CS 115 Computer Simulation, Assignment #2 – Train Unloading Dock (again)

In this assignment, you will write a simulation of a train unloading dock. The system being modeled is *exactly* the same as that described in assignment 1, except this time you will write your simulation in a special-purpose simulation language. I recommend using **CSIM** but I do not demand it; if you have another special-purpose language youôd like to try, please consult with me and we can discuss it. For example the Wikipedia page on event-driven simulation suggests SimPy and Salabim. As with Assignment #1, it will be tested for output correctness on the ICS openlab Linux computers.

The input and output specifications remain the same; I would like to be able to run your code with various parameters, and see the output myself. Output the same list of statistics at the end of your simulation as specified in Assignment #1. You should use separate CSIM random number streams for each of the four conceptual process streams (train arrivals, train unloading times, remaining crew time, replacement crew travel time), and use the same input file specification as in assôt #1.

The grading guidelines (*i.e.*, ñprettyò source code, correct simulation, brief but thoughtful write-up describing why you think your simulation works including various ñsanityò tests) also remain the same. The late penalty is the same, and you submit both electronically (using the Unix ñsubmitò command as before) and on paper.

In addition, you will compute two more statistics in (or at least from) your simulation(s):

a) Computer the 99% confidence interval for the mean time-in-system, based upon 100 runs of the simulation.
b) Compute the mean time-in-system to an accuracy of 1%, with 99% confidence. How many runs did it take to compute this? (That is, keep re-running your simulation, each time with a different seed, until your 99% confidence interval has a width which is less than 1% of the value of the mean time-in-system.)

These statistics can be computed by hand by running your simulation many times, or, if you are clever, it can all be done with a little extra coding inside CSIM. See the functions **reset, permanent_table, table_mean, report, report_table,** and the part of the CSIM User Manual discussing confidence intervals. If you do it this way, please ensure that the **default** action of your simulation is to run on the command line just as the input specification was for Assignment #1---I donôt want it to run 10 batches of runs when I type ñ./train 10 72000ò. (On the other hand, donôt think youôve managed to skip having to learn the details of confidence intervals; Iôm sure to ask about it on the midterm.) Note also that if you do it this way, you might get different numbers than if you do separate simulations and combine them by hand, because in the former case you wonôt start with an empty queue at the beginning of each batch, but in the latter you will.

In addition, you will use your simulation to answer the following questions:

1) At what average inter-arrival time does the system become overloaded? That is, leaving all distributions the same except the train arrival rate, how small can the average inter-arrival time be before the system becomes overloaded? How did you determine whether the system was overloaded or not?
2) Does your system overload at the same rate of train arrivals as your first assignment? If it does not, explain why not (which means that at least one of your simulations is wrong).
3) **(Bonus 10%):** Provide paper-and-pencil, analytical estimate of the maximum train arrival rate (ie., minimum average inter-arrival time), if all other values and distributions remain as they are. How close does your analytical estimate agree with the simulated one(s) above? If they disagree, why?