IIIT Vadodara
CS203: Design and Analysis of Algorithms

Endterm **Marks: 45**

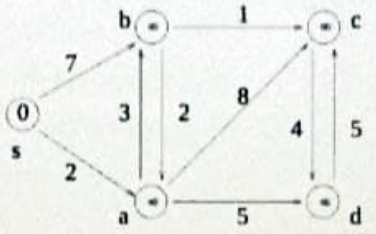
Course Instructor: Dr. Dibyendu Roy Time Limit: 180 minutes

Instructions: Question paper is of 2 pages. Clearly write your name and roll number. Solutions must be argued properly for getting credits. Scientific calculator is allowed.

(Q1) **[9 marks]**

(a) **(4 marks)** Explain Dijkstra's algorithm for finding shortest path. Discuss about its running time.

(b) **(5 marks)** Apply Dijkstra's algorithm to find the shortest path from the source vertex s to other vertices. Mention each step of your selection of your path.

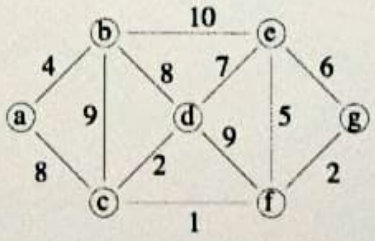


(Q2) **[9 marks]**

(a) **(4 marks)** Define the followings: (i) Minimum Spanning Tree, (ii) Cut of an undirected graph, (iii) Crossing cut, (iv) Light edge.

(b) **(2 marks)** Prove that if A be a subset of some minimum spanning tree of a connected, undirected and weighted graph $G = (V, E)$ then a light edge will be safe for A.

(c) **(3 marks)** Using Prim's algorithm find the minimum spanning tree of the following graph with the starting vertex is a.



(Q3) **[9 marks]**

(a) **(5 marks)** Describe Huffman encoding algorithm and prove its correctness.

(b) **(4 marks)** Using Huffman encoding algorithm find the encoding of the alphabets whose frequencies are as follows $a : 20$, $b : 15$, $c : 5$, $d : 15$, $e : 45$.

(Q4) **[9 marks]**

Describe Strassen's algorithm for matrix multiplication and derive its complexity.

(Q5) **[9 marks]**

Describe a recursive greedy algorithm for activity selection problem. Prove that the activity which is finishing first will definitely be a part of your selection.