# ECE 478/578: Fundamentals of Computer Networks

Homework Assignment # 5

Due Thursday April 5, In class

**Problem 1:** For the network of Figure 1 show the operation of Dijkstra's algorithm for computing the least cost path from node **E** to all the destinations (show the steps of adding each node to the set of nodes with known paths at every iteration of the algorithm). Show the forwarding table at node **B** as computed by the distance vector algorithm (you need not show all the steps but you can construct the forwarding table by inspection)

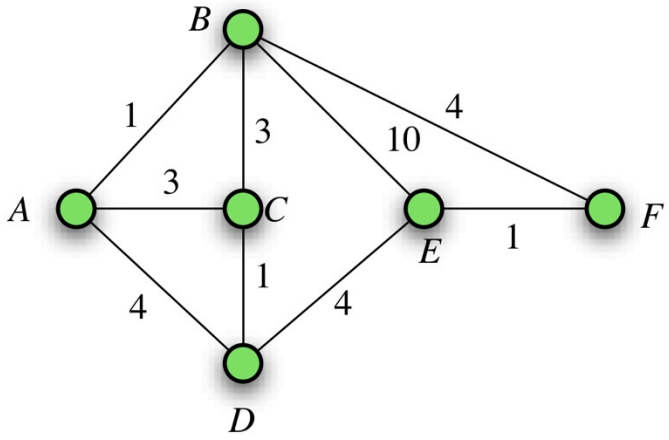


Figure 1: Network topology and associated edge costs.

**Problem 2:** For the network of Figure 1 show the application of the distance vector algorithm for computing the forwarding tables at every node in the network. Show the evolution of the forwarding tables at each node, with each iteration of the algorithm.

**Problem 3:** Consider the network topology of Figure 2. Compute the minimum-cost spanning tree using the following two algorithms. For every algorithm iteration, show the nodes that are already selected as part of the tree and the edges that connect them.

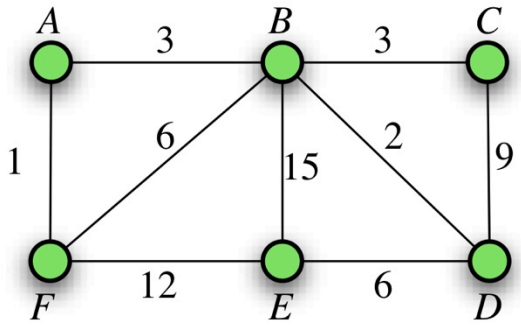

Figure 2: Network topology and associated edge costs.

a. Prim-Dijkstra's Algorithm
   i. Step 1: Select a starting node at random.
   ii. Step 2: Add a minimum-weight outgoing edge (an edge that does not belong to the current tree) that extends the tree by one node.
   iii. Repeat until all nodes of the network are spanned.

b. Kruskal's Algorithm
   i. Step 1: All nodes of the network are considered to be starting nodes. Consider nodes to be the starting points of subtrees.
   ii. Step 2: Add a minimum-weight outgoing edge for each starting node that extends the sub-tree of that node by one.
   iii. Step 3: Repeat step 2 until the sub-tree is connected to a spanning tree.

**Problem 4:** Consider the network topology of Figure 3. The number shown next to each link is the probability of the link failing during the lifetime of a virtual circuit from node A to node B. It is assumed that links fail independently from each other. Find the most reliable virtual circuit (path) from A to B using a modified version of a shortest-path algorithm of your preference. Make sure to show all iterative steps in the application of the shortest-path algorithm.

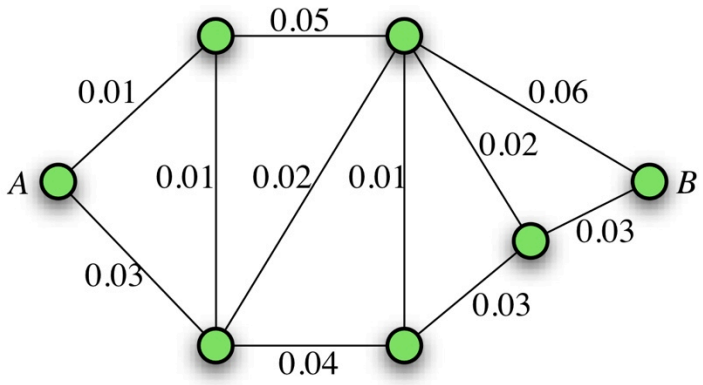


Figure 3: Network topology and associated link failure probabilities.

**Problem 5:** Does Dijkstra's algorithm produce the shortest path tree if edges are assigned negative weights? If your answer claims that Dijkstra's algorithm does not work with negative weights show a counter-example that proves your claim.