

CSCE-629 Analysis of Algorithms

Spring 2019

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Assignment # 3 (Due March 7)

1. Suppose that we have a sequence of MakeSet-Find-Union operations in which no Find appears before any Union. What is the computational time for this sequence?

2. (Question 24.1-5, Textbook, p. 655) Let $G = (V, E)$ be a weighted directed graph. Develop an $O(nm)$ -time algorithm that finds the value $\delta(v)$ for **every** vertex v , which is defined as:

$$\delta(v) = \min_{w \in V} \{\text{the length of the shortest path in } G \text{ from } w \text{ to } v\}.$$

3. Assume that multiple edges are allowed in a weighted graph G , which is given in an adjacency list $G[n]$. Therefore, for each vertex v , the linked list $G[v]$ for v may contain elements of the forms $[u, w_1]$ and $[u, w_2]$, standing for two edges from v to u , with weights w_1 and w_2 , respectively. Now the goal is that for each pair of vertices in the graph G , we want to remove all multiple edges except the one with the largest weight. Design a linear-time algorithm for this problem.

4. Modify the QuickSort algorithm so that the pivot is selected using the linear-time Median-Finding algorithm. Prove that this modified QuickSort algorithm takes time $O(n \log n)$ *in the worst case*. Discuss why this algorithm is not used in practice.