Homework #3

You should work individually on this assignment, but you may discuss and debate your answers with your teammates.

1. Lucy Lindner owns a small campus bookstore that sells UC sportswear. In February, she must place an order with Nike for a new UC football shirt for the coming season. The long lead time is required for the contract manufacturers in Asia to order the necessary materials and to begin production in April. The shirts will be delivered to Lucy in early August just in time for the new season. Nike will charge Lucy $50 for each shirt she orders, and she will sell each shirt for $75 during the football season. There will not be another opportunity for Lucy to order any more shirts if she runs out. At the end of the season, Lucy will be able to sell up to 5 leftover shirts at a price of $15 per shirt. Obviously, Lucy doesn't know exactly what the demand for these shirts will be, but during the past few years she has sold an average of 50 shirts each season. Based on historical sales the demand for the shirts appears to follow a Poisson distribution with a mean of 50 shirts, and Lucy is planning to order 55 shirts this year. Develop a simulation model for this problem using Python in a Jupyter Notebook. Generate a simulation sample of 10,000 trials and use it to answer the questions below.
   a. Generate a histogram for your sample and provide a verbal description.
   b. What are the maximum, mean, median, and minimum profit in your sample?
   c. What is the probability that Lucy will incur a net loss on her planned order?
   d. What order quantity maximizes Lucy's mean profit?

2. A consumer electronics firm produces a line of battery rechargers for cell phones. The sales price per unit ranges from a minimum of $18.95 to a maximum of $26.95 with the most likely value being $24.95. The cost per unit ranges from $12.00 to $15.00 with all values equally likely. The quantity sold is equal to 10,000 – 250 x sales price + a random term that is normally distributed with a mean of 0 and a standard deviation of 10. Fixed costs are normally distributed with a mean of $30,000 and a standard deviation of $5,000. Develop a simulation model using Python in a Jupyter Notebook, and use it to generate a simulation sample of 10,000 trials to answer the questions below.
   a. Generate a histogram for your sample and provide a verbal description.
   b. What are the maximum, mean, median, and minimum profit in your sample?
   c. What is the probability of incurring a loss?