

9. Homework

Due 4/21/09 before class

This homework is for extra credit only. The extra credit will be applied to the overall class score total (and may therefore help make up for low test scores.)

1. Negative edge weights (3+2+4 points)

- a) Give an example of a directed connected graph with real edge weights (that may be negative) for which Dijkstra's algorithm produces incorrect answers. Justify your answer.
- b) Does Dijkstra's algorithm only produce incorrect answers in the presence of a negative weight cycle, or could it also produce incorrect answers in the mere presence of negative weight edges (without any negative weight cycles)? Justify your answer.
- c) Suppose the weighted, directed graph $G = (V, E)$ has a special structure in which edges that leave the source vertex s may have negative weights. All other edge weights are nonnegative, and there are no negative-weight cycles. Show that Dijkstra's algorithm correctly finds shortest paths from s in G .

2. Floyd-Warshall (5 points)

During the Floyd-Warshall all-pairs shortest paths algorithm, the shortest paths can be stored in a predecessor matrix. This is similar to storing a predecessor array for Dijkstra's algorithm, just that there is such an array for every vertex. Modify Floyd-Warshall's algorithm to include the computation of the predecessor matrix. Page 632 in the textbook may provide useful information for this task.

3. Floyd-Warshall (5 points)

Question 25.3-4 on page 640 in the textbook.