HW#3

In this homework, we don't change process's behavior but the execution model (i.e., the way to activate the execution of process; an imaginary scheduler in distribution system for the purpose of simulation) of the simulation. We reuse the same input files in HW#2.

(a) This is a sequel of HW2b. We inherit the same assumption (anonymous algorithm plus randomized initial values; M1 plus M2) and the same decision making rule. However, we no longer assume that program executions are synchronized in a round basis. Instead, we consider a different execution model (called it Model 1) that allows only one process to make a decision at a time (i.e., no two or more processes make decisions at the same time). A process is active if it is making its decision. Which process will be active at any time is purely stochastic (i.e., does not have any pattern or regularity). However, to make Model 1 fair, we assume that all processes have the same probability to get active. The simulation ends when no process will change its decision any longer. Call the new program HW3a. Run HW3a 1,000 times, each with different randomized initial values, on the same input data file and answer the following questions. ① Is it possible that HW3a does not stop for some input? Why? ② If HW3a always stops for some input file, please list all possible results (one line for each set of duplicated results) with respective percentages. Are all these results correct (independent sets)?

(b) The same as (a) but we consider another execution model called Model 2. It is still round-based but allows an arbitrary number of processes (instead of all processes) to be active in a single round. The number of processes being active in a round is random, and the numbers may be different in different rounds. We also assume that each process has the same probability p to be active. This model actually subsumes Model 1 (only one active process in each round) and the original synchronized model. The simulation ends when no process will change its decision any longer. Call the new program HW3b. Run HW3b 1,000 times, each with different randomized initial values, on the same input data file and answer the following questions.① Is it possible that HW3b does not stop for some input? Why? ② If HW3b always stops for some input file, please list all possible results (one line for each set of duplicated results) with respective percentages. Are all these results correct (independent sets)?

(c) Consider two performance matrices: ① averaged total weight (in the set) and ② averaged convergence time (the number of rounds to the end of the simulations). Change the value of p in (b) from 0.1 to 0.9 (with step 0.1) and run HW3b 1,000 times on the same input data file for each possible setting of p. Collect the statistics. (a) Use an x-y graph to show how ① changes with the setting of p. (b) Use an x-y graph to show how ② changes with the setting of p.