National Taiwan Normal University
Department of Computer Science and Information Engineering

CSC0056 - Data Communication

Homework 4

(Due on 12/2/2019, 9:10 AM. Submit your answer via Moodle)

1. (50 points) Answer the following review questions for Lecture 12. Each review question is a statement for you to judge whether it is true or not, according to the materials covered in the lecture and the textbook Sections 5.2-5.2.3. If you think the statement is true, answer 'T'; otherwise, answer 'F' and give a reason:

   Statement 1 (10 points): In the graph model, a *tree* is a connected graph that contains no cycles.

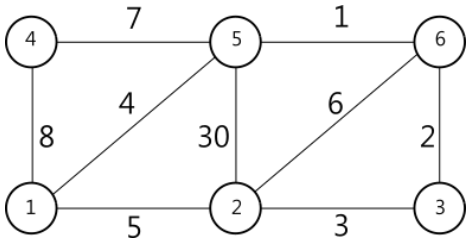
   Statement 2 (10 points): Following Statement 1, the *minimum weight spanning tree* (MST) of a graph *G* is a tree that contains all nodes in *G* and has the minimum sum of arc weights.

   Statement 3 (10 points): Using the Prim-Dijkstra algorithm to construct a MST, we can begin the algorithm at any node in the graph; using Kruskal's algorithm to construct a MST, we can begin the algorithm at any arc in the graph.

   Statement 4 (10 points): Given a directed graph $G=(N, A)$, in the worst case the Bellman-Ford algorithm may take $|A|$ iterations before termination, where $|A|$ is the size of the total number of arcs in *G*.

   Statement 5 (10 points): Using Dijkstra's algorithm to construct the shortest paths of a graph, in each iteration we will be able to determine the shortest path for exactly one node, and that node is different from the ones for which we have determined the shortest path in previous iterations.

2. (50 points) Consider the following graph and answer three questions:



   Question 1 (20 points): Use the Prim-Dijkstra algorithm and Kruskal's algorithm, respectively, to construct a MST. 10 points per algorithm. Draw your answer at each iteration, like that in Figure 5.26 on page 392.

   Question 2 (20 points): Use the Bellman-Ford algorithm and Dijkstra's algorithm, respectively, to find the shortest paths to node 1. 10 points per algorithm. Draw your answer at each iteration, like that in Figure 5.35 on page 403.

   Question 3 (10 points): In this graph, are the paths in the MST the shortest paths to node 1? Are they the shortest paths to node 5? 5 points for each answer.