National University of Computer and Emerging Sciences, Karachi

Spring-2023, FAST School of Computing

CS3001-Computer Networks

Practice Questions

1. What is meant by a control plane that is based on logically centralized control? In such cases, are the data plane and the control plane implemented within the same device or in separate devices? Explain.

2. Compare and contrast link-state and distance-vector routing algorithms. Give an example of a routing protocol that takes a centralized and a decentralized approach.

3. What is the "count to infinity" problem in distance vector routing? Will the count-to-infinity problem occur if we decrease the cost of a link? Why? How about if we connect two nodes which do not have a link?

4. Why are different inter-AS and intra-AS protocols used in the Internet? Is it necessary that every autonomous system use the same intra-AS routing algorithm? Why or why not?

5. True or false: When an OSPF route sends its link state information, it is sent only to those nodes directly attached neighbors. Explain.

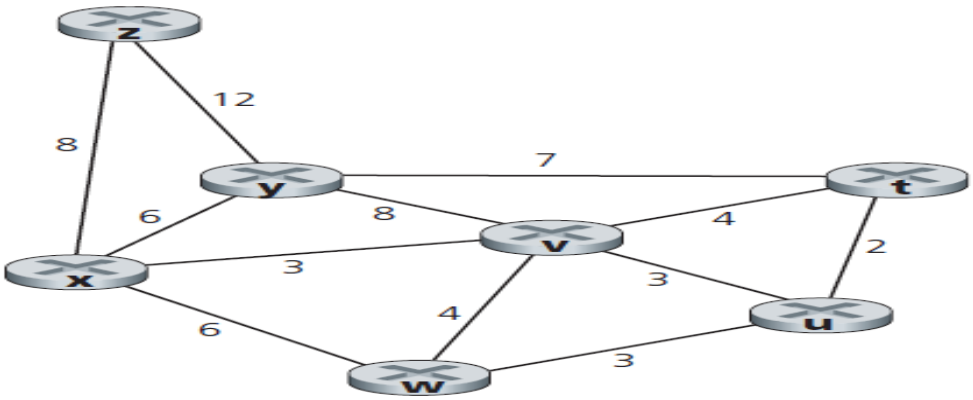
6. What is meant by an area in an OSPF autonomous system? Why was the concept of an area introduced?

7. True or false: When a BGP router receives an advertised path from its neighbor, it must add its own identity to the received path and then send that new path on to all of its neighbors. Explain.

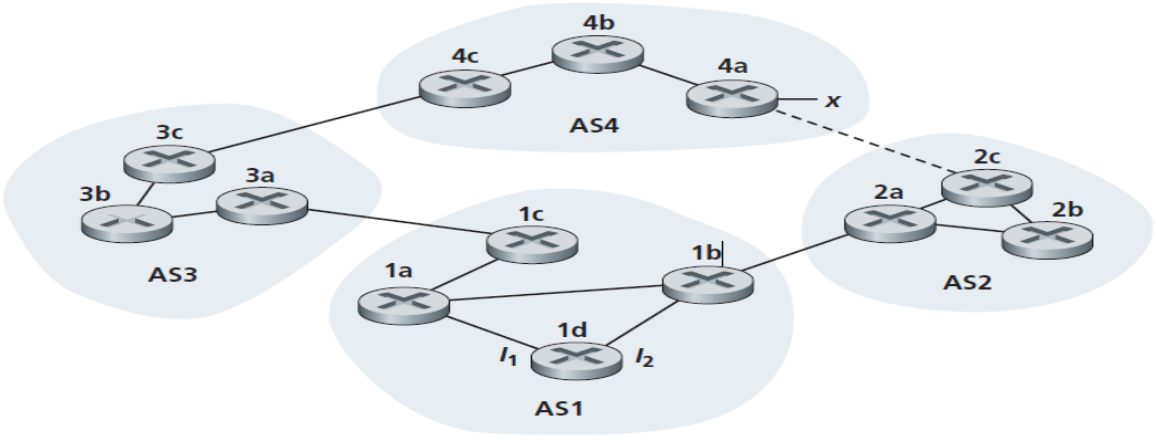
8. How does BGP use the NEXT-HOP attribute? How does it use the AS-PATH attribute?

9. Suppose you wanted to implement a new routing protocol in the SDN control plane. At which layer would you implement that protocol? Explain.

10. 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.



