CMSC 417 - Section 2, Fall 2014
Homework 1
Due: Oct 15, 2014 Wed, 9:00 am

1. Consider a point-to-point link of 100 km in length. At what bandwidth would be the propagation delay (at speed of 2x10^8 m/s) equal to the transmission delay for a) 500 bytes packets? b) 1250 bytes packets?

2. We will transfer n packets of size L bytes each over a path that contains 5 switches and 6 point-to-point links each having a bandwidth of 2 Mbps and propagation delay of 5 ms. How long would it take to transfer n packets using packet switching (with store-and-forward)? How long would it take if circuit switching is used (ignore circuit switching latency)? Assume packets are sent back-to-back at the source and there are enough buffers in the switches.

3. Consider a connection (link) that has 10 Mbps capacity and going over a 10000 km distance. Assume speed of propagation is 2x10^8 m/s. What is the bandwidth-delay product of this connection? Assume packet size is 500 bytes. How many packets should be sent back-to-back without waiting for ACK (i.e., number of outstanding packets) to utilize the link bandwidth optimally? What would be the link utilization if we send one packet at a time (i.e., we send the next packet after receiving an ACK for the currently sent packet)?

4. Show the NRZI and Manchester encoding of the following bitstream: 100111110001. Assume NRZI signal starts out low.

5. Consider a generator polynomial x^3+1. Compute the 3-bit CRC for the following data message: 11011011.

6. Consider the sliding window protocol described in the textbook. Assume there are 10 packets (1 to 10) to be sent to from a sender to a receiver. The transmisson time of each data packet is 10 ms and the transmission time of each ACK packet is 0 ms (i.e., ACK is sent in very short amount of time so that we can take it to be 0). The one-way propagation delay is 30 ms. Assume the first transmissions of packets 3 and 6 fail (packets lost). No other packets are lost. Assume timeout value is 80 ms (a timer is set at the time when the corresponding packet is sent out completely). Draw the timeline of packet and ACK transmissions and find out when each packet is completely received by the receiver. Assume SWS=RWS=4.

7. Consider 5 bridges (B1 throughout B5) and 8 LAN segments (segments L1 through L8). L1 is connected to B2 and B3. L2 is connected to B2, B3, B1. L7 is connected to B3. L6 is connected to B1. L3 is connected to B4 and B5. L5 is connected to B4. L4 is connected to B1, B4 and B5. L8 is connected to B5. Consider the distributed spanning tree algorithm we have seen. Which ports will be used for forwarding out? Show in a diagram.

8. Solve exercise 1 of chapter 3.

9. Solve exercise 72 of chapter 3.

10. An IP packet of size 9000 bytes (including IP header) is to be transmitted over an Ethernet link. How many fragments will be generated by IP fragmentation algorithm and what is the size of each fragment (including header and data in it)?

11. An organization has been assigned the prefix 139.180.13/24. It wants to form IP subnets for 4 departments (A, B, C, D) each having the following number of machines: A:70 hosts, B: 40 hosts, C: 25 hosts, and D: 19 hosts. Give a possible arrangement of subnet masks to make this possible.