CS 372 – Intro to Networks – Benjamin Brewster, adapted from Kurose & Ross

Problems 5 – Chapter 5 (Book Required)

QUESTIONS

1. Re-read the analogy about transportation in section 5.1.1 of our book. If the passenger is analogous to a datagram, what might be analogous to a link layer frame?

2. Imagine that every single link in the Internet was able to provide completely reliable service between nodes. Would TCP's reliable data transmission guarantees still be useful? Would they be redundant? Why or why not?

3. Review and list some the possible services that a link-layer protocol can offer to the network layer. These can be found in sections 5.1 and 5.2 of our book. Which of these link-layer services have similar services in IP? Which of these link-layer services have similar services in TCP?

4. Imagine a LAN with a very large token-ring deployment (i.e. the perimeter is very large). Would this be an inefficient method of managing the link layer? Contrast this with an Ethernet deployment in a star configuration, with the same number of nodes.

5. A) How big is the IPv6 address space - i.e. how many addresses are there?

   B) How big is the MAC address space?

   C) How big is the IPv4 address space?

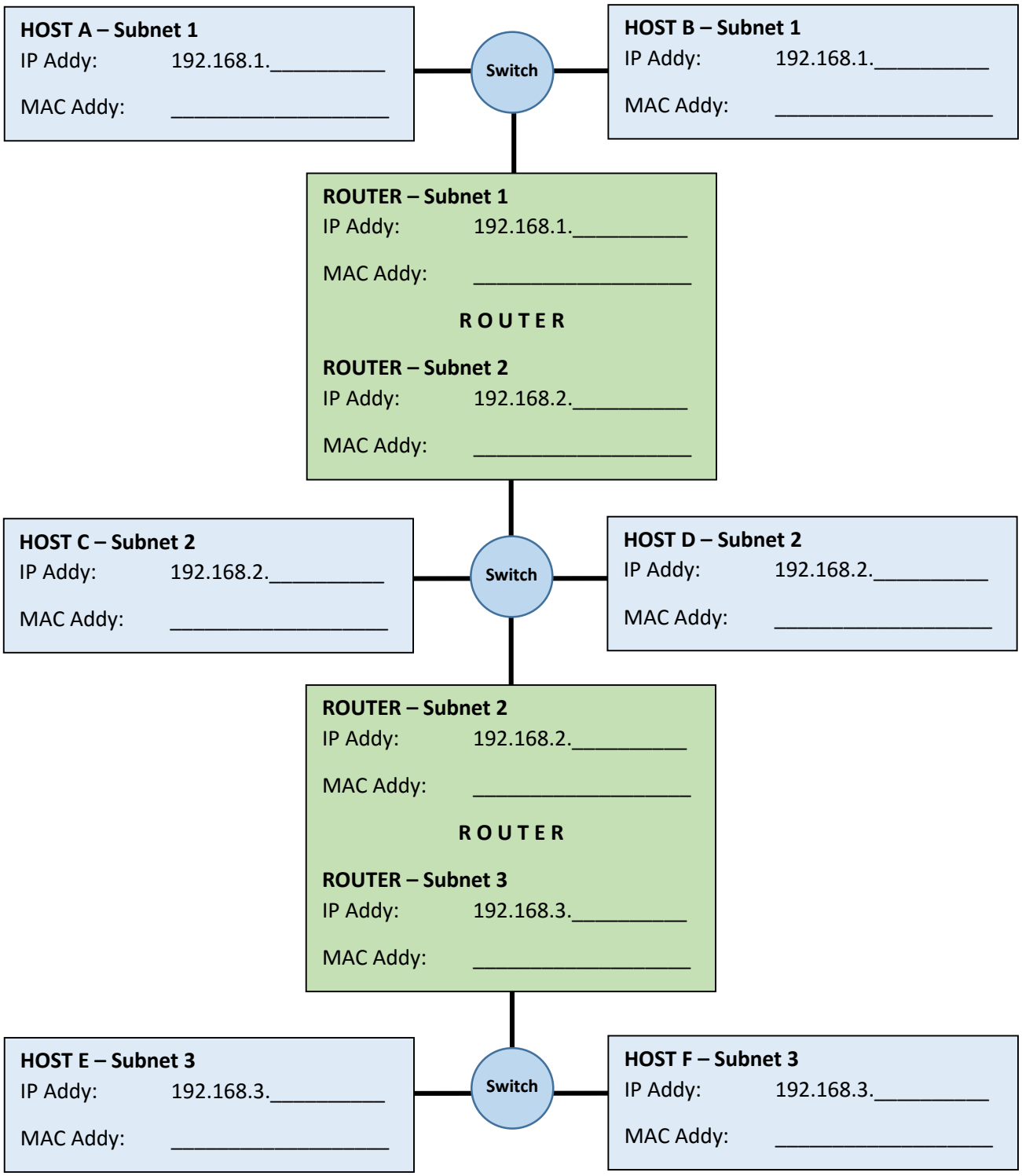
6. For what reason is an ARP request sent within a broadcast frame? How come an ARP response is sent back within a frame to a specific destination MAC address?

