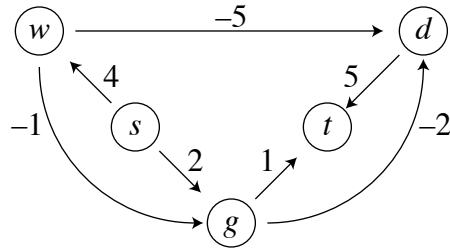


UNDERGRADUATE–CS 163, Winter 2019, Midterm

Name:

UCInetID:

1. (20 points) Find a topological ordering of the following graph:



2. (20 points) If we run Dijkstra's algorithm on the graph from question 1, starting with vertex s , in what order will it remove the vertices from its priority queue? Will it produce a correct answer for the distance from s to t ?

3. (20 points) Draw a directed graph with exactly two strongly connected components, both containing at least two vertices.

4. (20 points) Suppose that a project consists of three tasks P, Q, and R. P must be completed before the starts of Q and R, but Q and R may be performed in parallel. P will take time p , Q will take time q , and R will take time r to complete. Draw a DAG D with starting vertex s , ending vertex t , additional vertices for the starts and ends of the three tasks, and edges labeled by amounts of time, such that longest-path scheduling in D will produce an optimal schedule for your project.

5. (20 points) State the definitions of the width of a path, and of the widest path in a graph.

6. (20 points) Let C be a graph consisting of k vertices, connected into a simple cycle, with all edges having length 1. For the algorithm that approximates the TSP by taking an Euler tour of a doubled minimum spanning tree, what is its approximation ratio on input C ? Give your answer as a function of k .