**Chapter: 17 Questions**

**Q17-1.**How is a repeater different from an amplifier?

Ans: An amplifier amplifies the signal (*even the noise that comes with the signal*) whereas the repeater regenerate the signal, bit for bit, at the original strength.

**Q17-2.**What do we mean when we say that a switch can filter traffic? Why is filtering   
important?

Ans: Bridges have access to station physical address and can forward the packet to appropriate segment of the network which help control congestion and this is how they filter traffic.

**Q17-3.**What is a transparent switch?

Ans: A transparent switch is the transparent bridge in which the stations are completely unaware of the bridge’s existence. Reconfiguration is not necessary if the switch is added or deleted from the system.

**Q17-4.**How is a hub related to a repeater?

Ans: Multi port repeater is a hub.

**Q17-5.**What is the difference between a forwarding port and a blocking port?

Ans: The forwarding port forwards the frame it receives and the blocking port does not do the same.

**Q17-6.**How does a VLAN save a company time and money?

Ans: Reconfiguration of the system is done by software but not physically and this saves time and money.

**Q17-7.**How does a VLAN provide extra security for a network?

Ans: Members of a VLAN can send broadcast messages with the assurance that the users of the other groups don't receive these messages.

**Q17-8.**How does a VLAN reduce network traffic?

Ans: A VLAN creates a virtual workgroups in which each member can send broadcast messages to other members in the workgroup which eliminates the need for multicasting and the related overhead messages.

**Q17-9.**What is the basis for membership in a VLAN?

Ans: Membership in a VLAN can be based on Port Numbers, MAC Addresses, IP Addresses, IP Multicast Addresses or a combination of any of these characteristics.

**Q17-10.**What do we mean when we say that a link-layer switch can filter traffic? Why   
is filtering important?

Ans: A link-layer switch have access to station link-layer addresses and can forward a packet to the appropriate segment of the network. In this way, they filter traffic and help reducing traffic.

**Q17-11.**Which one has more overhead, a switch or a router? Explain your answer.

Ans: A router has more overhead than a switch.

a)  A router process the packet at three layers; a switch processes a frame at only two   
layers.

b)  A router needs to search a routing table for finding the output port based on the best route to the final destination; A switch needs only to consult a filtering table based on the location of stations in a local network.

c) A routing table is normally longer than a filtering table; searching a routing table needs more time than searching a filtering table.

d) A router changes the link-layer addresses; a switch does not.

**Q17-12.**Which one has more overhead, a hub or a switch? Explain your answer.

Ans: A switch has more overhead than a repeater.

a)  A switch processes the frame at two layers; a repeater processes a frame at only one layer.

b)  A switch needs to search a table and find the forwarding port as well as to regenerate the signal; a repeater only regenerates the signal. In other words, a switch is also a repeater (and more); a repeater is not a switch.

**Chapter: 18 Questions**

**Q18-1.**Why does the network-layer protocol need to provide packetizing service to the transport layer? Why can’t the transport layer send out the segments with- out encapsulating them in datagrams?

Ans: The transport layer communication is between two ports. The network layer communication is between two hosts. This means that each layer has a different source/destination address pair. Each layer needs a different header to accommodate these pair of addresses. In addition, there are other pieces of information that need to be separately added to the corresponding header.

**Q18-2.**Why is routing the responsibility of the network layer? In other words, why can’t the routing be done at the transport layer or the data-link layer?

Ans: Routing cannot to be done at transport layer because the communication at transport layer is one single logical path between the source port and the destination port. Routing cannot be done at Data-link layer because the communication at the data-link layer is between two nodes (one single path); there is no need for routing. On the other hand, there are several possible paths for a packet between the source host and destination host at the network layer. Routing is the job for selecting one of these path for the packet.

**Q18-3.**Distinguish between the process of routing a packet from the source to the destination and the process of forwarding a packet at each router.

Ans: Forwarding is delivery to the next node. A router uses its forwarding table to send a packet out of one of its interfaces and to make it to reach to the next node. In other words, forwarding is the decision a router makes to send a packet out of one of its interfaces. Routing, on the other hand, is an end-to-end delivery resulting in a path from the source to the destination for each packet. This means a routing process is a series of forwarding processes. To enable each router to perform its forwarding duty, routing protocols need to be running all of the time to provide updated information for forwarding tables. Although forwarding is something we can see in the foreground, in the background, routing provides help to the routers to do forwarding.

