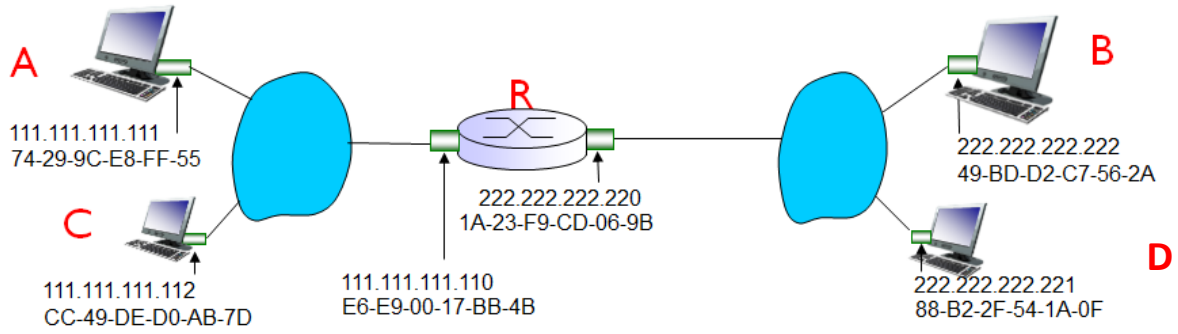
Homework 10 A B D E

Name_____

1. **Direct and Indirect Delivery**

The network below shows three hosts A, B and C along with their IP and MAC addresses. Router R connects the two networks over 2 interfaces.



a. Write Direct Delivery or Indirect Delivery for the following transfers:
A→B: A→C:

b. Let's investigate the fields in the data frame for a transfer from A to C. List the destination MAC address, source MAC address, source IP and destination IP (in this order):

c. Now let's look at a transfer from A to B. This transfer must go through the router R, so there will be one link layer header encapsulating the packet when it goes from A to router R, and then a second link layer header when Router R sends it out to host B.

What is the source IP address and destination IP address?

For the transfer from A to router R, draw the link layer frame showing SRC/DST IP and SRC/DST MAC addresses (refer to lecture 27, last slide)

For the transfer from router R to destination B, what is the destination MAC address and the source MAC address?

Think over this transfer from A to B. Do the source and destination IP addresses ever change?

d. Briefly, what is the purpose of ARP?

e. If this system is just started up, at what points in the transfer of a packet from A to B could ARP be used?

f. Where does IP Forwarding happen in this example?

2. **Roles of the CPU and NIC**

In class we have discussed the roles of the CPU and the NIC for sending and receiving packets on an Ethernet LAN. Please answer the following two questions concerning this interaction.

The CPU has a packet to send. What does it do? What does the NIC do?

The CPU tells the NIC to get any packets transmitted to it. What does the NIC do?

3. **Link Layer Principles**
    a. What is the purpose of the link layer?

    b. What are some of the different types of communication links we have discussed?

    c. What is a shared medium?

    d. How does a host using the Aloha protocol decide to access the channel?

    e. What change does CSMA make for hosts to decide to access the channel?

    f. Why do hosts on Class Ethernet not immediately hear all transmissions?

4. Think about a broadcast link, such as classic Ethernet or wireless. Convince yourself that a MAC address is needed by describing what the Network Interface Controller (NIC) does to decide whether or not it should accept a packet (it hears all the packets). Draw yourself a picture.

5. Read the Wiki article listed in the Weekly Reading. Draw the pictures of the original Ethernet implementation and the modern Ethernet implementation (article has both pictures under the heading "Comparison… ". Highlight the communication links in the two pictures where there can be data collisions.

6. CSMA/CD Exponential Backoff (we will do this in class on Wednesday)

We discussed in class the that CSMA/CD has three states. If you don't remember, refer to the Figure 4.5 on page 269 of the online Tannenbaum book OR in the class notes.

a. What does the CD part in CSMA/CD mean?

b. Name and describe each of the 3 states in CSMA/CD

c. Give a brief description of the Exponential Backoff algorithm:

After a collision, the contention period is divided into slots. Stations randomly choose a slot for the time to back off from transmission. Slot 0 means transmit again immediately.

d. After one collision, how many slots are there to choose from?

e. After two collisions...

f. After five collisions....

g. Think about the fact that hosts on Ethernet are able to "hear" collisions. However, they do not "hear" immediately… what is the time delay called in which the bits are present on the wire, but have not yet reached their destination?

h. The fact that hosts on Ethernet have the ability to hear every transmission is very significant. With wireless networks we see that even after the propagation delay, nodes might not hear transmissions from other stations. What is that problem called?

7. CSMA-CA (Wednesday)

a. What does CSMA/CA stand for?

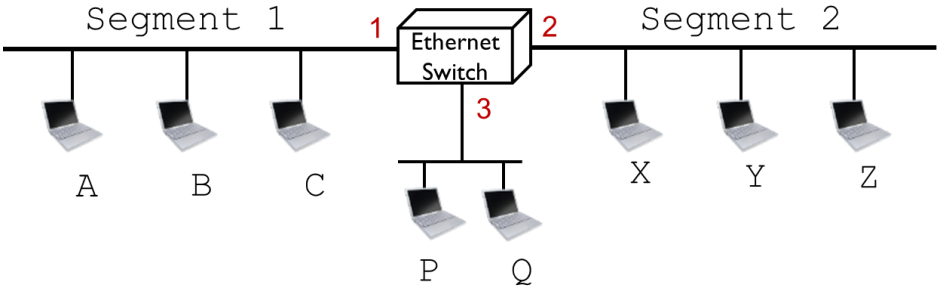
b. Why can't wireless stations use CSMA/CD?

c. What is the hidden terminal problem?

d. How do we solve the hidden terminal problem?

8. Ethernet Switch (Learning) --Friday

Below is an Ethernet switch connecting Classic Ethernet segments 1, 2 and 3 of a small LAN. The column "Event" of first table lists packets that are sent on the LAN after startup. After each of these packets is sent, list which MAC addresses the switch knows are reachable on an interface, as well as which segments hear the transmission. Initially, the Switch Table is empty so it is not shown.



		What does the Switch know?		
Event	**Which Segments see the packet?**	**Computers on Interface 1**	**Computer on Interface 2**	**Computer on Interface 3**
Switch powers on	**None**	**None**	**None**	**None**
A → B				
B → A				
X broadcasts				
Y → A				
Y → X				
X → Z				
Z → X				
P broadcasts				
Q → P				

After the above transfer of packets, fill in the Switch table:

Switch Table	
Destination	**Interface**
A	
B	
C	
X	
Y	
Z	
P	
Q	