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.]

If P has only one edge, then P definitely remains a shortest s-t path.

X

P definitely remains a shortest s-t path.

V

P might or might not remain a shortest s-t path (depending on the graph).

 \geq

P definitely does not remain 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|?

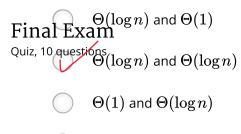
 $heta(n^2)$

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

2 points

3

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



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

2 points

4

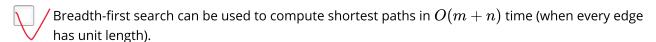
On adding one extra edge to a directed graph G, the number of strongly connected components...?

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

2 points

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 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.

Depth-first search can be used to compute a topological ordering of a directed acyclic graph in O(m+n) time.

	points
Fin	al Exam

Quiz,

ୀଡ଼ questions When does a directed graph have a unique topological ordering?
Whenever it is a complete directed graph
None of the other options —
Whenever it is directed acyclic
Whenever it has a unique cycle
$\frac{2}{\text{points}}$ 7. Suppose you implement the operations Insert and Extract-Min using a <i>sorted</i> 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.) $\Theta(1) \text{ and } \Theta(n)$
$\Theta(n)$ and $\Theta(1)$
$\Theta(\log n)$ and $\Theta(1)$
$igotimes \Theta(n)$ and $\Theta(n)$
2 points 8. 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)?
None of the other options
Repeated maximum computations
Repeated lookups
Repeated minimum computations



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 minimum computations
Repeated lookups
Repeated maximum computations
None of the other options
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 correctly compute shortest-path distances (from a given source vertex to all other vertices), depending on the graph.
It is guaranteed to correctly compute shortest-path distances (from a given source vertex to all other vertices).
It is guaranteed to terminate.
It may or may not terminate (depending on the graph).

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