DaiPark Exercise

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Exercise 9

A camera store specializes in a particular popular and fancy camera. As- sume that these cameras become obsolete at the end of the month. They guarantee that if they are out of stock, they will special-order the cam- era and promise delivery the next day. In fact, what the store does is to purchase the camera from an out of state retailer and have it delivered through an express service. Thus, when the store is out of stock, they actually lose the sales price of the camera and the shipping charge, but they maintain their good reputation. The retail price of the camera is \$600, and the special delivery charge adds another \$50 to the cost. At the end of each month, there is an inventory holding cost of \$25 for each camera in stock (for doing inventory etc). Wholesale cost for the store to purchase the cameras is \$480 each. (Assume that the order can only be made at the beginning of the month.)

(a) Assume that the demand has a discrete uniform distribution from 10 to 15 cameras a month (inclusive). If 12 cameras are ordered at the beginning of a month, what are the expected overstock cost and the expected understock or shortage cost? What is the expected total cost?

$*$ P(selling price) = 600

$*$ C_v (Buying price) = 480

$*$ h(holding cost) = 25

$*$ b(back order cost) = 50

$*$ y(ordering quantity) = 12

$C_u = p + b = 650$

$C_o = h = 25$

d	10	11	12	13	14	15
$Pr = D = d$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$
$Pr = D \leq d$	$\frac{1}{6}$	$\frac{2}{6}$	$\frac{3}{6}$	$\frac{4}{6}$	$\frac{5}{6}$	1
$(D-12)^+$	0	0	0	1	2	3
$(12-D)^+$	2	1	0	0	0	0

$\mathbb{E}[C_o] = \mathbb{E}[(X-12)^+] = 25$

$\mathbb{E}[C_u] = \mathbb{E}[(12-X)^+] = 325$

$\mathbb{E}[expected\ total\ cost] = \mathbb{E}[C_o] + \mathbb{E}[C_u] = 350$

(b) What is optimal number of cameras to order to minimize the expected total cost?

To, find optimal number of order(Y) F(Y)$\geq \frac{C_u - C_v}{C_u + C_o}$

$\frac{C_u - C_v}{C_u + C_o} = \frac{34}{135}$. So, F(Y)$\geq \frac{34}{135}$ $\therefore Y = 10$

(c) Assume that the demand can be approximated by a normal distribu- tion with mean 1000 and standard deviation 100 cameras a month. What is the optimal number of cameras to order to minimize the expected total cost?

F(Y)=$\frac{C_u - C_v}{C_u + C_o} = \frac{34}{135}$

Find the percentile of f(y) = 932.8654

Exercise 10

Next month's production at a manufacturing company will use a certain solvent for part of its production process. Assume that there is an ordering cost of $1,000 incurred whenever an order for the solvent is placed and the solvent costs $40 per liter. Due to short product life cycle, unused solvent cannot be used in following months. There will be a $10 disposal charge for each liter of solvent left over at the end of the month. If there is a shortage of solvent, the production process is seriously disrupted at a cost of $100 per liter short. Assume that the initial inventory level is m, where m = 0; 100; 300; 500 and 700 liters.

(a) What is the optimal ordering quantity for each case when the demand is discrete with $Pr\{D = 500\} = Pr\{D = 800\} = \frac{1}{8}$,$Pr\{D = 600\} = \frac{1}{2}$ and $Pr\{D = 700\} = \frac{1}{4}$?

d	500	600	700	800
$Pr\{D = d\}$	$\frac{1}{8}$	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{8}$
$Pr\{D \leq d\}$	$\frac{1}{8}$	$\frac{5}{8}$	$\frac{7}{8}$	1

$C_u = 100$

$C_o = 50$

Find, y qualified that $F(y) \geq \frac{100}{150}$

y = 700

(b) What is the optimal ordering policy for arbitrary initial inventory level m? (You need to specify the critical value m* in addition to the optimal order-up-to quantity $y*$. When m≤m*, you make an order. Otherwise, do not order.)

y* is 700. but the m* will be different. because we didn't consider the fixed cost and the ordering quantity up to 700. So, we have to compare that 700 and 600 and 500

This is quantity of 700 Expected cost.

$\mathbb{E}[cost] = \mathbb{E}[understock.c] + \mathbb{E}[overstock.c] = (200 \times \frac{1}{8} \times 50) + (100 \times \frac{1}{2} \times 50) + (100 \times \frac{1}{8} \times 100) = 5000$

This is quantity of 600 Expected cost.

$\mathbb{E}[cost] = (100 \times \frac{1}{8} \times 50) + (100 \times \frac{1}{4} \times 100) + (200 \times \frac{1}{8} \times 100) = 5625$

This is quantity of 500 Expected cost.

$\mathbb{E}[cost] = (100 \times \frac{1}{2} \times 100) + (200 \times \frac{1}{4} \times 100) + (300 \times \frac{1}{8} \times 100) = 13750$

So, we can know that 700 has the lowest expected cost. Up to 700, ordering cost + gap of quantity multiplied by solvent cost.

if m is 600, up to 700 we must pay 5000 for buy solvent. but the cost gap is only 625. if m is 500, up to 700 we must pay 9000 for buy solvent. but the cost gap is only 8750. So, we presume that the m is under the 500. And then we find the cost of solvent to qualified that equation.

$1000 + (700 - x) \times 40 \leq \mathbb{E}[cost, x] - \mathbb{E}[cost, 700] = 495.833333$

(c) Assume optimal quantity will be ordered. What is the total expected cost when the initial inventory m = 0? What is the total expected cost when the initial inventory m = 700?

We already know when m is 700, expected total cost is 5000.

But, when m is 0, expected total cost = order cost + Expected cost(700).

first, order cost is $1000 + (700 - 0) \times 40 = 29000$

Second, expected cost is 5000

So, sum of that is 34000