Problem Set #2

Quiz, 5 questions

3.75/5 points (75%)

Try again once you are ready.

Required to pass: 80% or higher

You can retake this quiz up to 2 times every 12 hours.

Back to Week 2

Retake

1 / 1
point

1.
Consider a directed graph with distinct and nonnegative edge lengths and a source vertex s. Fix a destination vertex t, and assume that the graph contains at least one s-t path. Which of the following statements are true? [Check all that apply.]

- [ ] There is a shortest s-t path with no repeated vertices (i.e., a "simple" or "loopless" such path).

Correct

- [ ] The shortest s-t path must include the minimum-length edge of G.

Un-selected is correct

- [ ] The shortest (i.e., minimum-length) s-t path might have as many as $n-1$ edges, where n is the number of vertices.

Correct

- [ ] The shortest s-t path must exclude the maximum-length edge of G.

Un-selected is correct

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1 / 1
point

2.

Consider a directed graph G with a source vertex s, a destination t, and nonnegative edge lengths. Under what conditions is the shortest s-t path guaranteed to be unique?

- When all edge lengths are distinct positive integers.
- None of the other options are correct.
- When all edges lengths are distinct positive integers and the graph G contains no directed cycles.
- When all edge lengths are distinct powers of 2.

Correct

Two sums of distinct powers of two cannot be the same (imagine the numbers are written in binary).

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0 / 1 point

3.

Consider a directed graph $G=(V,E)$ and a source vertex s with the following properties: edges that leave the source vertex s have arbitrary (possibly negative) lengths; all other edge lengths are nonnegative; and there are no edges from any other vertex to the source s. Does Dijkstra's shortest-path algorithm correctly compute shortest-path distances (from s) in this graph?

- Never
- Only if we add the assumption that G contains no directed cycles with negative total weight.

This should not be selected

The hypotheses in the problem statement already imply that there is no such cycle,

- Maybe, maybe not (depends on the graph)
- Always

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1 / 1 point

4.

Consider a directed graph G and a source vertex s. Suppose G has some negative edge lengths but no negative cycles, meaning G does not have a directed cycle in which the sum of the edge lengths is negative. Suppose you run Dijkstra's algorithm on G (with source s). Which of the following statements are true? [Check all that apply.]

Dijkstra's algorithm always terminates, but in some cases the paths it computes will not be the shortest paths from s to all other vertices.

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Correct

Nonnegativity of the edge lengths was used in the correctness proof for Dijkstra's algorithm; with negative edge lengths, the algorithm is no longer correct in general.

Dijkstra's algorithm always terminates, and in some cases the paths it computes will be the correct shortest paths from s to all other vertices.

Correct

See Question 3.

Dijkstra's algorithm might loop forever.

Un-selected is correct

It's impossible to run Dijkstra's algorithm on a graph with negative edge lengths.

Un-selected is correct

0.75 / 1 point

5.

Consider a directed graph G and a source vertex s. Suppose G contains a negative cycle (a directed cycle in which the sum of the edge lengths is negative) and also a path from s to this cycle. Suppose you run Dijkstra's algorithm on G (with source s). Which of the following statements are true? [Check all that apply.]

Dijkstra's algorithm always terminates, and in some cases the paths it computes will be the correct shortest paths from s to all other vertices.

This should not be selected

When there is negative cycle reachable from s, there is no shortest path from s from any vertex on cycle (every path can be made shorter by going around the cycle an additional time).

It's impossible to run Dijkstra's algorithm on a graph with a negative cycle.

Un-selected is correct

Dijkstra's algorithm might loop forever.

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Un-selected is correct

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Dijkstra's algorithm always terminates, but in some cases the paths it computes will not be the shortest paths from s to all other vertices.

Correct