

Problem Set 3 - Inventory Models

Problem 1

The demand for tables at a furniture store is fairly regular throughout the year at 200 tables per year. Each table costs \$50 to make. Assuming the fixed order placement costs to be \$5/order, the holding cost rate to be 30% of the table cost per year, and the lead time to be 4 weeks, determine the optimal order quantity and the average annual inventory-related costs (assume a month has 4 weeks).

Problem 2

EcoTable is a retailer of specialty organic and ecologically friendly foods. In one of their Cambridge, MA, stores, they plan to offer a gift basket of Tanzanian teas for the holiday season. They plan on placing a single order prior to the holiday season and any leftover inventory will be discounted at the end of the season. Demand for this store is estimated to have a Poisson distribution with an average of 4.5 units (values for this probability distribution are shown in Table 1). The gift basket sells for \$55, the purchase cost to EcoTable is \$32, and leftover baskets will be sold for \$20.

1. If they purchase only 3 baskets, what is the probability that some demand will not be satisfied?
2. If they purchase 10 baskets, what is the probability that they will have to mark down at least 3 baskets?
3. How many baskets should EcoTable purchase to maximize its expected profit?
4. Suppose they purchase 4 baskets. How many baskets can they expect to sell?
5. Suppose they purchase 6 baskets. How many baskets should they expect to have to mark down at the end of the season?
6. Suppose EcoTable wants to satisfy all demand with at least 90% probability. How many baskets should they order?
7. Suppose EcoTable orders 8 baskets. What is the expected profit?

x	Pr(D = x)	Pr(D ≤ x)
0	0.011	0.011
1	0.050	0.061
2	0.112	0.174
3	0.169	0.342
4	0.190	0.532
5	0.171	0.703
6	0.128	0.831
7	0.082	0.913
8	0.046	0.960
9	0.023	0.983
10	0.010	0.993
11	0.004	0.998
12	0.002	0.999

Table 1: Demand probability distribution for Gift Baskets

Problem 3

Geoff Gullo owns a small firm that manufactures "Gullo Sunglasses." He has the opportunity to sell a particular seasonal model to Land's End. Geoff offers Land's End two purchasing options:

- **Option 1:** Geoff offers to sell the glasses to Land's End at \$65 per unit; he also agrees to credit Land's End \$53 for each unit Land's End returns to Geoff at the end of the season (because those units did not sell). Since styles change each year, there is essentially no value in the returned merchandise.
- **Option 2:** Geoff offers a price of \$55 for each unit, but returns are no longer accepted. In this case, Land's End throws out unsold units at the end of the season.

This season's demand for the model will be normally distributed with mean of 200 and standard deviation of 125. Land's End will sell those sunglasses for \$100 each. Geoff's production cost is \$25 per unit.

1. How much would Land's End buy if they chose option 1?
2. How much would Land's End buy if they chose option 2?
3. Which option will Land's End choose, if given the choice?
4. Which option is better for Geoff Gullo?

Problem 4

HG's Clothes sells a large number of white dress shirts. The shirts, which bear the store label, are shipped from a manufacturer in China. Hi, the proprietor, says "I want to be sure

that I never run out of dress shirts. I always try to keep at least two months supply in stock. When my inventory drops below that level, I order another two month supply. I've been using that method for 20 years and it works!" The shirts cost \$8 each and sell for \$25 each. The cost of processing an order and receiving new goods amounts to \$80 and the replenishment lead time is one month. Monthly demand is approximately normally distributed with mean 120 and standard deviation 60. Assume 15% annual holding cost rate.

1. What is the order quantity Q that Hi is using to control the inventory of white dress shirts?
2. The reorder point is the inventory level at which a firm decides to place a new order. What is the reorder point for Hi?
3. What is the probability that whenever HI places an order, he will run out of inventory before the order arrives?
4. Based on the models covered in class, how might you suggest setting the order quantity? How would you set the reorder point so as to have a 99% probability of not stocking out ?
5. Determine the difference in annual holding and ordering costs between Hi's policy and the policy found in (4).

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