**Q18-4.**What is the piece of information in a packet upon which the forwarding deci- sion is made in each of the following approaches to switching?   
**a.** datagram approach **b.** virtual-circuit approach

Ans: In the datagram approach, the forwarding decision is based upon the destination address in the packet header. Whereas in the Virtual Circuit Approach, the forwarding decision is based on the label of the packet header.

**Q18-5.**If a label in a connection-oriented service is 8 bits, how many virtual circuits   
can be established at the same time?

Ans: Here n=8. An n bit can create 2n different virtual circuit identifier. So 2\*8 = 16.

**Q18-6.**List the three phases in the virtual-circuit approach to switching.

Ans: Set up Phase, Data transfer and Tear Down Phase.

**Q18-7.**Do we have any of the following services at the network layer of TCP/IP? If not, why?   
**a.** flow control **b.** error control **c.** congestion control

Ans: None of these services are implemented for the IP protocol in order to make it simple.

**Q18-8.**List four types of delays in a packet-switched network.

Ans: Transmission Delay, Propagation Delay, Processing Delay and the Queuing Delay.

**Q18-9.**In Figure 18.10, assume that the link between R1 and R2 is upgraded to 170 kbps and the link between the source host and R1 is now downgraded to 140 kbps. What is the throughput between the source and destination after these changes? Which link is the bottleneck now?

Ans: 140 kbps (smallest transmission rate) is throughput. Link between source host and the R1 is the bottleneck.

**Q18-10.**In classless addressing, we know the first and the last address in the block. Can we find the prefix length? If the answer is yes, show the process.

Ans: If the first and the last address are known then the block is fully defined. First we can find the number of addresses in the block (N) and then find the prefix length (n).

N = (last address) - (first address) + 1

n = 32 - log2N

Block = (first address)/n

**Q18-11.**In classless addressing, we know the first address and the number of addresses in the block. Can we find the prefix length? If the answer is yes, show the process.

Ans: The first address and the number of addresses in the block defines a unique block. We can easily define the last address using the relation N=232 - n ; n=32 - log2N. Block = (first address)/n. For example: If we know the first address say 17.24.12.64 and the number of addresses in the block are 32. We know the last address is 17.24.12.95. So the prefix length is also n=32 - log2(32) = 27 which will give us 17.24.12.64/27.

**Q18-12.** In classless addressing, can two different blocks have the same prefix length? Explain.

Ans: Yes, in classless addressing, two different blocks can have the same prefix length. The prefix length only determines the number of addresses in the block but not the block itself. Two blocks can have same prefix length but the start but starting with two different point in address space. Suppose we have two blocks say 127.15.12.32/27 and 174.18.19.64/27. The length of the blocks are same but the blocks are different.

**Chapter 18 Problems**

**P18-1.**What is the size of the address space in each of the following systems?

Solution: The size of the address is the base to the power of number of digits.

1. A system in which each address is only 16 bits = 216 = 65536.
2. A system in which each address is made of six hexadecimal digits = 166 = 16,777,216
3. A system in which each address is made of four octal digits = 84 = 4096.

**P18-2.**Rewrite the following IP addresses using binary notation:

**a.** 110.11.5.88 = 01101110 00001011 00000101 01011000

**b.** 12.74.16.18 = 00001100 01001010 00010000 00010010

**c.** 201.24.44.32 = 11001001 00011000 00101100 00100000

**P18-3.**Rewrite the following IP addresses using dotted-decimal notation:

1. **01011110 10110000 01110101 00010101 = 94.176.117.21**
2. **10001001 10001110 11010000 00110001 = 137.142.208.49**
3. **01010111 10000100 00110111 00001111 = 87.132.55.15**

**P18-4.**Find the class of the following class full IP addresses:

1. 130.34.54.12 = Class B (first byte is between 128 and 191)
2. 200.34.2.1 = Class C (first byte is between 192 and 223)
3. 245.34.2.8 = Class E (first byte is between 240 and 255)

**P18-5.**Find the class of the following class full IP addresses:

1. **01110111 11110011 10000111 11011101 = Class A (first bit is 0)**
2. **11101111 11000000 11110000 00011101 = Class D (first four bits are 1110)**
3. **11011111 10110000 00011111 01011101 = Class C (first three bits are 110)**

**P18-6.**In classless addressing, show the whole address space as a single block using the CIDR notation.

Solution: The whole block can be represented as 0.0.0.0/0. The first address in the class is 0.0.0.0. The prefix is 0 because no bits define the block but the address itself. Another test to prove that the prefix is 0 is that the number of addresses in the block can be found as 232-n. The value of n should be 0 in order to make the number of addresses N = 232.

