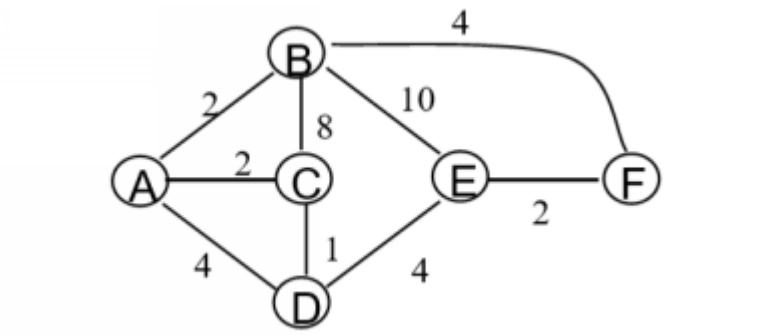
**Homework 7 – CS 158, Fall 2020**

**Due Date: Wednesday, October 21**

1 **Dijkstra's (Link State) algorithm.** – Problem 1 [**20 Points**]

Consider the network shown below. Show the operation of Dijkstra's (Link State) algorithm for computing the least cost path from **D** to all destinations.



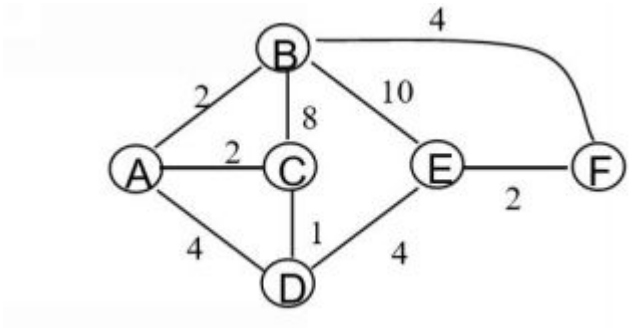

a [15 points] Fill out the table below to show the working of Dijkstra's algorithm:

| N | D(A),p(A) | D(B),p(B) | D(C),p(C) | D(E),p(E) | D(F),p(F) |
|---|---|---|---|---|---|
| D | 4 | infinite | 1 | 4 | infinite |
| DC | 3 | 9 | 1 | 4 | infinite |
| DCA | 3 | 5 | 1 | 4 | Infinite |
| DCAE | 3 | 5 | 1 | 4 | 6 |
| DCAEB | 3 | 5 | 1 | 4 | 6 |

b [5 points] What is the shortest path from D to B, and what is the cost of this path?
DCAB with a cost of 1 + 2 + 2 = 5

**2. Distance Vector Algorithm**. – Problem 2 [**35 Points**]

Consider the network below.




**a.** [15 points] 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 distance vectors by inspection.* Recall that a nodes distance vector is vector of the least cost paths from itself to each of the other nodes in the network.

A)
AB = 2
AC = 2
AD = 4

AE = 7
AF = 6

B)
AB = 2
BC = 4
BD = 5
BE = 6
BF = 4

C)
CA = 2
CB = 4
CD = 1
CE = 5
CF =7

D)
DA = 2
DB = 5
DC = 1
DE = 4
DF = 6

E)
EA = 7
EB = 6
EC = 5
ED = 4
EF = 2

F)
FA = 6
FB = 4
FC = 7
FD = 6
FE = 2

**b.** [3 points] Now let us consider node C. From which other nodes does C receive its distance vector?

Node C utilizes node D and E to get the value of E, and the value of F

**c.** [7 points] Consider node C again. Through which neighbor will C route it packets destined to E. Explain how you arrived at this answer, given the distance vectors that C has received from its neighbors.
*C* would route its packets to E through D, as in Dijkstra's algorithm, we first compute the immediate neighbors, then we take the shortest path and check it. Since C to D is of cost 1, it will add D to its table, and then it will see a cost to E, and so it will route to it.

**d.** [3 points] Now let us consider node E. From which other nodes does E receive its distance vector?
Node D as it gives A and C

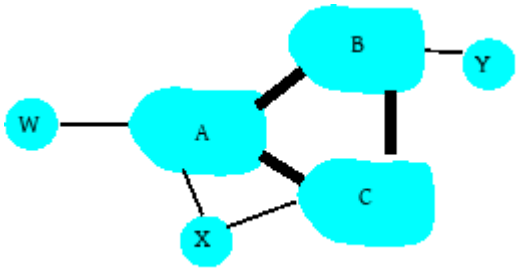
**e.** [7 points] Consider node E again. Through which neighbor will E route it packets destined to B. Explain how you arrived at this answer, given the distance vectors that E has received from its neighbors.
Through F because again it has the shortest cost, and so once you have EF in your table, node E will see a short path to B.

## **3. Border Gateway Protocol (BGP)** – Problem 2 [**10 Points**]

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? For each answer provide a one sentence explanation.

A will advertise By, Cby, and Aw to x (assuming all networks provide service to all)




**b.** What routes will X advertise to A?
X is a customer network, so It wont try to advertise any routes.

**c.** What routes will A advertise to C?
A will advertise that it can reach Ax and Aw, and not y because that might cause C to route to Y via A when C has a link directly to B