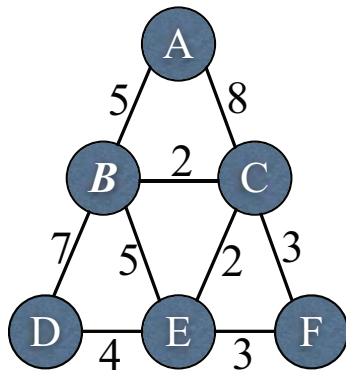


# Fundamentals of Information Science: Homework 8

March 18, 2025

## Problem 1.

Consider the the network shown in the following figure. Each node implements Dijkstra's shortest paths algorithm using the link costs shown in the picture.



(a) Initially, node  $D$ 's routing table contains only one entry, for itself. When  $D$  runs Dijkstra's algorithm, in what order are nodes added to the routing table? List *all possible answers*.

(b) Now suppose the link cost for one of the links changes but all costs remain non-negative. For each change in link cost listed below, state whether it is possible for the route at node  $C$  (i.e., the link used by  $C$ ) for any destination to change, and if so, name the destination(s) whose routes may change.

- The cost of link  $(B, D)$  increases:
- The cost of link  $(B, D)$  decreases:
- The cost of link  $(B, E)$  increases:
- The cost of link  $(B, E)$  decreases:

## Problem 2.

Consider the the network in Problem 2. If the network implements the distance-vector protocol, describe how the routing table at node  $D$  changes after each step of integration. Given the network topology, how many steps are sufficient for the distance-vector protocol to converge (i.e., every node can find the shortest paths to its destinations).

## Problem 3.

Annette Werker conducts tests between a server and a client using the sliding window pro-

protocol described in this chapter. There is no other traffic on the path and no packet loss. Annette finds that:

- (1) With a window size  $W_1 = 50$  packets, the throughput is 200 packets per second.
- (2) With a window size  $W_2 = 100$  packets, the throughput is 300 packets per second.

Annette finds that even this small amount of information allows her to calculate several things, assuming there is only one bottleneck link. Calculate the following:

- (a) The minimum round-trip time between the client and server.
- (b) The average queueing delay at the bottleneck when the window size is 100 packets.
- (c) The average queue size when the window size is 100 packets.