

Homework 2 Solutions

Advanced Operations
Management.

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Q1 First, try the \$9.70 price.

$$D = \left(80 \frac{\text{boxes}}{\text{month}}\right) \left(12 \frac{\text{months}}{\text{year}}\right) = 960 \frac{\text{boxes}}{\text{year}}$$

$$\text{Then } h = (20\%)(9.70) = 1.94$$

$$EOQ_3 = \sqrt{\frac{2 \cdot 20 \cdot 960}{1.94}} \approx 146.69$$

This isn't admissible, so $q_3^* = 500$

$$\text{In this case } TC_3 = \frac{20 \cdot 960}{500} + (9.7)(960) + \frac{1.94 \cdot 500}{2} = \$9835.40$$

Next, try the \$9.80 price; $h = (20\%)(9.80) = 1.96$

$$EOQ_2 = \sqrt{\frac{2 \cdot 20 \cdot 960}{1.96}} \approx 139.97$$

Out of range again, so $q_2^* = 300$

$$\text{So } TC_2 = \frac{20 \cdot 960}{300} + (9.8)(960) + \frac{1.96 \cdot 300}{2} = \$9766$$

So, try \$10 price; $h = (20\%)(10) = 2$

$$EOQ_3 = \sqrt{\frac{2 \cdot 20 \cdot 960}{2}} \approx 138.56$$

$$TC_3 = \frac{20 \cdot 960}{138.56} + (10)(960) + \frac{2 \cdot 138.56}{2} \approx \$9877.12$$

TC_2 is the smallest, so we order 300 units per order, and place $960/300 = 3.2$ orders per year.

Q2 First, note that if we order in the \$10 quantity range, things will be the same as in Q1, and the total cost is $\$9877.12$ / year, with an order of about 139

Suppose we order in the 300-500 unit range boxes.

Then the cost per order is

$$\begin{aligned} & \$20 + (\$10)(300) + (\$9.80)(q - 300) \\ &= \$20 + (\$10 - 9.8)(300) + 9.8q \\ &= \$20 + (0.2)(300) + 9.8q \\ &= \$80 + 9.8q \end{aligned}$$

h is now \$2/box year, and

$$EOQ = \sqrt{\frac{2kD}{h}} = \sqrt{\frac{2 \cdot 80 \cdot 960}{2}} \approx 277.13$$

↑ not admissible

$$q^* = 300$$

$$TC = \frac{80 \cdot 960}{300} + (9.8)(960) + \frac{2 \cdot 300}{2} = 9964$$

Finally, we try the 500+ unit range.

In this case, the cost per order is

$$\underbrace{\$80 + 9.8(500)} + 9.7(q - 500)$$

cost to order
500, from last
calculation

$$= 80 + (9.8 - 9.7)(500) + 9.7q$$

$$= 130 + 9.7q$$

$$EOQ = \sqrt{\frac{2 \cdot 130 \cdot 960}{2}} \approx 353.27$$

Inadmissible $\Rightarrow q^* = 500$

$$TC = \frac{130 \cdot 960}{500} + (9.7)(960) + \frac{2 \cdot 500}{2} = 10,061.60$$

So, the best option is to order
139 boxes

	A	B	C	D	E
1	Quantity Discount Present Value Inventory Model				
2					
3	Discount Rate	20%			
4	Demand	960	units/year		
5					
6	Cost Data				
7	Setup Cost	\$ 20.00			
8					
9		Level 1	Level 2	Level 3	
10	After Quantity	0	300	500	
11	Unit Price is	\$ 10.00	\$ 9.80	\$ 9.70	
12					
13	Discount Factor	0.833333333			
14					
15		Level 1	Level 2	Level 3	
16	Base Cost	\$ 20.00	\$ 80.00	\$ 130.00	
17					
18	Suppose we are in	Level 1	Level 2	Level 3	
19	q (chosen by Solver)	144.4628479	300	500	
20	C(q)	\$ 1,464.63	\$ 3,020.00	\$ 4,980.00	Sum
21	PV(q)	\$ 54,118.85	\$ 54,529.59	\$ 54,973.01	\$ 163,621.45
22					
23	Best Value	\$ 54,118.85			
24					
25	q or 0	144.4628479	0	0	
26					
27	Optimal q	144.4628479			

	A	B	C	D	E
1	Quantity Discount Present				
2					
3	Discount Rate	0.2			
4	Demand	960	units/year		
5					
6	Cost Data				
7	Setup Cost	20			
8					
9		Level 1	Level 2	Level 3	
10	After Quantity	0	300	500	
11	Unit Price is	10	9.8	9.7	
12					
13	Discount Factor	=1/(1+B3)			
14					
15		Level 1	Level 2	Level 3	
16	Base Cost	=B7	=B16+C10*(B11-C11)	=C16+D10*(C11-D11)	
17					
18	Suppose we are in	Level 1	Level 2	Level 3	
19	q (chosen by Solver)	144.462847919022	300	500	
20	C(q)	=B16+B11*B19	=C16+C11*C19	=D16+D11*D19	Sum
21	PV(q)	=B20/(1-\$B13^(B19/\$B4))	=C20/(1-\$B13^(C19/\$B4))	=D20/(1-\$B13^(D19/\$B4))	=SUM(B21:D21)
22					
23	Best Value	=MIN(B21:D21)			
24					
25	q or 0	=IF(B21=\$B23,B19,0)	=IF(C21=\$B23,C19,0)	=IF(D21=\$B23,D19,0)	
26					
27	Optimal q	=MAX(B25:D25)			