CS485/ECE440: Homework 4

October 23, 2008

General

- This homework is (mostly) about material covered in Chapter 2 and 3 of the text book.
- The answers to this homework are **due October 30, 2008**.
- Submit via e-mail to `riesen@cs.unm.edu` (Mail it before class on the 30th.) Your subject line must say: "Homework 4 Submission" (and **nothing else**).
- Your answers to the questions below must be in a PDF or plain text file attached as file named Homework4.pdf or Homework4.txt according to its format. (Not Hwk4.pdf, and no Microsoft Word or image files, such as jpeg, please.)
- Keep your answers (and programs) succinct.
- Obey the University rules on plagiarism. In particular, do use libraries and the web to find information you need to answer the questions, but do not copy whole answers or programs. Reference your sources. The work you turn in must be *your* work.

Exercise 1: Revisit Exercise 1.25b [30 points]

Graph problem 1.25 in the textbook... In Homework 2 we solved Exercise 1.25b in the textbook. The solution on our web page shows this formula:

$$t = (s+1)d + sq + \left(\frac{n}{p} + s\right)\frac{8 \cdot (p+h)}{b}$$

It calculates the time required to send n bytes across a network with s switches, each adding q seconds to process the packet. The propagation delay is d on each link and the bandwidth is b. The payload size is p bytes and the header is h bytes.

Investigate the following:

(a) Assume the parameters for the variables above are the ones given in Exercise 1.25b in the textbook. I.e., $s = 5$, $q = 1$ms, etc. Vary n between 1 byte and 1 megabyte. Create a graph that shows the time (y-axis) required to transfer a given file size n versus the file size (x-axis).

On the same graph show curves for link bandwidths 1 Mb/s, 4 Mb/s, 10 Mb/s, and 100 Mb/s. In a couple of sentences, describe what we can learn from that graph.

(b) Assume s is any number between 1 and 10. If all other parameters are the same as Exercise 1.25 and the file size n is 1,000 bytes, 10,000 bytes, 100,000 bytes, and 1,000,000 bytes,

graph the time required ((*y*-axis) to transfer each file size across 1 through 10 switches (*x*-axis).

Would you say the number of hops; i.e. number of switches a file has to go through has a big influence on the transfer time? Does the file size matter?

(c) Assume all parameters are the same as in Exercise 1.25. The header size h is fixed at 24 bytes, but the payload size varies and is either 500 bytes, 1,000 bytes, 1,500 bytes, 4,000 bytes, and 9,000 bytes. Graph the following file sizes with time t on the y-axis, and the payload size p on the x-axis: 1,000 bytes, 10,000 bytes, 100,000 bytes, and 1,000,000 bytes.

Exercise 2: Virtual Circuit Tables [15 points]

Do Exercise 3.1 in the textbook with the following events:

(a) Host I connects to host C.

(b) Host D connects to host E.

(c) Host C connects to host G.

(d) Host E connects to host F.

(e) Host C connects to host J.

(f) Host H connects to host F.

Exercise 3: Napster [15 points]

In Chapter 3 the book mentions Napster as an application that changed Internet usage almost over night when it was introduced in 1999. What did Napster do differently than other Internet applications, and how did that impact networking; i.e., what was the new problem? What has been done to alleviate the problem with Napster?

Note that this question refers to the original version of Napster and will require a little research on your part; i.e., the answer cannot be gotten from our textbook alone.

Exercise 4: Shortest Path [15 points]

Consider the network in Figure 1. Each circle in that diagram represents a switch that contains a forwarding table. The numbers beside each link is the cost of that link. Show the forwarding table for each switch such that datagrams get moved to their destination via the lowest-cost path.

Exercise 5: Routers and Switches [10 points]

What is the difference between a LAN switch (bridge) and a router? Name at least two differences. When is a router preferable over a switch?

Exercise 6: Learning Bridges [15 points]

Consider Figure 2. V, W, X, Y, and Z are hosts, and B1, B2, B3, and B4 are learning bridges. Answer the following questions:

(a) Which bridges learn where Y is, if it sends a packet to W?

(b) Does V's network interface see this packet?

(c) When W responds and sends a packet back to Y, which bridges learn where W is?

(d) Does V's network interface see the reply packet?

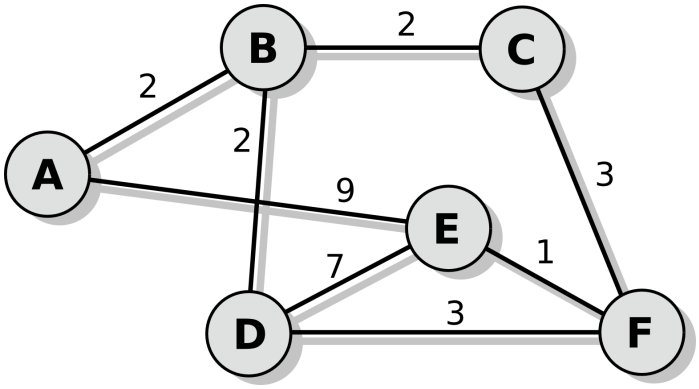

Figure 1: A network for exercise 4.

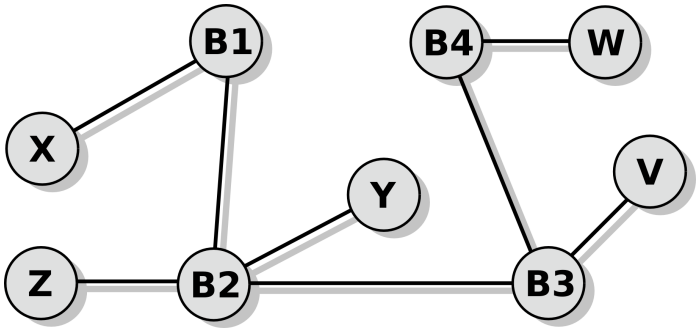

Figure 2: A network for exercise 6.

(e) After a message from X to W, Z sends a packet to W. Does Y's network interface see the second packet?

For each question briefly explain your answer (a single sentence for each is probably enough).