SIE 431 Simulation Modeling and Analysis

Problem 1:

Stacks of paper arrive at a trimming process with interarrival times of EXPO(10); all times are in minutes and the first stack arrives at time 0. There are two trimmers, a primary and a secondary. All arrivals are sent to the primary trimmer. If the queue in front of the primary trimmer is shorter than five, the stack of paper enters that queue to wait to be trimmed by the primary trimmer, an operation of duration TRIA(9, 12, 15). If there are already five stacks in the primary queue, the stack is balked to the secondary trimmer (which has an infinite queue capacity) for trimming, of duration TRIA(17, 19, 22). After the primary trimmer has trimmed 25 stacks, it must be shut down for cleaning, which lasts EXPO(30). During this time, the stacks in the queue for the primary trimmer wait for it to become available. Run your simulation for a single replication of 5,000 minutes. Collect statistics, by trimmer, for cycle time, resource utilization, number in queue, and time in queue.

For the problem above, about how many replications would be required to bring the half width of a 95% confidence interval for the expected average cycle time for both trimmers down to one minute? You need to do something to estimate the approximate number of replications that would be required and then run the simulation to verify.

Problem 2:

Trucks arrive with EXPO(9.1) interarrival times (all times are in minutes) to an unload area that has three docks; the first truck arrives at time 0. The unload times are TRIA(25, 28, 30), TRIA(23, 26, 28), and TRIA(22, 25, 27) for docks 1, 2, and 3, respectively. If there is an empty dock, the truck proceeds immediately to that dock. Assume zero travel times to all docks. If there is more than one empty dock, the truck places preference on the higher-numbered dock (3, 2, 1). If all the docks are busy, it chooses the dock with the minimum number of trucks waiting. If there is a tie, it places preference on the lowest numbered dock (1, 2, 3). Note that in "by Condition" Decide modules, the tests are done from top to bottom, and the first one resulting in a "true" sends the entity out through that corresponding exit point. Run your model for a single replication of length 20,000 minutes and collect statistics on dock utilization, number in queue, time in queue, and the time in system.

For the facility of the problem above, you've been asked to decide how much space should be planned for the trucks in queue to unload; address this question (being mindful of statistical issues, and of the fact that the space should be able to accommodate the queue all the time, not just during "average" times).