MIS 381N

Stochastic Control and Optimization: Project 5

We are planning ahead for the most important event of the year at our retail store: The Black Friday Sale. Being the most critical shopping day of the year, we want to strike the perfect balance between customer waiting times and our costs. We'd also want to make sure we experiment with various queue configurations.

Physically, there are 20 counters in total. We will have to choose how many of these we keep open. In terms of costs, hourly costs are $40 hourly for each counter that is open. Customers who wait more than 10 minutes are "annoyed" and we perceive a penalty of $1 for each delayed customer.

Provided Files

The data file "queue.Rdata" contains past arrival (A) and service (S) time observations.

Specifics

1. Use the function "fitdistr" in the R package MASS, to find the right parameters for inter-arrival and service time distributions. Try Gamma, Exponential and the Weibull distributions. Please use qqplots to to show the goodness of fits.
2. Use the distribution that fits the best to simulate the following queuing system. In this system, there are a number of checkout counters open, each with its own queue. Arriving customers randomly join one queue. Use your simulation to find the optimal number of checkout counters to keep open. What is the expected cost (salary + penalty)?
3. Next we will try another queuing configuration, where all queues are combined and made into one queue. All customers join this queue and then move to any counter that opens up. Again, use a simulation to find the optimal number of checkout counters to keep open in this configuration. What is the expected cost (salary + penalty)?
4. (Extra credit) Now we will consider the queuing configuration in 2 where each counter has its own queue, but arriving customers join the queue that has the shortest queue length. Use a simulation to find the optimal number of checkout counters to keep open in this configuration. What is the expected cost (pay + penalty)?

Hint: the condition that the queue would not grow infinitely long generates a lower limit of how many counters to use.

Submission Instructions:

Name your report as **project4_gZ.pdf** (Z is your group number). Upload your report and all your code as separate files to Canvas. You will have one code file for each of the steps above.

(We want to use speedgrader that requires separate files.)