CS 700 – Exercise 3
Due March 5

1. Write **a Monte Carlo simulation** to calculate the integral $\int_0^1 (1-x)/1+x)dx$. Use the method of independent replications to compute the result with an accuracy of 5% for a confidence level of 95%.

2. A service facility consists of two servers in series (tandem) each with its own FIFO queue. A customer completing service at server 1 proceeds to server 2, while a customer completing service at server 2 leaves the facility. Assume that the interarrival time of customers to server 1 is an exponentially distributed random variable with mean 1 minute. Service times of customers at server 1 and server 2 are exponentially distributed random variables with mean 0.7 minutes and 0.9 minutes respectively. Write **a discrete event simulation** program to determine the expected response time of a customer in the service facility, i.e., the time spent in the service facility including both queueing and service times at the two servers. Report the result with an accuracy of 5% for a confidence level of 95%. You can use any technique discussed in class (independent replications, batch means, regenerative simulation) and any programming language for your simulation program. Remember to estimate the length of the initial transient phase; your program should only collect statistics after the system has reached a steady state in the simulation run.

3. Use a profiling tool to create a profile of your simulation program for the tandem queue. Based on this profile, can you identify any aspects of your code that could benefit from further optimization. [On Unix platforms, you can use `gprof` to profile your C/C++ programs. There are several open source Java profilers available on the Internet; see `http://java-source.net/open-source/profilers`. Both MS Visual Studio and Apple's Xcode development environment include performance tools for application profiling. Even scripting languages like Perl have profiling tools.]