 <p>RV UNIVERSITY Go, change the world <i>an initiative of RV EDUCATIONAL INSTITUTIONS</i></p> <p>School of Computer Science & Engineering B.Tech(H) Program</p>	<p>INTERNAL ASSESSMENT #2 (model question paper) Academic Year: 2023-24 Term: Aug 02 to Nov 29, 2023 Semester: 3 Section: B</p> <p>Course Code: CS2000 Course Name: Design & Analysis of Algorithms Max Marks: 20</p>
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Note: If any pertinent details are missing, please feel free to make reasonable assumptions to address the question effectively.

PART A - Exhaustive Search, Greedy Design Techniques
(Answer for 5 Marks)

1. a) Given below graph, what is the order in which nodes are traversed if graph traversal methods are applied to the graph G given in Fig. 1. If there is a tie, visit them in the alphabetical order. **(5 Marks)**
- DFS
 - BFS

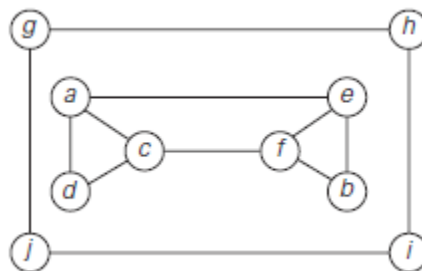


Fig. 1: Graph G1

- b) What is the time complexity of the DFS, BFS algorithms, justify your answer.
2. Given the below graph G2 in Fig. 2, **(5 Marks)**

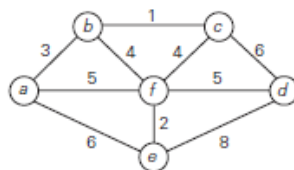



Fig. 2: Graph G2

- Construct the Minimum Cost Spanning Tree (MCST) which will have $v-1$ edges using Prim's algorithm.
- What is the minimum cost of the spanning tree constructed for the graph G2.

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iii. Give the reasoning for “Why Prim’s is a greedy algorithm?”.

PART B - Greedy & Dynamic Programming Design Techniques
(Answer for 5 Marks)

3. a) Define single source shortest path problem.
b) Write and trace the execution of Dijkstra’s algorithm for the below graph G3, Consider node a as source vertex.

(5 Marks)

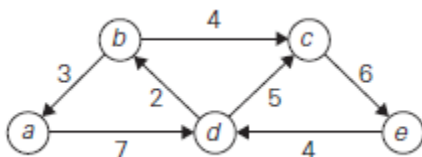


Fig. 3: Graph G3

4. a) In what cases, Bellman Ford algorithm is preferred over Dijkstra’s algorithm to solve single source shortest path problem, explain your reasoning with an example.
b) What is the time complexity of Bellman Ford algorithm? Justify your answer.

(5 Marks)

PART C - Greedy & Dynamic Programming Design Techniques
(Answer for 5 Marks)

(5 Marks)

5. a) Find all pairs shortest path for the below graph using Floyd’s algorithm

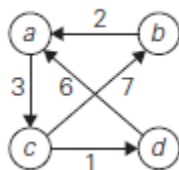



Fig. 3: Graph G4

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b) Write Floyd's algorithm pseudo code and provide time complexity of the algorithm.

6. a) Explain the concept of "overlapping sub-instances"? And give two example problems which follow this property.

b) Given below graph, verify the single source shortest path from vertex s using Bellman Ford algorithm exists.

(5 Marks)

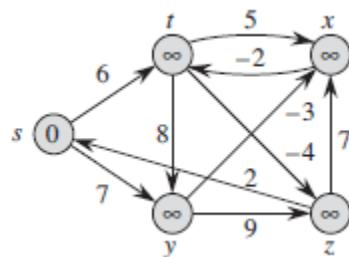


Fig. 3: Graph G5

PART D - Transform & Conquer and Exhaustive Search (Answer for 5 Marks)

7. Given the list of elements **10, 20, 30, 5, 60, 2, 55, 90** **(5 Marks)**

- Build max-heap and represent heap using array
- Sort the elements in ascending order using heap sort algorithm using the max_heap built.

8. a) Explain the concept of relaxing an edge in single source shortest path problem.

b) What are connected components in a graph? Let us consider there are two connected components in a graph, if we apply

- Depth first traversal
- Breadth first traversal

Do these algorithms guarantee that each node is visited in the graph or not? Give your reasoning with an example.

(5 Marks)