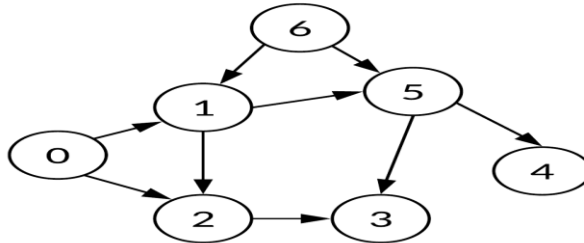


GUJARAT TECHNOLOGICAL UNIVERSITY
ME - SEMESTER- 2 • EXAMINATION – WINTER - 2023

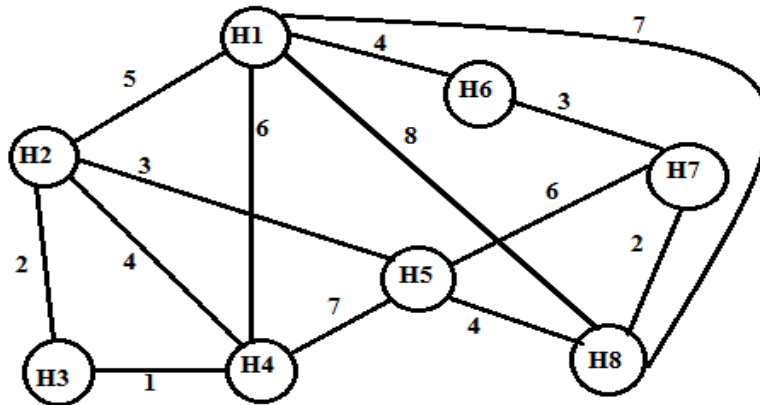
Subject Code:3720216**Date: 05 Jan 2024****Subject Name:Advance Algorithms****Time:10:30 AM TO 01:00 PM****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1 (a)** Define topological sort. Write an algorithm for topological sorting and also show the different topological orderings possible for the following graph. **07**



- (b)** A newspaper agent daily drops the newspaper to the area assigned in such a manner that he has to cover all the houses in the respective area with minimum travel cost. Compute the minimum travel cost. The area assigned to the agent where he has to drop the newspaper is shown in the figure below: **07**



- Q.2 (a)** Consider the adjacency list (with edge weights in parentheses) for a digraph. **07**
- A: B(4), F(2)
 B: A(1), C(3), D(4)
 C: A(6), B(3), D(7)
 D: A(6), E(2)
 E: D(5)
 F: D(2), E(3)
- (1) The digraph has 3 shortest paths from C to E (i.e., all with the same total weight). Find them. (List the sequence of vertices in each path).
 (2) Which of these paths is the one that would be found by Dijkstra's shortest path algorithm?
- (b)** Compute the product of the following matrices of 4 x 4 size, using Strassen's matrix multiplication method. Derive the time complexity of Strassen's Matrix **07**

multiplication. $A = \begin{bmatrix} 4 & 2 & 0 & 1 \\ 3 & 1 & 2 & 5 \\ 3 & 2 & 1 & 4 \\ 5 & 2 & 6 & 7 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & 1 & 3 & 2 \\ 5 & 4 & 2 & 3 \\ 1 & 4 & 0 & 2 \\ 3 & 2 & 4 & 1 \end{bmatrix}$.

OR

- (b) Solve the following system of linear equations by Crout's Method. (LU factorization or decomposition method) 07

$$3X_1 + 2X_2 + 7X_3 = 4$$

$$2X_1 + 3X_2 + X_3 = 5$$

$$3X_1 + 4X_2 + X_3 = 7$$

- Q.3 (a) Define Augmenting path. Using Ford-Fulkerson algorithm find the maximum flow. 07

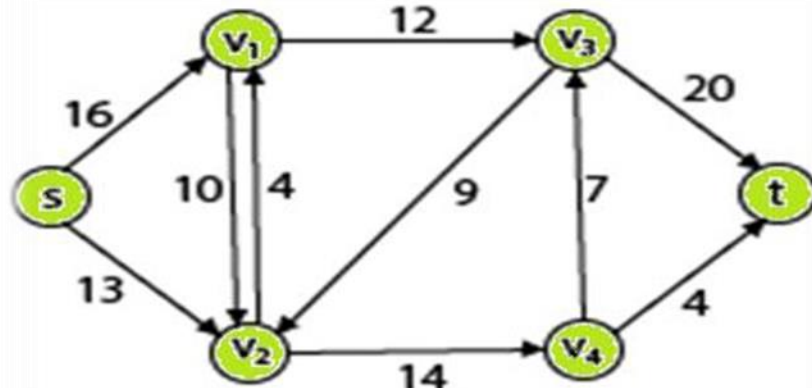


Figure 1

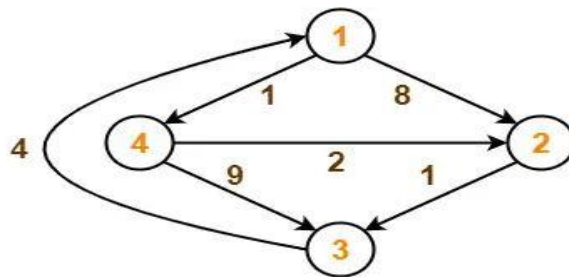
- (b) Discuss the accounting method and potential method for amortized analysis 07

OR

- Q.3 (a) Define flow network. Using Edmonds karp algorithm find the maximum flow of flow network shown in figure 1. 07

- (b) Discuss Schonhage-Strassen Integer Multiplication algorithm. 07

- Q.4 (a) Using Floyd Warshall Algorithm, find the shortest path distance between every pair of vertices. 07



- (b) Explain in detail about NP-Complete and NP-Hard problems with an example. 07

OR

- Q.4 (a) Compare best case, worst case, and average case time complexity of selection sort, insertion sort, and bubble sort. Provide scenarios for all sorting algorithms for best case and worst case with examples. 07

- (b) Briefly discuss how traveling-salesman problem can be solved using an approximation algorithm. 07

- Q.5 (a) Solve the following linear program using Simplex method. 07

$$\text{Maximize: } Z = 5x_1 + 3x_2$$

subject to

$$x_1 + x_2 \leq 2$$

$$5x_1 + 2x_2 \leq 10$$

$$3x_1 + 8x_2 \leq 12$$

$$x_1, x_2 \geq 0.$$

- (b)** Define matching in Graph. Discuss Augmenting path algorithm for finding maximum matching with example. **07**

OR

- Q.5 (a)** Compare and contrast between the greedy algorithm and dynamic programming method. **07**
- (b)** Briefly Discuss Chinese Remainder Theorem. **07**
