Homework Assignment 3: 100 points

Due date: Nov. 17, 2023 (Friday)

Question 1: (15 points)

(a) Please specify three examples of MAC protocols which are based on the rationale of "random access". (5 points)

(b) Can CSMA completely avoid collisions? Please explain your answer. (5 points)

(c) What are the differences between CSMA/CD and CSMA/CA? (5 points)

Question 2: (10 points)

(a) As shown in Figure 1, suppose that host A sends a datagram to host B. Will the source/destination IP addresses be changed when the datagram traverses through the router R? If yes, how will be changes? (5 points)

(b) As shown in Figure 1, suppose that host A sends a datagram to host B. Will the source/destination MAC addresses be changed when the frame traverses through the router R? If yes, how will be changes? (5 points)

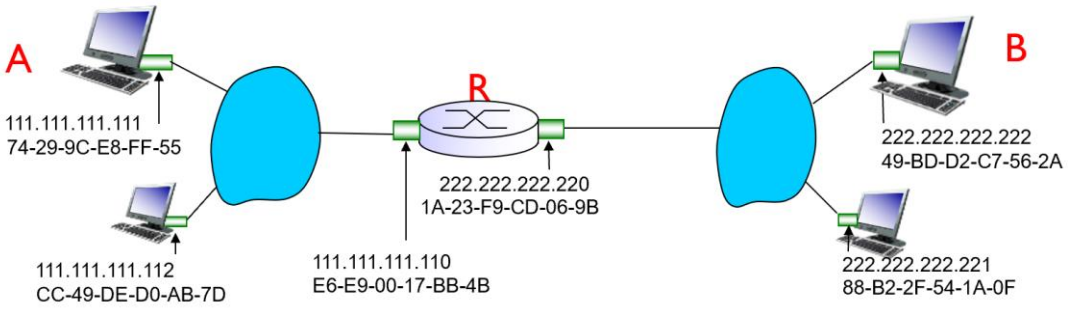

Figure 1

Question 3: (10 points)

(a) What are the differences between the functionality of the network layer and the functionality of the data link layer? (5 points)

(b) What are the differences between the MAC address and IP address? (5 points)

Question 4: (15 points)

Please explain the differences between the Link-State based routing algorithm and the Distance-Vector based algorithm.

Question 5: (30 points)

Consider the network topology as shown in Figure 2 below. Consider that all routers use Link-State based routing algorithm for finding the optimal routing.

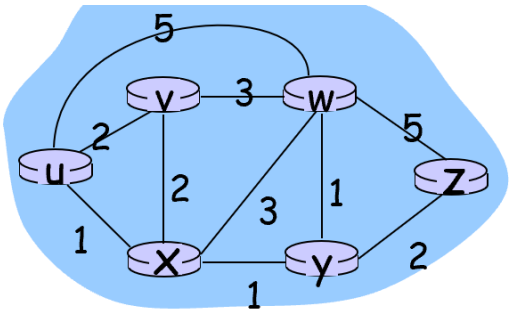

Figure 2

(a) Consider that router "u" is performing the Link-State routing algorithm. Please specify the detailed procedures for performing the Dijkstra algorithm by filling the following table. (15 points)

Step	N'	D(v), p(v)	D(w), p(w)	D(x), p(x)	D(y), p(y)	D(z), p(z)
0						
1						
2						
3						
4						
5						

(b) Consider that router "z" is performing the Link-State routing algorithm. Please specify the detailed procedures for performing the Dijkstra algorithm by filling the following table. (15 points)

Step	N'	D(v), p(v)	D(w), p(w)	D(x), p(x)	D(y), p(y)	D(u), p(u)
0						
1						
2						
3						
4						
5						

Question 6: (20 points)

(a) Consider the network topology shown in Figure 3. Suppose that the distance vector based algorithm is used. Please specify convergence process as shown in the following Figure 4. (10 points)

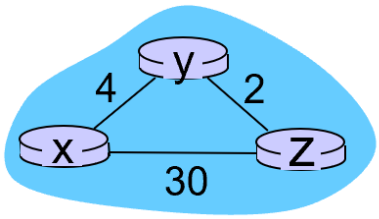

Figure 3

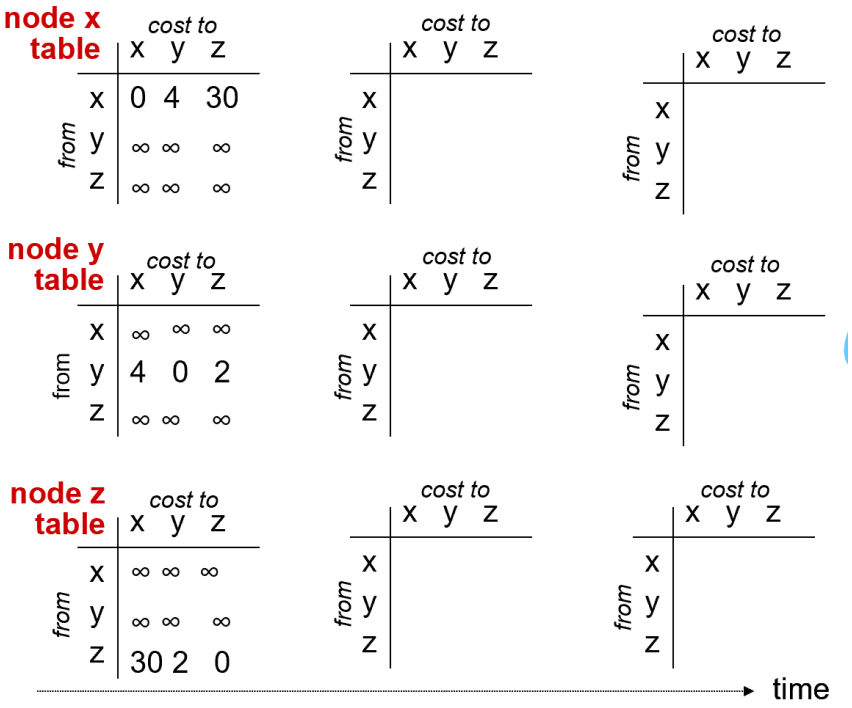

Figure 4

(b) After convergence of the distance vector based algorithm in Question 6(a), if the link cost between router x and router y is increased to 60 as shown in Figure 5, will the distance vector based algorithm converge quickly after this increased link cost? Please explain your reasons. (10 points)

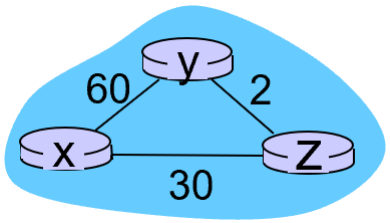

Figure 5