¡Felicitaciones! ¡Aprobaste!

Calificación recibida 100 % Para Aprobar 80 % o más

Ir al siguiente elemento

Problem Set #2

Calificación de la entrega más reciente: 100 %

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.]

1 / 1 punto

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

Correcto

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

Correcto

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?

1 / 1 punto

- ○ 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.
- ○ When all edge lengths are distinct positive integers.

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

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?

1 / 1 punto

- ◉ Always
- ○ Only if we add the assumption that G contains no directed cycles with negative total weight.
- ○ Never
- ○ Maybe, maybe not (depends on the graph)

Correcto
One approach is to see that the proof of correctness from the videos still works. A slicker solution is to notice that adding a positive constant M to all edges incident to s increases the length of every s-v path by exactly M, and thus preserves the shortest path.

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.]

1 / 1 punto

- [ ] Dijkstra's algorithm might loop forever.

- [x] 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.

Correcto
See Question 3.

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

- [x] 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.

Correcto
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.

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.]

1 / 1 punto

- [ ] Dijkstra's algorithm might loop forever.

- [x] 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.

Correcto

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

- [ ] 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.