CSC4200 – Homework 2 (Each question is worth 10 points)

1. What is the difference between circuit switching and packet switching?

2. What are the different layers in today's Internet? Why do we create layers?

3. Suppose there is a 10 Mbps microwave link between a geostationary satellite and its base station on Earth. Every minute the satellite takes a digital photo and sends it to the base station. Assume a propagation speed of 2.4 * 10^8 meters/sec.

a. What is the propagation delay of the link?
b. What is the bandwidth-delay product, $R \cdot d_{prop}$?
c. Let x denote the size of the photo. What is the minimum value of x for the microwave link to be continuously transmitting?

3. Calculate the total time required to transfer a 1000-KB file in the following cases, assuming an RTT of 50 ms, a packet size of 1 KB data, and an initial 2 × RTT of "handshaking" before data is sent:

(a) The bandwidth is 1.5 Mbps, and data packets can be sent continuously.
(b) The bandwidth is 1.5 Mbps, but after we finish sending each data packet we must wait one RTT before sending the next.
(c) The bandwidth is "infinite," meaning that we take transmit time to be zero, and up to 20 packets can be sent per RTT.

4. Assuming a framing protocol that uses bit stuffing, show the bit sequence transmitted over the link when the frame contains the following bit sequence:

11010111110101111101011111110

Mark the stuffed bits.

5. Suppose the following sequence of bits arrives over a link:

11010111110101111100101111110110

Show the resulting frame after any stuffed bits have been removed. Indicate any errors that might have been introduced into the frame.

6. Show an example two-dimensional parity that detects a 3-bit error.

7. How can a wireless node interfere with the communications of another node when the two nodes are separated by a distance greater than the transmission range of either node?

8. What kind of problems can arise when two hosts on the same Ethernet share the same hardware address? Describe what happens and why that behavior is a problem.

9. How can hidden terminals be detected in 802.11 networks?

10. Draw a timeline diagram for the sliding window algorithm with SWS = RWS = 3 frames, for the following two situations. Use a timeout interval of about 2 × RTT.
(a) Frame 4 is lost.
(b) Frames 4 to 6 are lost.