Homework 3

Review Questions

- Compare and contrast link-state and distance-vector routing algorithms.
- Discuss how a hierarchical organization of the Internet has made it possible to scale to millions of users.
- Is it necessary that every autonomous system use the same intra-AS routing algorithm? Why or why not?
- Why are different inter-AS and intra-AS protocols used in the Internet?
- Why are policy considerations as important for intra-AS protocols, such as OSPF and RIP, as they are for an inter-AS routing protocol like BGP?
- How big is the MAC address space? The IPv4 address space? The IPv6 address space?
- Describe polling and token-passing protocols using the analogy of cocktail party interactions.
- Why would the token-ring protocol be inefficient if a LAN had a very large perimeter?

Problems

1. Looking at Figure 4.27, enumerate the paths from *y* to *u* that do not contain any loops.

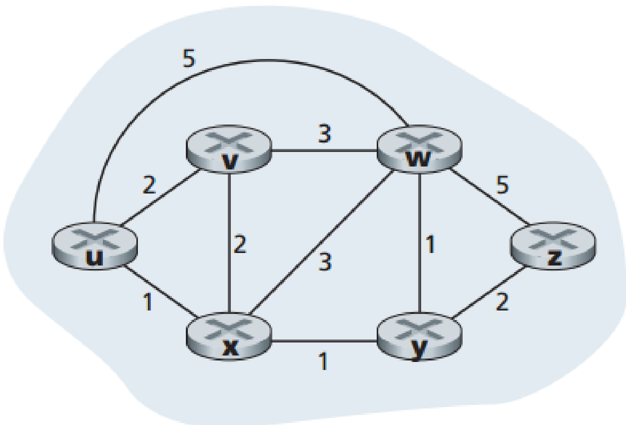


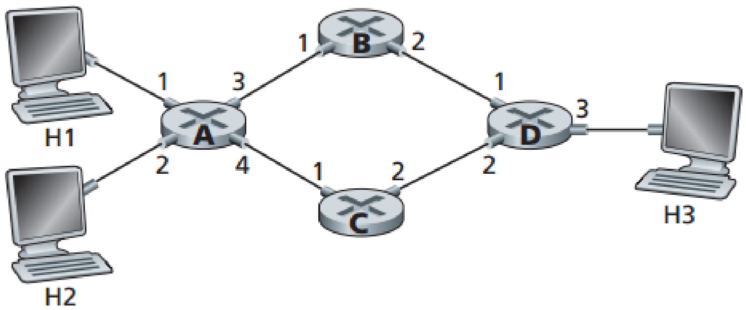
Figure 4.27 ♦ Abstract graph model of a computer network

2.

Consider the network below.

a. Suppose that this network is a datagram network. Show the forwarding table in router A, such that all traffic destined to host H3 is forwarded through interface 3.

b. Suppose that this network is a datagram network. Can you write down a forwarding table in router A, such that all traffic from H1 destined to host H3 is forwarded through interface 3, while all traffic from H2 destined to host H3 is forwarded through interface 4? (Hint: this is a trick question.)



3. Consider the network shown in Fig.26. Using Dijkstra's algorithm, and showing your work using a table similar to Table 1, do the following:

a. Compute the shortest path from *t* to all network nodes.

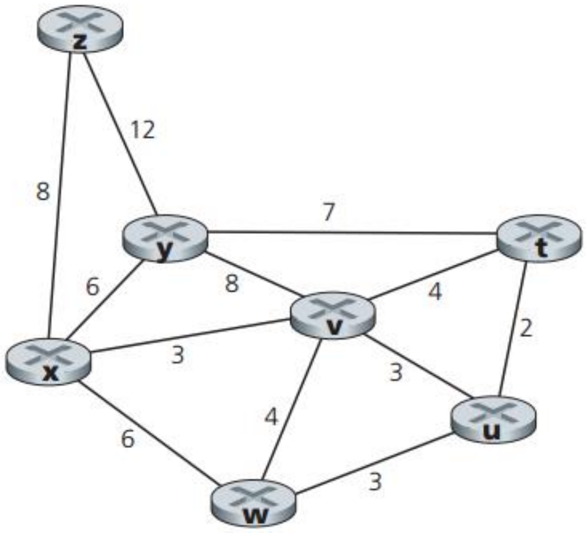
b. Compute the shortest path from *u* to all network nodes.

c. Compute the shortest path from *v* to all network nodes.

d. Compute the shortest path from *w* to all network nodes.

e. Compute the shortest path from *y* to all network nodes.

f. Compute the shortest path from *z* to all network nodes.