**P18-7.**In classless addressing, what is the size of the block (*N*) if the value of the pre- fix length (*n*) is one of the following?

Solution: The size of the block can be found as 232- n. So

1. *n*=0 ; 232- 0 = 4,294,967,296
2. *n*=14 ; 232 - 14 = 262,144
3. *n*=32 ; 232 - 32 = 1

**P18-8.**In classless addressing, what is the value of the prefix length (*n*) if the size of   
the block (*N*) is one of the following?

Solution: The prefix can be found as 32 - log2N. So

1. *N*=1 ; 32 - log2(1) = 32.
2. *N*=1024 ; 32 - log2(1024) = 22.
3. *N*= 232 32 - log2(232) = 0.

**P18-9.**Change each of the following prefix lengths to a mask in dotted-decimal   
notation:

Solution: To convert IP address in binary format to decimal format, dotted decimal notation is used. With which 32 bit binary address is divided into 4 bits chunks. Each known as Octet with 8 bits. Now

1. *n*=0 ; First write the prefix and then convert the 8 bit chunk to decimal.

00000000 00000000 00000000 00000000

Dotted Decimal notation after masking is 0.0.0.0

1. *n*=14 ; Add fourteen 1’s starting from msg bit (from left) and the remaining bit with 0’s to make it length of 32. Divide the 32 bit into 4 parts each of 8 bit chunk and then convert it into decimal.

11111111 11111100 00000000 00000000

Dotted Decimal notation after masking is 255.252.0.0

1. *n*=30 ; Add thirty 1’s starting from msg bit (from left) and the remaining bit with 0’s to make it length of 32. Divide the 32 bit into 4 parts each of 8 bit chunk and then convert it into decimal.

11111111 11111111 11111111 11111100

Dotted Decimal notation after masking is 255.255.255.252

**P18-10.** Change each of the following masks to a prefix length:

Solution: We first write the ask in binary notation and then out the number of leftmost 1’s.

1. 255.224.0.0 = 11111111 11100000 00000000 00000000 ; n = 11.
2. 255.240.0.0 = 11111111 11110000 00000000 00000000 ; n = 12.
3. 255.255.255.128 = 11111111 11111111 11111111 10000000 ; n = 25.

**P18-11.** Which of the following cannot be a mask in CIDR?

Solution: We first write each mask in binary notation and then check if it has a contiguous number of 1’s from the left followed by 0’s. So

1. 255.225.0.0 = 11111111 11100001 00000000 00000000 = Not a mask.
2. 255.192.0.0 = 11111111 11000000 00000000 00000000 = A Mask.
3. 255.255.255.6 = 11111111 11111111 11111111 00000110 = Not a mask.

**P18-12.**Each of the following addresses belongs to a block. Find the first and the last address in each block.

Solution: We can write the address in binary and then set the last 32 - n bits to 0’s to get the first address. And set the last 32 - n bits to 1’s to get the last address.

1. 14.12.72.8/24

Given: 00001110 00001100 01001000 00001000 = 14.12.72.8/24

First: 00001110 00001100 01001000 00000000 = 14.12.72.0/24

Last: 00001110 00001100 01001000 11111111 = 14.12.72.255/24

1. 200.107.16.17/18

Given: 11001000 01101011 00010000 00010001 = 200.107.16.17/18

First: 11001000 01101011 00000000 00000000 = 200.107.0.0/18

Last: 11001000 01101011 00111111 11111111 = 200.107.63.255/18

1. 70.110.19.17/16

Given: 01000110 01101110 00010011 00010001 = 70.110.19.17/16

First: 01000110 01101110 00000000 00000000 = 70.110.0.0/16

Last: 01000110 01101110 11111111 11111111 = 70.110.255.255/16

**P18-13.**Show the *n* leftmost bits of the following network-addresses/masks that can be used in a forwarding table.

Solution: We write the address in binary and keep only the leftmost n bits.

1. 170.40.11.0/24 = 10101010 00101000 00001011
2. 110.40.240.0/22 = 01101110 00101000 111100
3. 70.14.0.0/18 = 01000110 00001110 00