11. **Consider the network shown below. Suppose AS3 and AS2 are running OSPF for their intra-AS routing protocol. Suppose AS1 and AS4 are running RIP for their intra-AS routing protocol. Suppose eBGP and iBGP are used for the inter-AS routing protocol. Initially suppose there is no physical link between AS2 and AS4.**
    a. Router 3c learns about prefix x from which routing protocol: OSPF, RIP, eBGP, or iBGP?
    b. Router 3a learns about x from which routing protocol?
    c. Router 1c learns about x from which routing protocol?
    d. Router 1d learns about x from which routing protocol?



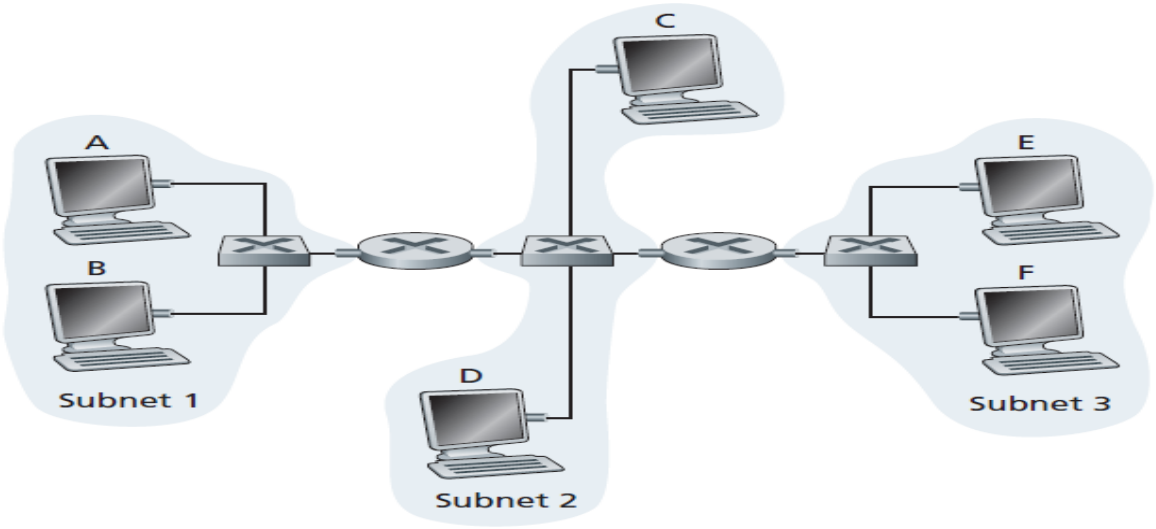
12. **What are some of the possible services that a link-layer protocol can offer to the network layer? Which of these link-layer services have corresponding services in IP? In TCP?**

13. **How big is the MAC address space? The IPv4 address space? The IPv6 address space?**

14. **Suppose nodes A, B, and C each attach to the same broadcast LAN (through their adapters). If A sends thousands of IP datagrams to B with each encapsulating frame addressed to the MAC address of B, will C's adapter process these frames? If so, will C's adapter pass the IP datagrams in these frames to the network layer C? How would your answers change if A sends frames with the MAC broadcast address?**

15. **Why is an ARP query sent within a broadcast frame? Why is an ARP response sent within a frame with a specific destination MAC address?**

16. **Consider three LANs interconnected by two routers, as shown below:**
    a. Assign IP addresses to all of the interfaces. For Subnet 1 use addresses of the form 192.168.1.xxx; for Subnet 2 uses addresses of the form 192.168.2.xxx; and for Subnet 3 use addresses of the form 192.168.3.xxx.
    b. Assign MAC addresses to all of the adapters.
    c. Consider sending an IP datagram from Host E to Host B. Suppose all of the ARP tables are up to date. Enumerate all the steps, as done for the single-router example in Section 6.4.1.
    d. Repeat (c), now assuming that the ARP table in the sending host is empty (and the other tables are up to date).



17. **In this problem, you will put together much of what you have learned about Internet protocols. Suppose you walk into a room, connect to Ethernet, and want to download a Web page. What are all the protocol steps that take place, starting from powering on your PC to getting the Web page? Assume there is nothing in our DNS or browser caches when you power on your PC.**
    (Hint: The steps include the use of Ethernet, DHCP, ARP, DNS, TCP, and HTTP protocols.) Explicitly indicate in your steps how you obtain the IP and MAC addresses of a gateway router.