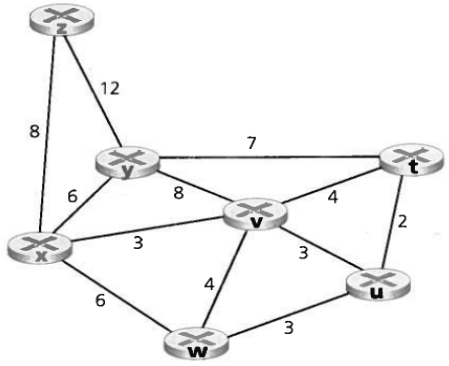
EECE 7374 – Fall 2023
Homework #4

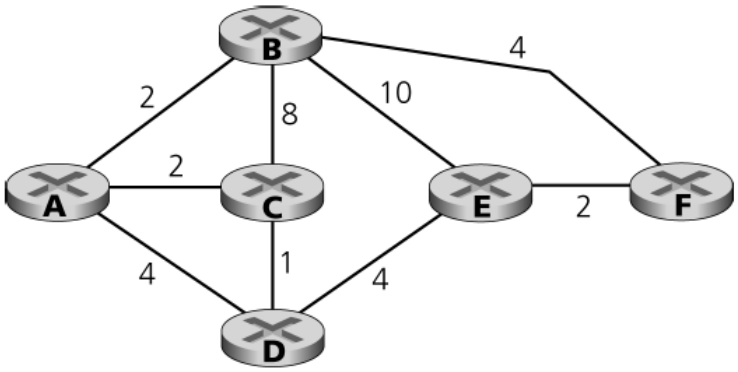
You should work on this homework alone.

0) **Academic integrity** – Print the following statement: "I (We) have read and understood the course academic integrity policy". **Your submission will NOT be graded without this statement.**

1) **Dijkstra's algorithm** – Consider the following network. With the indicated link costs, use Dijkstra's shortest-path algorithm to compute the shortest path from *x* to all network nodes. Show how the algorithm works by computing a table similar to Table 5.1. **(30 points)**

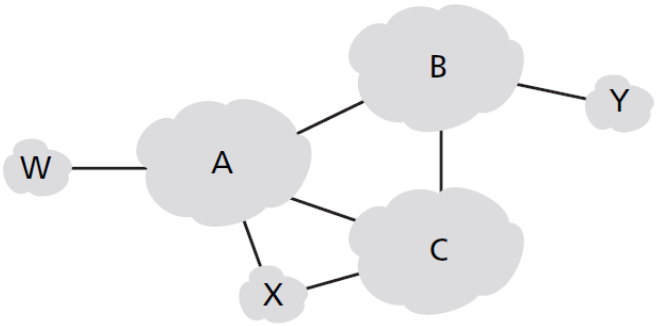


2) **Distance vector algorithm** – Consider the network below:
   a) What are A, B, C, D, E, and F's distance vectors? Note: you do not have to run the distance vector algorithm; you should be able to compute the distance vectors by inspection. Recall that a node's distance vector is the vector of the least cost paths from itself to each of the other nodes in the network. **(8 points)**
   b) Now consider node C. From which other nodes does C receive distance vectors? **(8 points)**
   c) Consider node C again. Through which neighbor will C route its packets destined to E? Explain how you arrived at your answer, given the distance vectors that C has received from its neighbors. **(8 points)**
   d) Consider node E. From which other nodes does E receive distance vectors? **(8 points)**
   e) Consider node E again. Through which neighbor will E route its packets destined to B? Explain how you arrived at your answer, given the distance vectors that E has received from its neighbors. **(8 points)**



3) **BGP –** Consider the network below in which network W is a customer of ISP A, network Y is a customer of ISP B, and network X is a customer of both ISPs A and C.
   a) What BGP routes will A advertise to X? **(10 points)**
   b) What routes will X advertise to A? **(10 points)**
   c) What routes will A advertise to C? **(10 points)**

   For each answer, provide a one-sentence explanation.



Bonus problem (Chapter 4) – You are interested in detecting the number of hosts behind a NAT. You observe that the IP layer stamps an identification number sequentially on each IP packet. The identification number of the first IP packet generated by a host is a random number, and the identification numbers of the subsequent IP packets are sequentially assigned. Assume all IP packets generated by hosts behind the NAT are sent to the outside world.

a) Based on this observation, and assuming you can sniff all packets sent by the NAT to the outside, can you outline a simple technique that detects the number of unique hosts behind a NAT? Justify your answer. **(10 points)**
b) If the identification numbers are not sequentially assigned but randomly assigned, would your technique work? Justify your answer. **(10 points)**