Final Exam Section 2 Fall 2015, Part B
Computer Science Department, SJSU
CS146: Data Structures and Algorithms
Instructor: Katerina Potika

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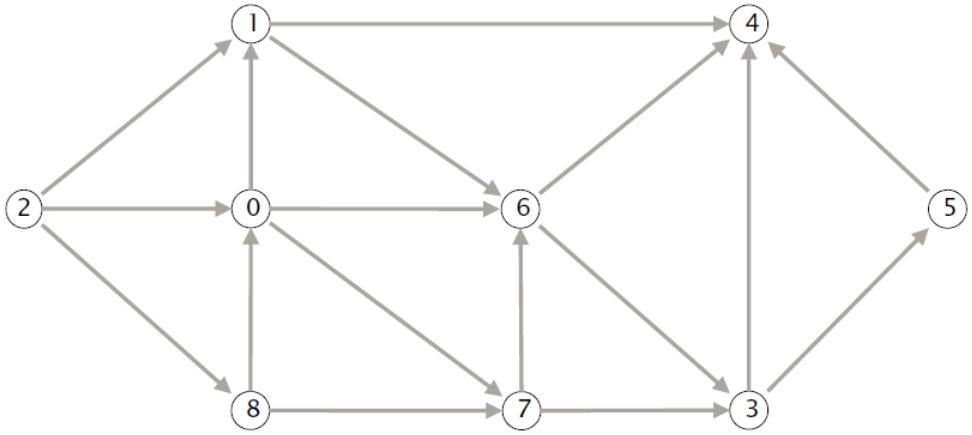
Section	Points
Question 1	_____Out of 10
Question 2	_____Out of 10
Question 3	_____Out of 18
Question 4	_____Out of 10
Total	_____ Out of 48

Duration 1 hour. Closed Books. Good luck!

Question 1

Consider the following DAG. Assume the adjacency lists are in sorted order: for example, when iterating through the edges pointing from 0, consider the edge 0 → 1 before 0 → 6 or 0 → 7.

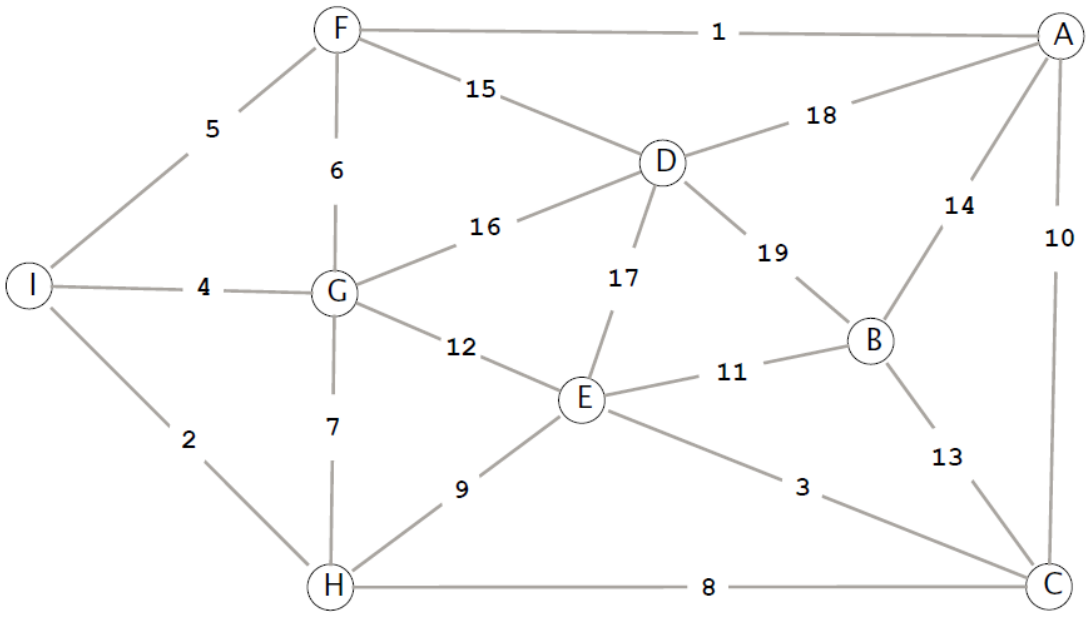


(a) [5pts] Compute the topological order by running the DFS-based algorithm (process vertices in order, i.e. 0 before 2 or 8). Give the topological sorting (list the vertices from left to right).

(b) [5pts] Run breadth-first search, starting from vertex 2. List the vertices in the order in which they are dequeued from the queue.

Question 2

Consider the following edge-weighted graph with 9 vertices and 19 edges. Note that the edge weights are distinct integers between 1 and 19.



a) [5pts] Complete the sequence of edges in the MST in the order that Kruskal's algorithm includes them (by specifying their edge weights).

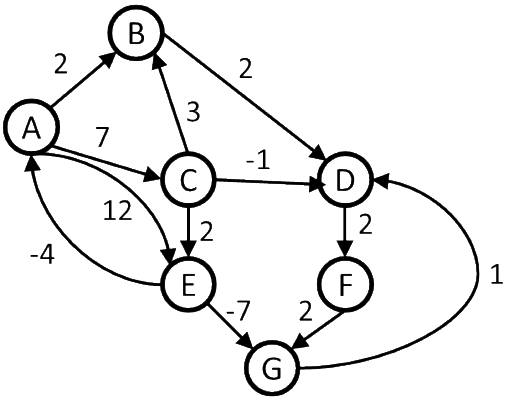
1 ____ ____ ____ ____ ____ ____ ____

b) [5pts] Complete the sequence of edges in the MST in the order that Prim's algorithm includes them (by specifying their edge weights) start with F.

1 ____ ____ ____ ____ ____ ____ ____

Question 3

Consider the following directed, weighted graph:



a. [12pts] Even though the graph has negative weight edges, step through Dijkstra's algorithm to calculate supposedly shortest paths from A to every other vertex. Show your steps in the table below. Set S includes all converged vertices..

S	A	B	C	D	E	F	G

b. [4pts] Dijkstra's algorithm found the wrong path to some of the vertices. For just the vertices where the wrong path was computed, indicate both the path that was computed and the correct path.

c. [2pts] What single edge could be removed from the graph such that Dijkstra's algorithm would happen to compute correct answers for all vertices in the remaining graph?

Question 4

Shortest directed cycle. Given a directed graph with V vertices and E edges, design an efficient algorithm to find a directed cycle with the minimum number of edges (or report that the graph is acyclic). Your answer will be graded on correctness, efficiency, clarity, and succinctness. For full credit, your algorithm should run in O(EV) time and use O(E + V) space. Describe an efficient algorithm and justify the running time and space complexity of your algorithm.

Hint: shortest directed cycle is a shortest path (number of edges) from s to v, plus a single edge v→s.

SCRATCH PAPER