CSCI 4041, Spring 2019, Quiz 6 (30 minutes, 20 points)

Name:

x500:

Discussion Start Time (**circle one**): 3:35 4:40 5:45 6:50 7:55 other:

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1. (1 points each) True/False - Circle one. Note that when asking about the properties of an algorithm, we specifically mean the version of that algorithm discussed in lecture.

True False Depth First Search will never find the shortest path from the starting node to each node reachable from the start.

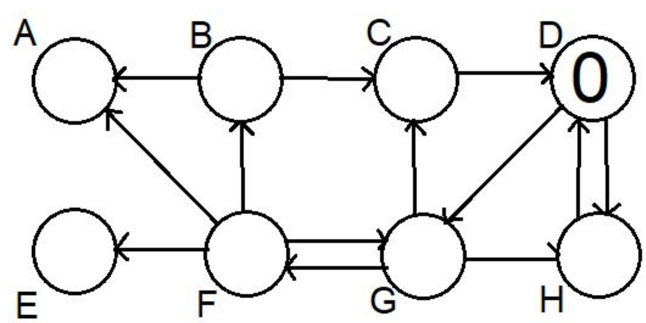
True False Depth First Search uses a stack or recursion.

True False If you run DFS and BFS on an undirected line of nodes of length 101, starting in the middle, BFS will use less memory than DFS.

True False The Bellman-Ford algorithm runs in O(VE) time.

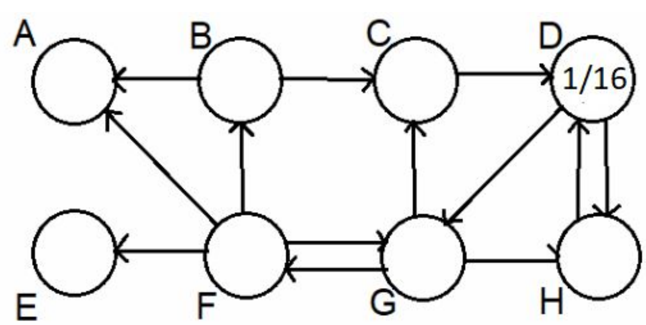
True False Dijkstra's algorithm is optimal so long as there are no negative weighted edges in the graph.

2. The following questions concern the graphs shown on the right:



a. (1 point) What is the out-degree of node G?

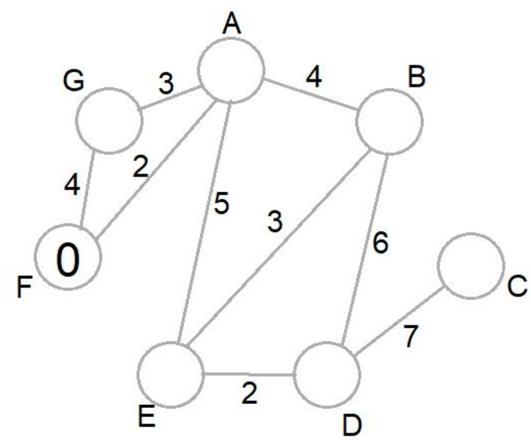
b. (1 points) Which node(s) are sinks, if any?



c. (2 points) Suppose we ran BFS starting at node D. Write the depth of each node within the circle representing the node on the upper graph

d. (2 points) Suppose we ran DFS starting at node D, and the adjacency list of each node was in alphabetical order. Write the discovery time and finish time for each node (in the format node.d/node.f) within the circle representing the node on the lower graph.

3. (4 points) Compute the minimum weight path from node F to every other node in the graph to the left, using any method. Write the final distance value to each node within the circle representing the node.



4. Suppose you are given a set $\{x_1, x_2, x_3, \ldots x_n\}$ of points on the real line (that is, floating point numbers). Consider the problem of determining the smallest set of unit-length closed intervals that contains all of the given points.

   For example, using the set {1.9, 7.0, 8.6, 8.8, 7.7}, all of the following sets of closed intervals contain all of the given points:
   { [1.2, 2.2], [6.1, 7.1], [7.3, 8.3], [8.6, 9.6] }
   { [1.9, 2.9], [6.5, 7.5], [7.7, 8.7], [8.8, 9.8] }
   { [1.5, 2.5], [7.0, 8.0], [8.5, 9.5] }
   but only the last set is a solution, because 3 is the minimum number of intervals required.

   a. (2 points) Describe, in English or pseudocode, a greedy algorithm that solves the above problem optimally.

   b. (3 points) Prove that the greedy choice is contained in at least one minimum size set of unit-length closed intervals.