Math 350 - Homework 7

Due 3/26/2010

1. (Text, problem 1, page 111.) Write a program to generate the desired output for the model of Section 6.2. Use it to estimate the average time that a customer spends in the system and the average amount of overtime put in by the server, in the case where the arrival process is a Poisson process with rate 10, the service time density is
$$g(x) = 20e^{-40x}(40x)^2, \ x > 0$$
and $T = 9$. First try 100 runs and then 1000.

2. (Text, problem 2, page 112.) Suppose in the model of Section 6.2 that we also wanted to obtain information about the amount of idle time a server would experience in a day. Explain how this could be accomplished.

3. (Text, problem 3, page 112.) Suppose that jobs arrive at a single server queueing system according to a nonhomogeneous Poisson process, whose rate is initially 4 per hour, increases steadily until it hits 19 per hour after 5 hours, and then decreases steadily until it hits 4 per hour after an additional 5 hours. The rate then repeats indefinitely in this fashion—that is, $\lambda(t + 10) = \lambda(t)$. Suppose that the service distribution is exponential with rate 25 per hour. Suppose also that whenever the server completes a service and finds no jobs waiting he goes on break for a time that is uniformly distributed on $(0, 0.3)$. If upon returning from his break there are no jobs waiting, then he goes on another break. Use simulation to estimate the expected amount of time that the server is on break in the first 100 hours of operation. Do 500 simulation runs.

As always, I plan to discuss some of these problems in class during the week. It will help a lot if you think about them beforehand.