

Final Exam

Quiz, 10 questions

2
points

1.

Consider a directed graph $G = (V, E)$ with non-negative edge lengths and two distinct vertices s and t of V . Let P denote a shortest path from s to t in G . If we add 10 to the length of every edge in the graph, then: [Check all that apply.]

- ☐ P definitely does not remain a shortest $s - t$ path.
 - ☐ If P has only one edge, then P definitely remains a shortest $s - t$ path.
 - ☐ P might or might not remain a shortest $s - t$ path (depending on the graph).
 - ☐ P definitely remains a shortest $s - t$ path.
-

2
points

2.

What is the running time of depth-first search, as a function of n and m , if the input graph $G = (V, E)$ is represented by an adjacency matrix (i.e., NOT an adjacency list), where as usual $n = |V|$ and $m = |E|$?

- ☐ $\theta(n^2 \log m)$
 - ☐ $\theta(n^2)$
 - ☐ $\theta(n * m)$
 - ☐ $\theta(n + m)$
-

Final Exam

2
points

Quiz, 10 questions

3.

What is the asymptotic running time of the Insert and Extract-Min operations, respectively, for a heap with n objects?

- ☐ $\Theta(1)$ and $\Theta(\log n)$
 - ☐ $\Theta(\log n)$ and $\Theta(\log n)$
 - ☐ $\Theta(n)$ and $\Theta(1)$
 - ☐ $\Theta(\log n)$ and $\Theta(1)$
-

2
points

4.

On adding one extra edge to a directed graph G , the number of strongly connected components...?

- ☐ ...cannot decrease
 - ☐ ...might or might not remain the same (depending on the graph).
 - ☐ ...cannot change
 - ☐ ...cannot decrease by more than 1
-

2
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5.

Which of the following statements hold? (As usual n and m denote the number of vertices and edges, respectively, of a graph.) [Check all that apply.]

- ☐ Breadth-first search can be used to compute shortest paths in $O(m + n)$ time (when every edge has unit length).
- ☐ Depth-first search can be used to compute a topological ordering of a directed acyclic graph in $O(m + n)$ time.

Final Exam

Quiz, 10 questions

☐

Breadth-first search can be used to compute the connected components of an undirected graph in $O(m + n)$ time.

☐

Depth-first search can be used to compute the strongly connected components of a directed graph in $O(m + n)$ time.

2
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6.

When does a directed graph have a unique topological ordering?

☐

Whenever it has a unique cycle

☐

Whenever it is directed acyclic

☐

Whenever it is a complete directed graph

☐

None of the other options

2
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7.

Suppose you implement the operations Insert and Extract-Min using a *sorted* array (from biggest to smallest). What is the worst-case running time of Insert and Extract-Min, respectively? (Assume that you have a large enough array to accommodate the Insertions that you face.)

☐

$\Theta(n)$ and $\Theta(1)$

☐

$\Theta(n)$ and $\Theta(n)$

☐

$\Theta(\log n)$ and $\Theta(1)$

☐

$\Theta(1)$ and $\Theta(n)$

2
points

8.

Final Exam

Quiz, 10 questions

Which of the following patterns in a computer program suggests that a heap data structure could provide a significant speed-up (check all that apply)?

- ☐ Repeated minimum computations
 - ☐ Repeated maximum computations
 - ☐ Repeated lookups
 - ☐ None of the other options
-

2
points

9.

Which of the following patterns in a computer program suggests that a hash table could provide a significant speed-up (check all that apply)?

- ☐ Repeated maximum computations
 - ☐ None of the other options
 - ☐ Repeated lookups
 - ☐ Repeated minimum computations
-

2
points

10.

Which of the following statements about Dijkstra's shortest-path algorithm are true for input graphs that might have some negative edge lengths? [Check all that apply.]

- ☐ It may or may not terminate (depending on the graph).
- ☐ It may or may not correctly compute shortest-path distances (from a given source vertex to all other vertices), depending on the graph.
- ☐ It is guaranteed to terminate.
- ☐ It is guaranteed to correctly compute shortest-path distances (from a given source vertex to all other vertices).

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Quiz, 10 questions



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