College of Computer Science
Northeastern University
CSG150: Fundamentals of Computer Networking

Fall 2003
October 13th, 2003

Problem Set 3
(due October 27th)

Important note: *Make sure that all your programs and simulation results are well documented (i.e., comments, how to run the simulation program, display intermediate results, and graphs). Make sure that your code is clean and well designed, because future homeworks might use it as a building bloc.*

1. **Problem 1** (**50 points**) The goal of this problem is to simulate a queuing system with 8 queues and one server.
   a. **(15 points)** Write a program that generates a Poisson distribution with rate λ. Write a program that generates an exponential distribution with mean $1/\mu$. For help on simulating random processes you can check: or http://www.ds.unifi.it/VL/VL_EN/poisson/poisson8.html.
   You can use C/C++, Java, or matlab (matlab is probably the easiest).

   b. **(35 points)** Let a system consist of:
      - Two computers connected using a 64Kbps line.
      - 8 parallel sessions, each with packet arrival rate λ=2pkts/s.
      - Packets length is exponentially distributed with mean 2000bits.

      Simulate and compute the average delay of packets for the following two strategies:
      1. Each has a dedicated share of the 64Kbps link. In other words, each session has 8Kbps.
      2. All sessions dynamically share the 64Kbps.

2. **Problem 2 (50 points):** Write a program that allows a user to download a file from one machine to another using UDP sockets. There will be a server and a client programs. First use a stop and wait ARQ mechanism. The server accepts one download request at a time.

sunstation1> download-server 1234 Download for *filename* requested by sunstation2. Download in progress: ############## Download complete.	**sunstation2**> download-client sunstation1 1234 *filename* Download in progress: ############## Download complete.

	sunstation2>

1. What is the average delay that you experience?

2. Artificially introduce an error probability of packets by dropping packets with probability *p.* Also introduce an artificial delay *d*. What is the average throughput that you get for the following values of *p* and *d:* `p = 0.2, 0.1, 0.01; and d = 10ms, 100ms.`