1.

**If two hosts on the same LAN share the same hardware address, the switch cannot accurately forward frames from the correct host. As each host sends frames, the switch's forwarding table flips back and forth, which can cause packets to be forwarded incorrectly, or completely dropped. For example, if host1 and host2 share the same address, packets for host1 could end up at host2, which has no knowledge of what this packet is or why it is at host2. This is inaccurate and causes failure.**

2.

**A switch connects devices within a network, and forwards based on MAC addresses. A router connects networks to networks, and forwards based on IP address.**

3. Consider the following network. IP and Ethernet addresses are marked for all interfaces. Assume a client on host A sends a TCP connection request message to a web server on host B. Show all the headers in the packet on link 1 and on link 2, assuming the addressing indicated on the figure. Include IP source and destination addresses, Ethernet source and destination addresses, and TCP source and destination port numbers. Use port numbers that make sense for the given application. Be sure to organize the headers in the proper layered order and label them.

**Link 1**

**Ethernet header**

Src MAC address : 43:00:08:A6:B1:13

Dst MAC address : 34:7E:09:A0:12:01

Type: 0x0800, IP

**IP header**

Src IP : 128.111.41.23

Dst IP : 128.111.52.112

Protocol: 6, TCP

**TCP header**

Src port: 50010, any temporary port

Dst port: 80

Flags: syn

**Link 2**

**Ethernet header**

Src MAC address : 0A:09:56:44:BE:CD

Dst MAC address : 45:32:C9:BD:F9:03

Type: 0x0800, IP

**IP header**

Src IP : 128.111.41.23

Dst IP : 128.111.52.112

Protocol: 6, TCP

**TCP header**

Src port: 50010, any temporary port

Dst port: 80

Flags: syn

4. a

**Host A : 128.111.41.1**
**Host B: 128.111.41.2**
**Host C: 128.111.42.1**
**Host D 128.111.42.2**
**Host E: 128.111.43.1**
**Host F: 128.111.43.2**

b)

**Host A: 00-00-00-00-00-01**
**Host B: 00-00-00-00-00-02**
**Host C: 00-00-00-00-00-03**
**Host D: 00-00-00-00-00-04**
**Host E: 00-00-00-00-00-05**
**Host F: 00-00-00-00-00-06**
**Router 1 left interface: 00-00-00-00-00-R1**
**Router 1 bottom interface: 00-00-00-00-00-R2**
**Router 2 top interface: 00-00-00-00-00-R3**
**Router 2 right interface: 00-00-00-00-00-R4**

c)

**Host a creates an IP datagram with source IP 128.111.41.1 and destination IP 128.111.43.1. Since the destination is not on subnet 1, A forwards the packet to its default router R1. A already knows R1's MAC address so it sends an Ethernet frame with A's MAC as the source and R1's subnet MAC as the destination. R1 receives the frame and removes the Ethernet header and then checks the destination IP. Its routing table shows that the next hop towards 128.111.43.1 is router 2 R2 on subnet 2 so R1 sends a new Ethernet frame on subnet 2 with R1's subnet 2 MAC as the source and R2's subnet 2 MAC as the destination. R2 receives the frame and strips the ethernet header and sees that the final destination is on subnet 3. Then, it forwards the datagram onto that subnet. R2 then sends a frame on subnet 3 with its own MAC as the source and E's MAC as the destination. Host E finally receives the frame and delivers the IP datagram up the stack.**

d)

**If A's ARP table is empty, the only difference is the first step. A still needs to send the packet to its default router R1, but since it does not know R1's MAC address, it first broadcasts an ARP request asking "who has 128.111.41.1?" R1 responds with its MAC address and A stores this entry in its ARP table. After that, A sends the Ethernet frame to R1 just like in part c. All remaining steps are the same as part c.**

5.

a)

**Source MAC: 72-9E-4A-31-9C-42**

**Destination MAC: 4C-9D-AA–74-D6-1F**

b)

**Source IP: 128.119.97.18, host A**

**Destination IP: 128.119.240.52 host C**

c)

**Source MAC: D5-A0-EE-9A-73-D5, host D**

**Destination MAC: 72-9E-4A-31-9C-42**

d)

**Source IP: 128.119.240.116, host D**

**Destination IP: 128.119.50.107, host B**

6.

a) What is the first entry added to the table? **A on interface 1**

b) What is the second entry added to the table?  **A' on interface 4**

c) What is the third entry added to the table? **B on interface 2**

d) What is the fourth entry added to the table? **B' on interface 5**