MS&E 260 Homework 2

Summer 2019, Stanford University

Due: July 10th, 2019, at 10:30AM (PDT)

Problem 1. Jerry plans on selling burritos at Palo Alto Burrito Festival. From last year's sales history, Jerry estimates that the demand for burritos during the day would be normally distributed with mean 250 and standard deviation 30. Jerry's supplier charges \$5 per burrito and Jerry decides to charge \$13 per burrito for sale. Since Jerry does not know how to calculate the optimal order quantity that will maximize his expected profit, he asked his brother, Phil who took MS&E 260 last year, for help. After solving the problem using a newsvendor model, Phil told Jerry "You should order 280 burritos considering that you can sell every unsold burrito to the nearby grocery store after the game."

(a) When solving the newsvendor problem, Phil assumed that the nearby grocery store would buy entire left over burritos at \$$x$ per burrito, where $x <$ \$12. What is the value of \$$x$? Please round your answer to the nearest tenth.

(b) Now assume that $x =$ \$2. The weather forecast predicts that there is a high chance of heavy rain on the day of the festival. Based on this report, Jerry comes up with the following discrete demand distribution. What is the optimal order quantity, given this demand distribution?

Q	240	245	250	255	260	265	270
P(demand = Q)	0.07	0.12	0.23	0.17	0.16	0.20	0.05

Table 1: Estimated Discrete Demand Distribution

(c) Since there is a high chance of rain, Jerry also plans to sell disposable umbrellas. He can buy these umbrellas for \$2 each and sell them for \$10 each if it rains that day. However, the salvage value of unsold umbrella is \$0. There is a 60% chance of rain and the demand will be 400 if it rains. But if it doesn't rain, the demand will be zero. How many umbrellas should be purchased?

Problem 2. In the lecture, we discussed the derivation of the critical ratio:

$$F(Q) = \frac{c_u}{c_o + c_u}$$

Please briefly discuss the implication of this equation.

Problem 3. Stanford warehouse of the famous wine distributor WS&E stocks materials required for the cases of wines. One type of wine that Stanford warehouse distributes is the Burgundy Chardonnay. Each case of this wine is purchased by the warehouse for $200. Since it is sent from Europe in intermodal containers it has a high lead time of 2 months (1/6 years) and the company uses an inventory carrying charge based on a 20% annual interest rate. The cost of order processing and receipt is $1,000 per order. Annual demand for this wine follows a normal distribution with mean 240 cases and variance of 600 cases (standard deviation of $\sim$24.5 cases). Assume that if a case of wine is demanded when the warehouse is out of stock, then the demand is backordered, and the cost associated with each backordered case is estimated to be at $80.

(a) Compute the mean and standard deviation of demand during lead time.

(b) The manager of the warehouse uses (Q, R) policy. Find the optimal values of the order quantity and the reorder level.

(c) Determine the safety stock.

(d) What are the average annual holding, setup and stockout costs associated with this wine?

(e) What is the cost of uncertainty? (You may compare to a case that there is no uncertainty, think about what this case refers to.)

(f) What is the proportion of order cycles in which no stock-outs occur?

(g) What is the expected proportion of demand that cannot be met at once?

Problem 4. Read the following articles:

- https://readwrite.com/2019/04/27/can-ai-save-the-supply-chain-from-its-own-destruction/
- https://hbr.org/2015/05/the-3-d-printing-revolution

Select one of these two articles, and do the following:

1) Briefly summarize the article.
2) Provide a few interpretive thoughts on the article, using what you have learned from class.
3) Provide one recommendation on how the dilemma posed in the article could be resolved.

Some notes:

- Please limit your responses to one page, double spaced, 12 point font.
- There is no right answer to this question. We are evaluating your ability to apply what you learn in class to practical applications.
- This question is not intended to be free points. If you do not demonstrate a sufficient level of critical thinking, full credit will not be awarded.