<Fig. 26>

Table 1

step	N′	D(v),p(v)	D(w),p(w)	D(x),p(x)	D(y),p(y)	D(z),p(z)
0	u	2,u	5,u	1,u	∞	∞
1	ux	2,u	4,x		2,x	∞
2	uxy	2,u	3,y			4,y
3	uxyv		3,y			4,y
4	uxyvw					4,y
5	uxyvwz					

4.

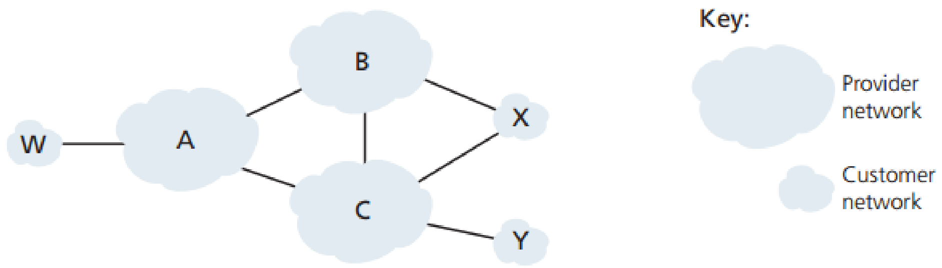
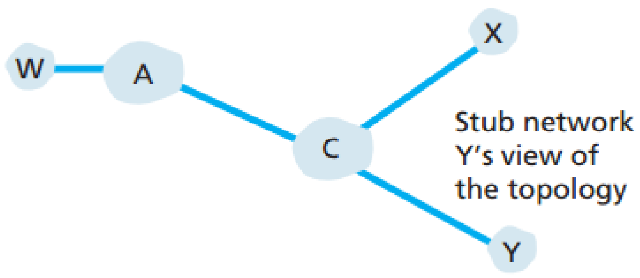


Figure 4.42 ♦ A simple BGP scenario

In Figure 4.42, consider the path information that reaches stub networks W, X, and Y. Based on the information available at W and X, what are their respective views of the network topology? Justify your answer. The topology view at Y is shown below.



5. In the class, lecture note provided an outline of the derivation of the efficiency of slotted ALOHA. In this problem we'll complete the derivation.

a. Recall that when there are N active nodes, the efficiency of slotted ALOHA is $Np(1 - p)^{N-1}$. Find the value of p that maximizes this expression.

b. Using the value of p found in (a), find the efficiency of slotted ALOHA by letting N approach infinity. *Hint*: $(1 - 1/N)^N$ approaches $1/e$ as N approaches infinity.

6. Suppose nodes A and B are on the same 10 Mbps broadcast channel, and the propagation delay between the two nodes is 325 bit times. Suppose CSMA/CD and Ethernet packets are used for this broadcast channel. Suppose node A begins transmitting a frame and, before it finishes, node B begins transmitting a frame. Can A finish transmitting before it detects that B has transmitted? Why or why not? If the answer is yes, then A incorrectly believes that its frame was successfully transmitted without a collision. *Hint*: Suppose at time $t = 0$ bits, A begins transmitting a frame. In the worst case, A transmits a minimum-sized frame of 512 + 64 bit times. So A would finish transmitting the frame at $t = 512 + 64$ bit times. Thus, the answer is no, if B's signal reaches A before bit time $t = 512 + 64$ bits. In the worst case, when does B's signal reach A?