 HW 5 – Due start of class 10/28

Homework is due at the start of class on 10/28. Please turn in a hardcopy. It can be handwritten. Please show all computations.

Reading from your textbook: Chapter 24.1. Remember that when reading you should cover all the "Answers" and derivations and try them yourself first.

Exercises:

1. Exercise 24.6 from your textbook. You can use an integration package for this exercise, or else do it by hand. This problem should be done via analysis.

2. This problem revists Exercise 14.5 from your PnC book chapter, but with several changes. The revised problem is below:

   Revised Exercise 14.5: In this problem, we will study the effect of variability of job sizes on response time. The job size distribution, S, throughout this problem will follow a DegenerateHyperexponential(μ, p) distribution, which will allow us to increase the variability in S by playing with μ and p parameters. The **Degenerate Hyperexponential** with parameters μ and p is defined as follows:

$$S \sim \begin{cases} \text{Exp}(p \cdot \mu) & \text{w.p. } p \\ 0 & \text{w.p. } 1-p \end{cases}$$

   (a) What is $\mathbf{E}[S]$? Is this affected by p?

   (b) Create a simulation to determine mean response time, $\mathbf{E}[T]^{FCFS}$, in a single queue with FCFS scheduling. The arrival process to the queue is a Poisson Process with rate $\lambda = 0.8$. The job sizes are denoted by

$$S \sim \text{DegenerateHyperexponential}(\mu = 1, p) \ .$$

   You will run multiple simulations, each with the appropriate value of p to create the cases of $C_S^2 = 1, 3, 5, 7, 9$. Draw a graph with $\mathbf{E}[T]$ on the y-axis and C_S^2 on the x-axis. Note that a job of size 0 may still experience a queueing time, even though its service time is 0.

   (c) Repeat the full set of simulations from (b), but this time for mean response time in a queue with non-preemptive Last-Come-First-Served scheduling (LCFS). You will be measuring $\mathbf{E}[T]^{LCFS}$.

   (d) Repeat the full set of simulations from (b), but this time for mean response time in a queue with Preemptive Last-Come-First-Served (P-LCFS) scheduling. You will be measuring $\mathbf{E}[T]^{P-LCFS}$.

   (e) Repeat the full set of simulations from (b), but this time for mean response time in a queue with Processor-Sharing (PS) scheduling. You will be measuring $\mathbf{E}[T]^{PS}$.

(f) Did some scheduling policies perform better than others? Provide some intuition for why you got the simulation results that you got for the different policies.