CS 5200 PSET - 3

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Due on: March 2, 8:00 AM

Problem 1 For the graph G below run the DFS algorithm with the following vertex ordering $(a, b, c, d, e, f, g, h, i)$. Identify the four different types of edges (tree, forward, back and cross). Show the DFS tree and identify all the connected component. Also determine the connected component graph $G_{\widetilde{G}}$.

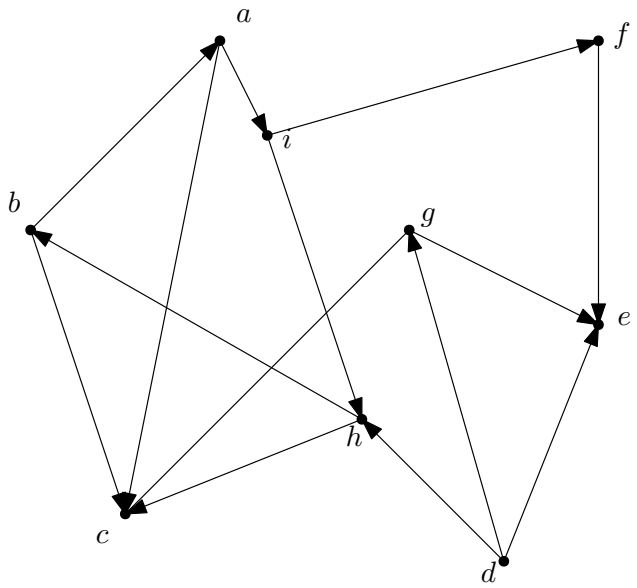

Figure 1: The graph G

Problem 2 Let $G_1 = (V, E_1, w_1)$ and $G_2 = (V, E_2, w_2)$ be two positive edge weighted graphs on the same vertex set V. We assume $w(u, v) = \infty$ if (u, v) is not an edge. Suppose $s \in V$ is the source vertex. Let $G = G_1 + G_2 = (V, E, w)$ is the graph on the same vertex set V where the set of edges and their weights are defined as follows:

$$E = \{(u, v) \mid \ (u, v) \in E_1 \text{ or } (u, v) \in E_2\}$$
$$w((u, v)) = \min(w_1(u, v), w_2(u, v)) \text{for all } (u, v) \in E$$

Let $d(s, u), d^1(s, u), d^2(s, u)$ be the shortest path distances between s and u in G, G_1, G_2 respectively. Determine whether the following statement is true or false. Justify your answer.

$$\forall u \in V : d(s, u) = \min(d^1(s, u), d^2(s, u))$$

Problem 3 Exercise 4.12 from the textbook except assume all edges have the same length.

Problem 4 Determine the number of linear orderings of the following DAG.