Assignment 06

This assignment consists of 6 problems. Problems 1 from 254 -255 pages. Problems 1, 2 of 262 page. Problem 4 of 287 page and problems 1, 2 of 294 page.

Problem #1:
Consider a fault-tolerant multiprocessor computer system with two processors, each with its own private memory module and a third memory module that is shared between the processors. Supposing that the processors and the memory modules have constant failure rates λ_p and λ_m, respectively, and the computer system is operational as long as there is at least one operational processor with access to either a private or shared memory module, determine the failure-time distribution for the computer system. Recompute the failure-time distribution of the computer system, this time, assuming a Weibull distribution for time to failure of the processors and memory modules with the different λ parameters and but the same shape parameter α.[*Hint:* Use conditioning (or factoring) on the event that the shared memory is operational or not.]

Problem #1:
Consider the **if** statement:
if B $\{S_1;\}$ **else** $\{S_2;\}$
Let the random variables X_1 and X_2 respectively, denote the execution times of the statement groups S_1 and S_2. Assuming the probability that the Boolean expression B = true is p, derive an expression for the distribution of the total execution tim eX of the **if** statement. Compute E[X] and Var[X] as functions of the means and variances of X_1 and X_2. Generalize your results to a case statement with k clauses.

Problem #2:
Describe a method of generating a random deviate of a two-stage hyperexponential distribution.

Problem #4:
Consider the following concurrent program:

CPU1
if B **then**
  cobegin
    CPU2; I/O2
  coend
else
  I/O1
end.

Derive expressions for the completion time distribution and the mean completion time for the whole graph. Assume that the execution time of the statement group CPU_i (i = 1, 2) is EXP(μ_i), the execution time of the statement group I/Oj (j = 1, 2) is EXP(λ_j), and P(B = true) = p. Assume all task executing times are mutually independent. For enhancing such models to allow for task failures, see Sahner et al.[SAHN 1996].

Problem #1:
Write and run a program to simulate an M/E_2/1 queue and obtain realizations of the four stochastic processes defined in Example 6.2. Plot these realizations. You may use a simulation language such as SIMULA or GPSS or you may use one of the standard high-level languages. You will have to generate random deviates of the interarrival time distribution (assume arrival rate $\lambda = 1$ per second) and the service time distribution (assume mean service time 0.8s) using methods of Chapter 3.

Problem #2:
Study the process $\{N_k | k = 1, 2, \ldots\}$ in detail as follows. By varying seeds for generating random numbers, you get different realizations. For a fixed k, different observed values of N_k for these distinct realizations can be used to estimate the mean and variance of N_k. Using a sample size of 30, estimate E[N_k], Var[N_k] for k = 1, 5, 10, 100, 200, 1000. What can you conclude from this experiment?