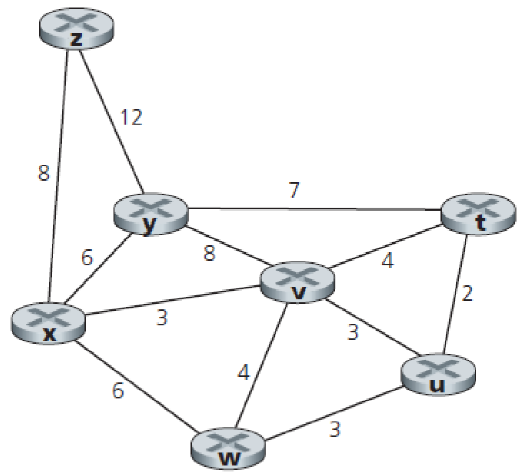
CSEE 4119: Computer Networks

Homework 5 — Due: 04/18/2019

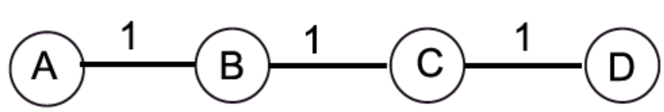
1. Consider the following network, with the indicated link costs.



Use Dijkstra's shortest-path algorithm to compute the shortest path from x to all the nodes. Show how the algorithm works by computing a table as in the class (where each row corresponds to one iteration of the algorithm.)

2. Consider the same network as in Problem 1. Assume node x is the only destination in the network. Use a table to show the computation process of the Bellman-Ford algorithm. Each row in the table corresponds to one iteration of the algorithm, and each column is a pair $(D_i(A), H_i(A))$ where $D_i(A)$ is the cost from node i to A and $H_i(A)$ is the next hop on the path from i to A. In each iteration, each node broadcasts its distance vector to its neighbors if there has been a change in its distance vector.

3. Consider the network below, where each link has a cost of 1.



Assume node A is the only destination, and nodes calculate the shortest paths using the Bellman-Ford algorithm. The initial routing tables at each node are illustrated in the table below.

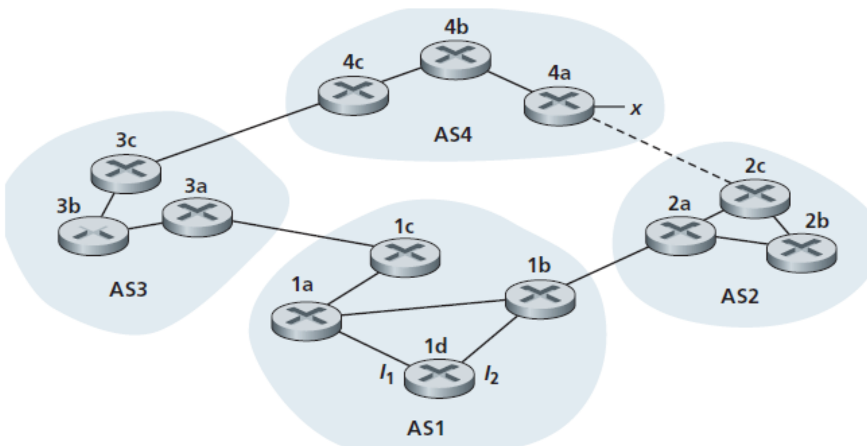
$(D_A(A), H_A(A))$	$(D_B(A), H_B(A))$	$(D_C(A), H_C(A))$	$(D_D(A), H_D(A))$
(0,A)	(1,A)	(2,B)	(3,C)

(i) Assume link BA goes down and B finds out about this failure. Wire down the first few iterations by adding rows to the above table, under the Bellman-Ford algorithm. Observe that each node's cost of a path to A slowly increases and goes to infinity.

(ii) Assume link BA goes down but there is another link between node A and node D with cost 10. Starting from the initial routing tables, how many iterations does it take for all nodes to find the alternative path to node A?

(iii) We saw in the class that one way to resolve the slow convergence issue is Poisoned Reverse. Illustrate the updates of the routing tables using the Poisoned Reverse rule.

4. Consider the network shown below. Suppose all AS's are running OSPF for their intra-AS routing, and eBGP and iBGP are used for the inter-AS routing protocol. Initially suppose there is no physical link between AS2 and AS4. Once router 1d learns about x it will put an entry (x, I) in its forwarding table.



(i) Router 1d learns about x from which routing protocol?

(ii) Will I be equal to I_1 or I_2 for this entry? Explain why in one sentence.

(iii) Now suppose that there is a physical link between AS2 and AS4, shown by the dotted line. Suppose router 1d learns that x is accessible via AS2 as well as via AS3. Will I be set to I_1 or I_2? Explain why in one sentence.

(iv) Now suppose there is another AS, called AS5, which lies on the path between AS2 and AS4 (not shown in diagram). Suppose router 1d learns that x is accessible via AS2 AS5 AS4 as well as via AS3 AS4. Will I be set to I_1 or I_2? Explain why in one sentence.