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Unit 12 - Week 4 Quiz

Week 4 Quiz

The due date for submitting this assignment has passed. Due on 2020-02-26, 23:59 IST.
As per our records you have not submitted this assignment.

All questions carry equal weightage. You may submit as many times as you like within the deadline. Your final submission will be graded.

1) A courier company has adopted a star-like model for its delivery network. Its central hub is at Bhopal. Bhopal is connected to delivery/collection centres in Delhi, Chennai, Kolkata and Mumbai. Each of these, in turn is connected to a next level of local delivery/collection points, and so on. A package from A to B travels along the shortest route in this star-like network. ***2 points***

For instance, suppose Vellore is connected to Chennai and Pune is connected to Mumbai. A package from Vellore to Pune would be sent via the route Vellore-Chennai-Bhopal-Mumbai-Pune. On the other hand, if both Bhubaneswar and Patna are connected to Kolkata, a package from Bhubaneswar to Patna would travel Bhubaneswar-Kolkata-Patna.

Each direct connection has a fixed delivery charge based on the transportation cost for that segment, which is the same in both directions. The total delivery charge for a package is the sum of the delivery charges of the individual segments.

We want to compute the delivery charge from a given city to every other city in the courier network. Which of the following is true for this specific situation?

- We can use BFS to compute the delivery charges and the answers will be the same as the ones obtained by Dijkstra's algorithm.
- BFS will compute the same delivery charges as Dijkstra's algorithm if the source node is the hub, Bhopal, but may not give the same answer otherwise.
- BFS will compute the same delivery charges as Dijkstra's algorithm if the source node is *not* the hub, Bhopal, but may not give the same answer otherwise.
- BFS will compute the same delivery charges as Dijkstra's algorithm that do not pass through the hub, Bhopal, but may not give the same answer otherwise.

No, the answer is incorrect.
Score: 0

Feedback:
The star network is a weighted tree, so there is only one path between any pair of nodes. Hence BFS will work as well as Dijkstra's algorithm from any starting point.

Accepted Answers:
We can use BFS to compute the delivery charges and the answers will be the same as the ones obtained by Dijkstra's algorithm.

2) An airline charges a fixed price for each direct flight. For each sequence of hopping flights, the ticket price is the sum of the fares of the individual sectors. ***2 points***

TripGuru has precalculated the cheapest routes between all pairs of cities on this airline's route network so that it can offer an optimum choice instantly to customers visiting its website.

The airline has decided to become a full-service carrier and has included a meal on each sector. To account for this, the airline has added a flat "convenience fee" of Rs 300 on each sector. Which of the following describes the impact of this surcharge on TripGuru's computation?

- There is no impact. Cheapest routes between all pairs of cities remains unchanged.
- The surcharge favours hopping flights with more sectors. TripGuru should recompute any cheapest route where there is a longer route in terms of number of flights.
- The surcharge favours hopping flights with fewer sectors. TripGuru should recompute any cheapest route where there is a shorter route in terms of number of flights.
- The impact is unpredictable. TripGuru should recompute all cheapest routes.

No, the answer is incorrect.
Score: 0

Feedback:
The cost per edge increases, so the price for a path with n hops increases by 300n. This means that a shorter path incurs a smaller penalty, so a longer "shortest" path in the original graph may be superseded by a shorter one after adding the penalty on each edge.

Accepted Answers:
The surcharge favours hopping flights with fewer sectors. TripGuru should recompute any cheapest route where there is a shorter route in terms of number of flights.

3) An airline charges a fixed price for each direct flight. For each sequence of hopping flights, the ticket price is the sum of the fares of the individual sectors. ***2 points***

TripGuru has precalculated the cheapest routes between all pairs of cities on this airline's route network. A major IT company has its offices at all the locations served by the airline, and books all official trips for its employees via TripGuru. To simplify administrative processing, the IT company has selected a subset of the airline's routes so that all of their office locations are reachable from each other, and the total cost of travelling across all the chosen routes is minimum.

The airline has decided to become a full-service carrier and has included a meal on each sector. To account for this, the airline has added a flat "convenience fee" of Rs 300 on each sector. Which of the following describes the impact of this surcharge on the IT company's computation of which subset of routes to use?

- There is no impact. The IT company can retain the same subset of routes.
- The surcharge favours hopping flights with more sectors. The IT company should reconsider including routes where there may be a longer route, with more hops.
- The surcharge favours hopping flights with fewer sectors. The IT company should reconsider including routes where there may be a shorter route, with fewer hops.
- The effect of the surcharge is unpredictable. The IT company should recompute its preferred subset of routes afresh.

No, the answer is incorrect.
Score: 0

Feedback:
The IT company computes a minimum cost spanning tree. Any spanning tree over n nodes had n-1 edges. So the cost of any spanning increases by the same amount, 300(n-1), after the surcharge. Hence, the

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MCST remains unchanged.

Accepted Answers:
There is no impact. The IT company can retain the same subset of routes.

4) Suppose we run Prim's algorithm and Kruskal's algorithm on a graph G and the two algorithms produce minimum-cost spanning trees T_P and T_G. Which of the following is true? ***2 points***

- T_P must be identical to T_G.
- If T_P is different from T_G, some pair of edges in G have the same weight.
- If e is a minimum cost edge in G, e belongs to both T_P and T_G.
- If e is a maximum cost edge in G, e belongs to neither T_P nor T_G.

No, the answer is incorrect.
Score: 0

Feedback:
If all edge weights are distinct, the MCST is unique. For the rest, consider a triangle with equal edge weights.

Accepted Answers:
If T_P is different from T_G, some pair of edges in G have the same weight.

5) Suppose we run the Bellman-Ford algorithm on a weighted graph with n vertices and observe that some distances decrease in iteration n+1. Which of the following is *not* a valid conclusion. ***2 points***

- The graph has negative edge weights.
- The graph has a negative cycle.
- If we iterate further, distances will continue to decrease.
- Some shortest path entry in iteration n+1 must be negative.

No, the answer is incorrect.
Score: 0

Feedback:
There is definitely a negative cycle, so there are negative edge weights and distances will continue to decrease. However, a large positive weight may have cancelled out small negative weights so there need not be a negative distance after n+1 iterations.

Accepted Answers:
Some shortest path entry in iteration n+1 must be negative.