

### Chapter 4 Homework

In what follows, if you are asked to traverse a graph and you have a choice of vertices, you are to pick the one that is alphabetically first.

1. [20 points] Let  $G$  be the directed graph with vertices  $a, b, c, d, e, f$  and edges

$$(a, b), (a, d), (b, c), (b, d), (d, e), (e, f), (f, c)$$

- (a) [10 points] Trace Dijkstra's algorithm on  $G$ . Display your results in tabular form, as on page 118 of the text (i.e., with rows being indexed by vertex name and with one column per iteration).
- (b) [5 points] Do a breadth-first search for  $G$ , starting at vertex  $a$ , listing the vertices in the order found.
- (c) [5 points] List the shortest paths from  $a$  to the other vertices of  $G$ .

2. [20 points] Let  $H$  be the weighted directed graph with vertices  $a, b, c, d, e, f$  and edges

$$(a, b, 1), (a, d, 4), (b, c, 3), (b, d, 2), (d, e, -2), (c, f, 1), (e, f, -1)$$

- (a) [10 points] List the shortest paths from  $a$  to all the other vertices of  $H$ , as well as the lengths of these shortest paths.
- (b) [5 points] Suppose we add a new edge  $(c, a, -4)$  to the graph  $H$ . What happens when we try to solve the shortest path problem on this new graph? (Your answer should mention the shortest paths themselves, as well as their lengths.)
- (c) [5 points] Suppose we add a new edge  $(c, a, -5)$  to the graph  $H$ . What happens when we try to solve the shortest path problem on this new graph?