1. The operator of a large website boasts that it handles an average of 300,000 logins per day, and the average number of users simultaneously logged in is 7,500. What is the average length of a login session at the site? Show your work.

2. Your cousin operates a small business in a busy train station, replacing watchbands and watch batteries, and making other minor watch and jewelry repairs “while you wait”. Customers arrive at an average rate of 3.5 per hour. Each repair takes an average of 8 minutes, with a standard deviation of 3 minutes. Use the Pollaczek-Khinchin formula to predict the average number of people waiting for repair, and the average waiting time for service.

3. (Pre-exam refresher for solving dynamic programming problems by hand) Solve problem 5 on page 292 of the text. Also assume it is possible to replace a running machine for the same cost as replacing a broken one. You should therefore have two possible states at each time period, “running” and “broken”. In the “running” state, the possible actions are “replace”, “maintenance”, or “do nothing”, while in the “broken” state, the possible actions are “replace” or “repair.” Find the policy with optimal expected profit by dynamic programming by hand and show your work. What is the expected profit for the four-week period, and what should you do in each situation that can occur?

4. You operate a customer-service call center for a company with two related businesses, a group of hotels and a group of extended stay facilities. These two businesses have different customer service numbers and different dedicated teams of customer service representatives. Calls arrive at the hotel customer-service number at an average rate of 1 per minute, while calls arrive at the extended-stay number at an average rate of one every 1.4 minutes. The service time for hotel calls is well-modeled by a triangular distribution with a minimum of 1 minute, a most likely value of 3 minutes, and maximum time of 8 minutes. Extended-stay calls are similar, but the corresponding times are 1, 4, and 10 minutes, respectively. After initial service, 20% of hotel calls and 30% of extended-stay calls must be referred to a payment specialist. Payment specialists are shared between the two kinds of calls, and process calls in time well-modeled by a uniform distribution with a minimum of 3 minutes and a maximum of 10 minutes. When there are not enough available employees of the type needed to service a call, calls wait in queue.

Suppose you have 5 hotel customer-service representatives, 5 extended-stay customer-service representatives, and 3 payment specialists on duty at all times. Simulating 400
hours and using a “warmup” time of 1 hour, use an Arena simulation to answer the following questions:

- What is the average waiting time for hotel calls to be answered?
- What is the average waiting time for payment specialists?
- What is the average total time for hotel calls?
- What is the average total time for extended-stay calls?

Hand in a screen shot of your graphical Arena model, and printouts of the Arena reports from the simulation. Also, submit your Arena “.doe” file to the class Sakai website.