7. A) Give an example of a two-dimensional parity check that can detect *and* correct a single bit error. Use figure 5.5 in the book for inspiration, but provide your own example.

   B) Give an example of a double-bit error that can be detected, but *not* corrected.

8. Calculate the value R that a sending link-layer device would use for a CRC EDC field. Use a generator (G) of 10011, and data (D) with a value of 1010101010.

9. A) Examine the following 3-LAN network. Fill in all blanks to assign IP and MAC addresses, as appropriate:



B) Let's say that all ARP tables are up to date. List all of the steps to send an IP datagram from Host E to Host B. Use the example in section 5.4.1 (page 469) as inspiration.

C) Now, let's say that all ARP tables are up to date *except* for the sender, Host E, whose ARP table is empty. List all of the steps to send an IP datagram from Host E to Host B.

10. Consider your graph above in problem 9. Let's say that Host A sends a datagram to Host F. Give the source and destination MAC and IP addresses in the frame surrounding this datagram as the frame gets transmitted:
    a. From Host A to the top-most router:

Source IP Address:	Destination IP Address:
Source MAC Address:	Destination MAC Address:

    b. From the top-most router to the bottom-most router:

Source IP Address:	Destination IP Address:
Source MAC Address:	Destination MAC Address:

    c. From the bottom-most router to Host F:

Source IP Address:	Destination IP Address:
Source MAC Address:	Destination MAC Address:

11. A) Examine the switch in Figure 5.25 on page 483 of your book. Let's say that a router that understands VLANs is connected to port 1 on this switch.

    Choose IP addresses for the 6 unassigned hosts and the router interface below:

    Router IP Addresses (router interface connected to switch):

    Port 1 IP Address (switch interface connected to router): ASSIGNED BY ADMIN
    Port 2 IP Address (switch interface for EE VLAN):
    Port 3 IP Address (switch interface for EE VLAN): UNASSIGNED
    Port 4 IP Address (switch interface for EE VLAN):
    Port 5 IP Address (switch interface for EE VLAN): UNASSIGNED
    Port 6 IP Address (switch interface for EE VLAN): UNASSIGNED
    Port 7 IP Address (switch interface for EE VLAN): UNASSIGNED
    Port 8 IP Address (switch interface for EE VLAN):

    Port 9 IP Address (switch interface for CS VLAN):
    Port 10 IP Address (switch interface for CS VLAN):
    Port 11 IP Address (switch interface for CS VLAN): UNASSIGNED
    Port 12 IP Address (switch interface for CS VLAN): UNASSIGNED
    Port 13 IP Address (switch interface for CS VLAN): UNASSIGNED
    Port 14 IP Address (switch interface for CS VLAN): UNASSIGNED
    Port 15 IP Address (switch interface for CS VLAN):
    Port 16 IP Address: UNASSIGNED

    B) Describe the steps for BOTH the network layer and link layer to transfer an IP datagram from a CS host to an EE host. Include in your comments a section on the VLAN tagging needed.

12. For this Problem, you'll be using much of what you have learned about networking protocols. You'll need to use DHCP, DNS, IP, ARP, TCP, HTTP, and MAC addresses as part of your answer.

    Describe the networking steps needed for a brand-new computer, with empty DNS, ARP, and web browser caches, to connect to an Ethernet for the first time and download a web page from the internet. Be very clear in how you get the IP and MAC addresses of the gateway router, and the IP address of your new computer. Note that this problem is worth 30 points, while the rest of the questions in this assignment are worth 10.

    Please type your answer, or write very clearly.

INSTRUCTIONS

Write up your answers in any way you see fit, including appropriate equations and descriptions. Submit the resulting work as a document upload to Canvas, either scanning your paper work, or producing the work initially on a computer. If you have multiple files, please enclose them in a zip file.

I recommend you work in groups. If you choose to do so, you must still write and turn in your own work.

Please post your questions onto the relevant Canvas Discussion board.

GRADING

Problems 1 through 11 are worth 10 points if correctly answered, and worked out with appropriate equations and descriptions. If an answer to a problem is only partially correct, or is grossly missing supporting work, the grader may instead assign 5 points. Completely wrong or unanswered problems are worth 0 points.

Problem 12 is worth 30 points. If (major) steps are missed, partial credit will be given.

The total available is 140 points for this assignment.