CS 3251 – Spring 2019 - Homework 1
Assigned: January 24, 2019, Due: January 31, 2019

You must show your work. Answers without work will not be given credit.

1. Do the Wireshark exercise found here, which will introduce you to the Wireshark tool: https://gaia.cs.umass.edu/wireshark-labs/Wireshark_Intro_v7.0.pdf

2. Do the Wireshark exercise found here, which will allow you to explore HTTP: https://gaia.cs.umass.edu/wireshark-labs/Wireshark_HTTP_v7.0.pdf

3. Chapter 1, P5 from K&R 7th edition: Review the car-caravan analogy in Section 1.4. Assume a propagation speed of 100km/hour.

a. Suppose the caravan travels 150 km, beginning in front of one tollbooth, passing through a second tollbooth, and finishing just after a third tollbooth. What is the end-to-end delay?

b. Repeat (a) assuming there are eight cars in the caravan instead of 10.

4. Chapter 1, P7 from K&R 7th edition: In this problem, we consider sending real-time voice from Host A to Host B over a packet-switched network (VoIP). Host A converts analog voice to a digital 64 kbps bit stream on the fly. Host A then groups the bits into 56 byte packets. There is one link between Hosts A and B; its transmission rate is 2 Mbps and its propagation delay is 10 msec. As soon as Host A gathers a packet, it sends it to Host B. As soon as Host B receives an entire packet, it converts the packet's bits to an analog signal. How much time elapses from the time a bit is created (from the original analog signal at Host A) until the bit is decoded (as part of the analog signal at Host B)?

5. Chapter 1, P10 from K&R 7th edition: Consider a packet of length L that begins at end system A and travels over three links to a destination end system. These three links are connected by two packet switches. Let d_i, s_i, and R_i denote the length, propagation speed, and the transmission rate of link i for i=1,2,3. The packet switch delays each packet by d_proc. Assuming no queueing delays, in terms of d_i, s_i, R_I (i=1,2,3), and L, what is the total end-to-end delay for the packet? Suppose now the packet is 1,500 bytes, the propagation speed on all three links is 2.5 x 10^8 m/s, the transmission rates of all three links are 2 Mbps, the packet switch processing delay is 3 msec, the length of the first link is 5,000 km, the length of the second link is 4,000 km, and the length of the last link is 1,000 km. For these values, what is the end-to-end delay?

6. Chapter 2, P10 from K&R 7th edition: Consider a short, 10-meter link, over which a sender can transmit at a rate of 150 bps in both directions. Suppose that packets containing data are 100,000 bits long, and packets containing only control (e.g., ACK or handshaking) are 200 bits long. Assume that N parallel connections each get 1/N of the link bandwidth. Now consider the HTTP protocol, and support that each downloaded object is 100 Kbits long, and that the initial downloaded object contains 10 referenced objects from the same sender. Would parallel downloads via parallel instances of non-persistent HTTP make sense in this case? Now consider persistent HTTP. Do you expect significant gains over the non-persistent case? Justify and explain your answer.