# Chapter 1

R1, R3-5, R7-8, R11-16, R18-20, R22-23, R25-27; P3-4, P6-7, P9, P12, P16, P24, P31 DONE

R1. What is the difference between a host and an end system? List several different types of end systems. Is a Web server an end system?

A: There is no difference. “end system” includes computer, smartphone, tablet, Web sever and all Internet-connected things. Web sever is an end system.

R3. Why are standards important for protocols?

A: Standards are important for protocols so that people can create networking systems

and products that interoperate.

R4. List four access technologies. Classify each one as home access, enterprise access, or wide-area wireless access.

A:

R5. Is HFC transmission rate dedicated or shared among users? Are collisions possible in a downstream HFC channel? Why or why not?

A: Hybrid Fiber Coaxial bandwidth is share among users. Collisions will not happen in downstream HFC channel, because there is only one head end.

# Chapter 6

R2-3, R6, R8-12, R15; P1-2, P5-6, P8, P15-17, P26 Done

R2. If all the links in the Internet were to provide reliable delivery service, would the TCP reliable delivery service be redundant? Why or why not?

A: Although each link guarantees that an IP datagram sent over the link will be received at the other end of the link without errors, it is not guaranteed that IP datagrams will arrive at the ultimate destination in the proper order. With IP, datagrams in the same TCP connection can take different routes in the network, and therefore arrive out of order. TCP is still needed to provide the receiving end of the application the byte stream in the correct order. Also, IP can lose packets due to routing loops or equipment failures.

R3. 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?

A: Framing: there is also framing in IP and TCP; link access; reliable delivery: there is also reliable delivery in TCP; flow control: there is also flow control in TCP; error detection: there is also error detection in IP and TCP; error correction; full duplex: TCP is also full duplex.

# Chapter 4

8th edition: R1-5, R17-18, R20-21, R24-31; P1, P8-11, P13-15, P19 DONE

R1. Let’s review some of the terminology used in this textbook. Recall that the name of a transport-layer packet is segment and that the name of a link-layer packet is frame. What is the name of a network-layer packet? Recall that both routers and link-layer switches are called packet switches. What is the fundamental difference between a router and link-layer switch?

A: datagram; link-layer switch works on link layer, router works on network layer.

R2. We noted that network layer functionality can be broadly divided into **data plane functionality** and **control plane functionality**. What are the main functions of the data plane? Of the control plane?

A: Data plane functionality: determining how a datagram arriving a router’s input link is forwarded to one of this router’s output link.

Control plane functionality: determining how a datagram is routed among routers along an end2end path.

R3. We made a distinction between the forwarding function and the routing function performed in the network layer. What are the key differences between routing and forwarding?

A: Forwarding function focus on the router-local action of transferring datagram from an input link interface to an appropriate output link interface. Routing function focus on network-wide process that determines the end2end path a packet should take from source to destination.

R4. What is the role of the forwarding table within a router?

A: It is a map, indicating the outgoing link interface to which a packet is to be forwarded.

R5. We said that a network layer’s service model “defines the characteristics of end-to-end transport of packets between sending and receiving hosts.” What is the service model of the Internet’s network layer? What guarantees are made by the Internet’s service model regarding the host-to-host delivery of datagrams?

A: Best-effort service. No guarantees.

R17. Suppose Host A sends Host B a TCP segment encapsulated in an IP datagram. When Host B receives the datagram, how does the network layer in Host B know it should pass the segment (that is, the payload of the datagram) to TCP rather than to UDP or to some other upper-layer protocol?

A: The upper-layer protocol field in IP header indicates the transport protocol to which the segment is passed.

R18. What field in the IP header can be used to ensure that a packet is forwarded through no more than N routers?

A: Time-to-live

R19. Recall that we saw the Internet checksum

A: Section 3.3

R20. When a large datagram is fragmented into multiple smaller datagrams, where are these smaller datagrams reassembled into a single larger datagram?

A: identifier, flags and fragmentation offset field.

R24. Suppose there are three routers between a source host and a destination host. Ignoring fragmentation, an IP datagram sent from the source host to the destination host will travel over how many interfaces? How many forwarding tables will be indexed to move the datagram from the source to the destination?

A: 8 interfaces; 3 forwarding table.

R25. Suppose an application generates chunks of 40 bytes of data every 20 msec, and each chunk gets encapsulated in a TCP segment and then an IP datagram. What percentage of each datagram will be overhead, and what percentage will be application data?

A: IP header 20 bytes, TCP header 20 bytes.

Percentage of application data in TCP segments = 40/60 = 66.7%

Percentage of application data in IP datagrams = 40/80 = 50%

R26. Suppose you purchase a wireless router and connect it to your cable modem. Also suppose that your ISP dynamically assigns your connected device (that is, your wireless router) one IP address. Also suppose that you have five PCs at home that use 802.11 to wirelessly connect to your wireless router. How are IP addresses assigned to the five PCs? Does the wireless router use NAT? Why or why not?

A:

R27. What is meant by the term “route aggregation”? Why is it useful for a router to perform route aggregation?

A: The ability to use a single prefix to advertise multiple networks

R28. What is meant by a “plug-and-play” or “zeroconf” protocol?

A:

R29. What is a private network address? Should a datagram with a private network address ever be present in the larger public Internet? Explain.

A: A private network addresses only have meaning to devices within the network. A datagram with a private network address will never be present in a larger public Internet because there are hundreds of thousands of networks using this block of addresses. Packets forwarded beyond the network will use the IP address of outside link interface.

R30. Compare and contrast the IPv4 and the IPv6 header fields. Do they have any fields in common?

A:

R31. It has been said that when IPv6 tunnels through IPv4 routers, IPv6 treats the IPv4 tunnels as link-layer protocols. Do you agree with this statement? Why or why not?

A:

# Chapter 5

Same for 7th and 8th edition: Chap5: R4-6, R8; P3, P5 DONE

R4. Compare and contrast link-state and distance-vector routing algorithms.

A: Link state algorithms: Computes the least-cost path between source and destination using complete, global knowledge about the network. Distance-vector routing: The calculation of the least-cost path is carried out in an iterative, distributed manner. A node only knows the neighbor to which it should forward a packet in order to reach given destination along the least-cost path, and the cost of that path from itself to the destination.

R5. What is the “count to infinity” problem in distance vector routing?

A: The problem means that it takes a long time for a distance vector routing algorithm to converge when there is a link cost increase. The cost will eventually be calculated to infinite.

R6. Is it necessary that every autonomous system use the same intra-AS routing algorithm?

Why or why not?

A: It’s not necessary.

R8. True or false: When an OSPF route sends its link state information, it is sent only to those

nodes directly attached neighbors. Explain.

A: False. OSPF is link-state routing, each router will floods advertisements to all other nodes in the AS.