Homework 4

Problem 1 (*10 points*) Jack Weatherhead is a first-year MS-BUAI student. In order to pay the rent, he decides to take the job in the computer department of a local department store. His only responsibility is to answer phone calls from customers about store hours and product availability. As Jack is the only person answering the calls, the manager of the store is concerned about queueing problems.

Currently, the department receives a call every 3 mins on average. The standard deviation of the inter-arrival time is 3 mins. Jack can handle a call in 2 mins on average, with a standard deviation of 1 min.

The customer service number is toll-free. For each incoming call, the store has to pay the phone company at a price of $5.00 per hour, regardless of whether the call is being answered or is waiting. Assume that the customers do not hang up even if having to wait for a long time.

1. (*2 points*) Jack has to read the book "The Goal" for one of his courses. He can read 1 page per minute. The manager allows Jack to study when he is not answering calls. How many pages can Jack read during an 8-hour shift?
2. (*3 points*) How long does a customer have to wait, on average, before talking to Jack?
3. (*2 points*) At any given moment, on average how many calls are on the line?
4. (*3 points*) On average, what is the total cost of telephone lines over an 8-hour shift?

Problem 2 (*10 points*) Five Lakes Video, a small video rental store in Cleveland, is open 24 hours a day, and --- due to its proximity to a prestigious business school --- experiences customers arriving around the clock. A recent analysis indicates that on average, 30 customers arrive every hour, with a standard deviation of the inter-arrival time being 2 minutes. This arrival pattern stays true regardless of the time of the day. The checkout is currently operated by one employee, who needs an average of 1.7 minutes to check out a customer. The standard deviation of this check-out time is 3 minutes.

As a special service, the store offers free popcorn and sodas for customers waiting in line at the checkout desk. (Note: the person that is being served is too busy with paying to eat or drink.) The store owner estimates that, for every minute a customer waits in line, it costs the store 75 cents because of the consumed food. If the goal of the store is to minimize cost, what is the optimal number of employees at checkout? Assume a wage rate of $10 per hour. (*Show your work to receive full credits.*