CMPSC 465 Data Structures & Algorithms
Fall 2025 Ke Chen and Yana Safonova

Quiz 6

Lecture Section: **Monday, Oct 13, 2025**

Student Name: **PSU Email ID:**

1. (2 pts.) Bellman-Ford can be used to find shortest paths in an **undirected** graph with negative edge weights.

(a) True

(b) False

Answer False
An undirected graph can be treated as a directed graph by replacing all edges with one forward and backward edge between connected vertices. As a result, this graph will contain cycles with negative edge weights. Bellman-Ford algorithm can't be used in this case.

2. (2 pts.) While running Bellman-Ford on a graph with no negative cycles, updating every edge $|V|^2$ times instead of $|V|-1$ times has no effect on the output.

(a) True

(b) False

Answer True
The operation of updating the shortest path ending with a given edge is safe. Once the shortest paths are found, the output will not change.

3. (2 pts.) Which of the following recursions is used in Floyd-Warshall? Here, $dist_k[i,j]$ is the shortest path from vertex i to vertex j using only the first k vertices and $\ell(i,j)$ is the weight of the edge from i to j.

(a) $dist_k[i,j] = dist_{k-1}[i,j] + \ell(k-1,j)$

(b) $dist_k[i,j] = dist_k[i,k] + dist_k[k,j]$

(c) $dist_k[i,j] = \max \left\{ \begin{matrix} dist_{k-1}[i,j], \\ dist_{k-1}[i,k] + dist_{k-1}[k,j] \end{matrix} \right\}$

(d) $dist_k[i,j] = \min \left\{ \begin{matrix} dist_{k-1}[i,j], \\ dist_{k-1}[i,k] + dist_{k-1}[k,j] \end{matrix} \right\}$

Answer (d):
The new shortest path is the minimum between the known shortest path and some possible shorter path that goes through node k.

4. (2 pts.) In a valid flow, the total flow out of the unique source vertex s (i.e., the value of the flow) is greater than the total flow into the unique sink vertex t.

(a) True

(b) False

Answer False
They are equal to each other.

5. (2 pts.) In a network flow, if the capacity of an edge is increased, the maximum flow from the source to the sink must increase.

(a) True

(b) False

Answer False
Increasing the capacity of an edge in a network flow does not always increase the maximum flow.