CSCE-629 Analysis of Algorithms

Fall 2017

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Assignment # 4
(Due November 9, 2017)

1. (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:

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

2. 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?

3. Design a linear-time algorithm for the following problem: given a directed acyclic graph G, and three vertices s, w, and t, construct a *simple* path (i.e., it does not repeat vertices) in G that starts from s, ends at t, contains the vertex w, and is the longest over all s-t paths in G that contain w. If there is no such a path in G, your algorithm should report so. You should explain why the path constructed by your algorithm is simple.

4. Given a linear-time algorithm that takes as input a directed acyclic graph G and two vertices s and t, and returns the number of simple paths from s to t in G. Your algorithm needs only to count the simple paths, not list them. Note that different paths from s to t may share common vertices.