**CS 422 (Park)** **Assignment I** **Due: Feb. 4 (Wed.), 2004**

*Submission instructions: Please type your answers and submit electronic copies using* `turnin` *by 5pm on the due date. You may use any number of word processing software (e.g., Framemaker, Word, LaTeX), but the final output must be in pdf or ps format that uses standard fonts (a practical test is to check if the pdf/ps file prints on a CS Department printer without problem). For experiments and programming assignments that involve output to terminal, please use* `script` *to record the output and submit the output file. Use* `gnuplot` *to plot graphs. Use* `ps2gif` *to convert a eps/ps plot to gif format (e.g., for inclusion in Word).*

**PROBLEM 1** (20 pts)

Read Chapter 4 from Comer. Read `http://www.isoc.org/internet/history/brief.shtml` and provide a 1 page commentary on the article. Specifically, address the following questions: What were the motivations for constructing the Internet? What is an RFC and what is its role? In your opinion, what were the key events that shaped the evolution of the Internet (include more recent events such as those that you personally experienced since your kindergarten, high school, or college days)? In your opinion, what are some of the key challenges facing the Internet today?

**PROBLEM 2** (20 pts)

What are the key differences between a computer network, as understood by the introductory lectures, and a railway system (think of Amtrak)? Distinguish between fundamental vs. cosmetic differences. What are the features that they share? Which system, in your view, is easier to manage? Explain your reasoning. For the last question, take as a reference point a large file transfer for computer networks and a large shipment of coal by freight train.

**PROBLEM 3** (30 pts)

Consider a 3-hop network where host $A$ is connected to router $R_1$, $R_1$ is connected to router $R_2$, and $R_2$ is connected to host $B$. The link bandwidths are 100 Mbps and the link latencies 20 msec (millisecond). Suppose a 10 MB file is being transmitted from $A$ destined for $B$. At $A$, the file is chunked up into packets of size 1 KB. Note that the first bit belonging to a packet, after it arrives at a router, waits for the last bit of the packet before it is further processed. Compute the completion time for transferring the 10 MB file. Show all calculations. Indicate what your idea is, and why it is correct. (*Hint: First compute the completion time for a single 1 KB packet, then use this result to calculate the total completion time.*)

What happens in the above scenario when the bandwidth between routers $R_1$ and $R_2$ is increased to 1 Gbps? Show the calculations for completion time. You may assume that router $R_2$, a bottleneck, has ample buffer space. What is the maximum size to which the buffer at $R_2$ builds up any time during the transmission?

**PROBLEM 4** (40 pts)

Carry out the experiments specified in `http://www.cs.purdue.edu/~park/cs422-hw1.html`.