COSC 3P01 Assignment #1

Due: Friday February 10th at 11:59pm

1. What is a client program? What is a server program? Does a server program request and receive services from a client program?

2. What advantage does a circuit-switched network have over a packet-switched network? What advantages does TDM have over FDM in a circuit-switched network?

3. Suppose users share a 2Mbps link. Also suppose each user transmits continuously at 1 Mbps when transmitting, but each user transmits only 20% of the time. (See section 1.3 for statistical multiplexing)

a) When circuit switching is used, how many users can be supported?
b) For the remainder of this problem, suppose packet switching is used. Why will there be essentially no queueing delay before the link if two or fewer users transmit at the same time? Why will there be a queueing delay if three users transmit at the same time?
c) Find the probability that a given user is transmitting.
d) Suppose now there are three users. Find the probability that at any given time, all three users are transmitting simultaneously. Find the fraction of time during which the queue grows.

4. This elementary problem begins to explore propagation delay and transmission delay, two central concepts in data networking. Consider two hosts, A and B, connected by a single link of rate R bps. Suppose that the two hosts are separated by *m* metres, and suppose the propagation speed along the link is *s* metres/second. Host A is to send a packet size of L bits to Host B.

a) Express the propagation delay, d_{prop}, in terms of *m* and *s*.
b) Determine the transmission time of the packet, d_{trans}, in terms of L and R.
c) Ignoring processing and queueing delays, obtain an expression for the end-to-end delay.
d) Suppose Host A begins to transmit the packet at time t=0. At time t=d_{trans}, where is the last bit of the packet?
e) Suppose d_{prop} is greater than d_{trans}. At time t=d_{trans}, where is the first bit of the packet?
f) Suppose d_{prop} is less than d_{trans}. At time t=d_{trans}, where is the first bit of the packet?
g) Suppose s=2.5·108, L=120 bits, and R=56 kbps. Find the distance *m* so that d_{prop} equals d_{trans}.

5. Consider a packet of length L which 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 $2.5 \cdot 10^8$ m/s, the transmission rates of all three links are 2 Mbps, the packet switch processing delay is 3msec, the length of the first link is 5,000km, the length of the second link is 4,000km, and the length of the last link is 1,000km. For these values, what is the end-to-end delay?

6. What is message segmentation? Discuss some advantages and drawbacks of it. (In particular, consider it in the context of sending large files)

7. Consider the 5-layer model for network communication. i) Tell me the *purpose* of each layer. ii) For the top three layers, what, precisely, is talking to what?

8. (Warning: Very open-ended question! Only worry about being detailed and providing useful information; not what I'm expecting!) Though professionals in the field will need to know of numerous security concerns when it comes to networking and IT, everyone has at least some responsibility to keep their communications and data safe. Tell me about three (separate!) network/internet security concerns that a *regular* person should know about and be responsible for minding: i) What it is, ii) Why it matters, iii) What they should know to do about it. (Note: I said 'regular', meaning layman. The average person probably doesn't have to worry about ARP poisoning, etc.)

Some questions are taken from the course textbook.

Submission Guidelines:
Please ensure that all of your answers are entirely legible. Typing it out is strongly suggested. Showing your work (for calculations) is also strongly advisable. Staple your answers together, place them in an envelope if you so choose, and then attach a proper departmental coverpage with your student number and barcode on it.
Electronic submission is not required for this assignment.