a,e,c

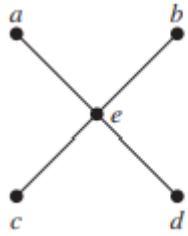


13. Draw these graphs.
a)K_5 b)$K_{1,5}$
c)C_5 d)W_7

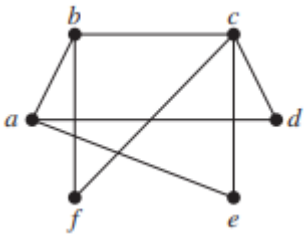
14. A company has three production facilities S_1, S_2 and S_3 with production capacity of 7,9, and 18 units (in 100s) per week of a product, respectively. These units are to be shipped to four warehouses D_1, D_2, D_3 and D_4 with requirement of 5, 6, 7 and 14 units (100s) per week, respectively. The transportation cost (in rupees) per unit between factories to warehouses are given in the table below:Use North-West Corner Method to find an initial basic feasible solution to the given transportation problem.

	D_1	D_2	D_3	D_4	Capacity
S_1	19	30	50	10	7
S_2	70	30	40	60	9
S_3	40	8	70	20	18
Demand	5	8	7	14	34

15. Determine whether these graphs are bipartite.If not, give reason.
a)



b)



16. Solve the following Linear programming problem graphically;
minimize: $z = 3x_1 - x_2$
subject to: $x_1 - 2x_2 \geq 4$
$x_1 + x_2 \leq 8$
$-4x_1 + 2x_2 \leq 20$
$x_2 \leq 4$
$x_1 \leq 8$
$x_1 \geq 4$
$x_1 , x_2 \geq 0$

17. Suppose 1000 people enter a chess tournament. Use a rooted tree model of the tournament to determine how many games must be played to determine a champion, if a player is eliminated after one loss and games are played until only one entrant has not lost. (Assume there are no ties.)

18. Use backtracking to find a subset, if it exists, of the set {27, 24, 19, 14, 11, 8} with sum

a) 60. b) 41.

(2 x 6 = 12 weight)

PART C

Answer any 2 questions **Weights: 5**

19. A company has factories at F_1, F_2, and F_3 which supply to warehouses at W_1, W_2 and W_3. Weekly factory capacities are 200, 160 and 90 units, respectively. Weekly warehouse requirement are 180, 120 and 150 units,respectively. Unit shipping cost (in rupees)are as follows:

	W_1	W_2	W_3	Supply
F_1	16	20	12	200
F_2	14	8	18	160
F_3	26	24	16	90
Demand	180	120	150	450

Determine the optimal distribution for this company to minimize total shipping cost.

20. Use Big-M Method to solve the following linear programming problem;

maximize: $z = 5x_1 + x_2$

subject to: $5x_1 + 2x_2 \leq 20$

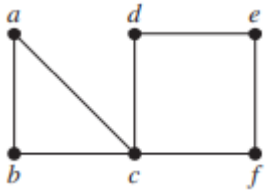
$x_1 \geq 3$

$x_2 \leq 5$

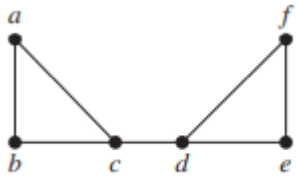
$x_1, x_2 \geq 0$

21. Show that in every simple graph there is a path from any vertex of odd degree.Find all cut vertices and cut edges of the given graphs.

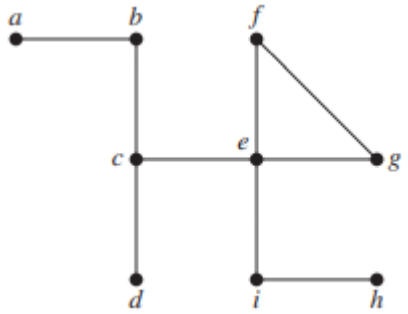
a)



b)



c)



22. a) Represent the expressions (x + xy) + (x/y) and x + ((xy + x)/y) using binary trees.
Write these expressions in
b) prefix notation.
c) postfix notation.
d) infix notation.

(5 x 2 = 10 weight)
