ECE 358, Spring 2014 — (Pencil & Paper) Assignment 1
Due Wed, May 14, 11:59:59 PM

(Written responses must be typeset and in pdf. Mention the names of both group members. Use the dropbox on Learn.)

1.(5 points) "The Internet is a store-and-forward network." In at most two sentences of at most 25 words each, explain what this means.

2.(10 points) Suppose you have 40 GBytes of data to send from Halifax to Vancouver. You have available a 100 Mbps dedicated link for data transfer. Would you prefer to transmit the data via this link or use Canada Post overnight delivery? Explain.

3.(15 points) Consider two hosts A and B connected by a single link of rate R bps. Suppose that the two hosts are separated by m meters, and suppose the propagation speed along the link is s meters/second. Host A is to send a packet of size L 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 the processing and queuing 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 $t = d_{\mathsf{trans}}$, where is the last bit of the packet?

(e) Suppose $d_{\mathsf{prop}} > d_{\mathsf{trans}}$. At time $t = d_{\mathsf{trans}}$, where is the first bit of the packet?

(f) Suppose $d_{\mathsf{prop}} < d_{\mathsf{trans}}$. At time $t = d_{\mathsf{trans}}$, where is the first bit of the packet?

(g) Suppose $s = 2.5 \times 10^8$, $L = 120$ bits, $R = 56$ kbps. Find the distance m so that $d_{\mathsf{prop}} = d_{\mathsf{trans}}$.

4.(20 points) Suppose users share a 3 Mbps link. Also suppose each user requires 150 kbps when transmitting, but each user transmits only 10% of the time.

(a) When circuit switching is used, how many users can be supported?

(b) For questions (b) and (c) assume that packet switching is used. We have 120 users. What is the probability, p, that 21 or more users transmit simultaneously?

(c) Suppose we increase the number of users, n, beyond 120. Show a graph of $120 \leq n \leq 400$ versus p. Briefly explain why the curve looks like it does. In particular, state whether p reaches 1 for some n or not, and explain why or why not.

5.(7 points) Suppose N packets arrive simultaneously to a link at which no packets are currently being transmitted or queued. Each packet is of length L and the link has transmission rate R. What is the average queuing delay for the N packets?