CS 176A: Homework #5

Part 1: Problems: (30 points total)

Complete the problems on the attached handout. *Answer each question (not sub-question) on a fresh page. Convert your document into a PDF and upload on Gradescope under HW5. When you do this identify where each question AND sub-question is (follow the Gradescope prompts on this).*

Part 2: Programming Assignment (70 points total)

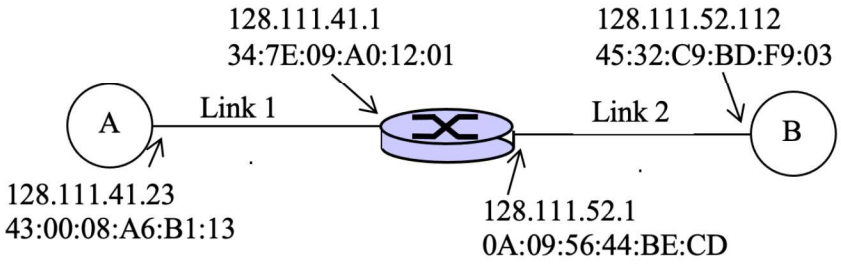
Complete the Programming Assignment on the attached handout. Turn in your code using the "Homework 5 Programming Assignment" Gradescope link. PLEASE pay attention to the turn-in requirements at the end of the assignment. Also, all code must be operational on **Gradescope**. Please ensure that you pass all the tests on **Gradescope** before turning in the assignment.

Homework 5 Problems

1. What kinds of problems can arise when two hosts on the same LAN share the same hardware address? Using a specific example, describe what happens and why that behavior is a problem.

2. In your own words, describe the difference between a switch and a router.

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.



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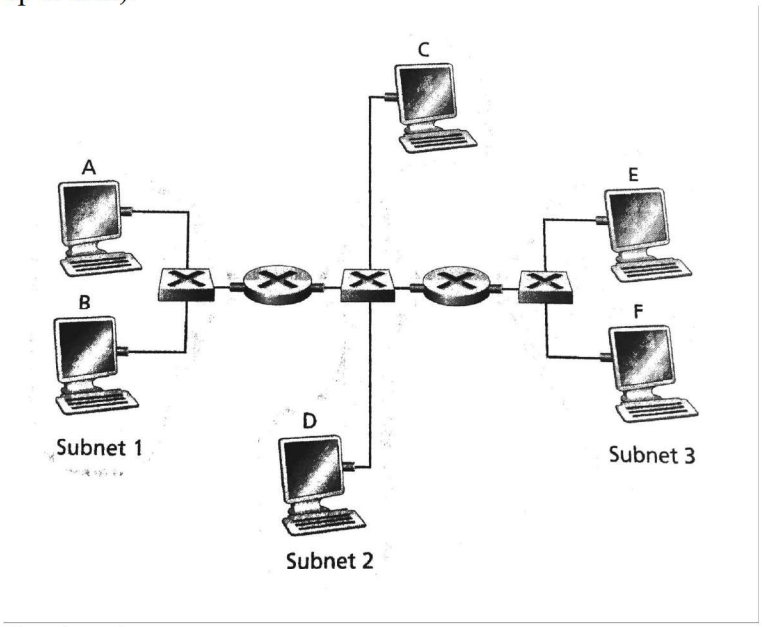
4. Consider 3 LANs interconnected by two routers as in the figure below.
a) Assign IP addresses to all of the interfaces. For subnet 1 (nodes A and B) use addresses of the form 128.111.41.xxx; for subnet 2 (nodes C and D) use addresses of the form 128.111.42.xxx; and for subnet 3 (nodes E and F) use addresses of the form 128.111.43.xxx.
b) Assign MAC addresses to all the adapters.
c) Consider sending an IP datagram from host A to host E. Suppose all of the ARP tables are up to date. Enumerate all the steps, as done in the book for the single-router example in section 6.4.1.
d) Repeat (c) assuming that the ARP table in the sending host is empty (and the other tables are up to date).



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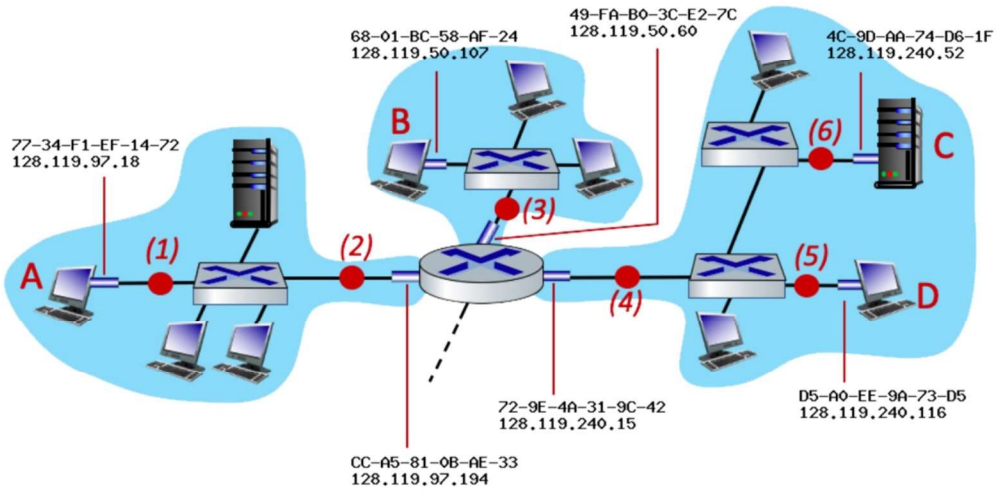
5. Consider the network shown below. The IP and MAC addresses are shown for hosts A, B, C and D, as well as for the router's interfaces. Consider an IP datagram being sent from node A to node C.



a) What is the source and destination MAC address on the frame at point (4)?

b) What is the source and destination IP address of the datagram at point (4)?

Now consider an IP datagram being sent from node D to node B.

c) What is the source and destination MAC address on the frame at point (5)?

d) What is the source and destination IP address of the datagram at point (5)?

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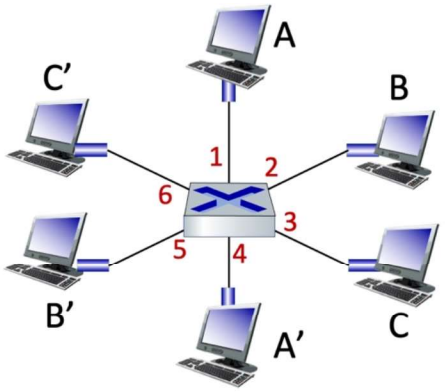
6. Consider the network below with six nodes, star-connected into an Ethernet switch. Suppose that A sends a frame to A', A' replies to A, then B sends a message to B' and B' replies to B. Enter the values (node identifier and interface) that are present in the switch's forwarding table after B'-to-B frame is sent and received. Assume that the table is initially empty and that entries are added to the table sequentially.



a) What is the first entry added to the table?

b) What is the second entry added to the table?

c) What is the third entry added to the table?

d) What is the fourth entry added to the table?