Computer Science 616 - Stochastic Models in Computer Science
Fall 2007, Homework 4, due Oct 3 at noon

1. This homework is to prepare you for stochastic modeling and analysis with Mobius.

   (a) Download Mobius from http://www.mobius.uiuc.edu/download.html for your appropriate operating system, (license information has been send to you by email).

   (b) If you are installing Mobius on your office computer, all you need to do is run the Setup program (from the download package). All other packages are already installed.

   (c) Run the setup program, follow the instructions along the way.

   (d) The installation directory should be in your home directory.

   (e) The Mobius project directory can be in either your home directory or your scratch directory.

   (f) After installation is complete. To run Mobius go into the /bin directory in your mobius installation and run mobius. 0

2. Work through the Mobius example of the fault tolerant multi processor model as described in Section B of the manual. Provide results for the mean realiability of the system for t=20 yrs for experiments 1 and 2 of the experimental study, use both possible solution methods a) transient analysis of the underlying Markov chain and b) discrete event simulation. Submit the result files generated by Mobius as well as a brief textual summary written by yourself that summarizes the numerical results and provides a list of comments on shortcomings of the manual (which will be send to the Mobius group as feedback, so please provide constructive comments). 50

3. Create a small model from scratch, that models the following. A variable "counter" has an initial value 0 and a range 0,1,...,1000. The counter is either incremented by an action "increment" or decremented by an action "decrement" within the given range, i.e., the model can perform in state counter=0 only an increment action, in state counter=1000 only a decrement action. Actions can happen repeatedly after some random delay. For "increment", the delay is exponentially distributed with rate λ. For "decrement", the delay is exponentially distributed with rate 1. Model each action by a single atomic SAN model and compose them by a join node in a Rep/join model. The counter variable becomes a shared variable in that join node. Define a reward variable that will give you the mean value of that counter observed in the long run. Analyze the model with steady state numerical analysis of Markov chains and with simulation. Provide results observed in a series of experiments running λ from 0.1 to 1.5 with stepsize 0.1 in a table. In addition to analysis results, provide a list of terms that you had to investigate for clarification in order to be able to solve this exercise. 50