Question 1: Montegut Manufacturing produces a product for which the annual demand is 10,000 units. Production averages 100 units per day, while demand is 40 units per day. Holding costs are $2.00 per unit per year, and setup cost is $200.00.

(a) If the firm wishes to produce this product in economic batches, what size batch should be used?

(b) What is the maximum inventory level?

(c) How many order cycles are there per year?

(d) What are the total annual holding and setup costs?

Data:

D = 10,000 units

p = 100 units/day

d = 40 units/day

H = $2 per unit/per year

S = $200

(a) If the firm wishes to produce this product in economic batches, what size batch should be used?

Find EPQ [Economic Production Quantity]

EPQ = Q* = $\sqrt{\frac{2DS}{H(1-\frac{d}{p})}} = \sqrt{\frac{(2)(10{,}000)(200)}{2(1-\frac{40}{100})}}$ = 1825.7419 ≈ 1826 units

(b) What is the maximum inventory level?

Maximum Inventory Level:

= (total produced during the production run) – (total used during the production run)

= (p • t) – (d • t)

However, Q = total produced = p • t ; t = $\frac{Q}{p}$

= (p • $\frac{Q}{p}$) – (d • $\frac{Q}{p}$)

= Q (1- $\frac{d}{p}$)

= 1825.7419(1- $\frac{40}{100}$)

≈ 1096 units

(c) How many order cycles are there per year?

Number(#) of Order Cycles = $\frac{D}{Q} = \frac{10{,}000}{1825.7419}$ = 5.4772 cycles per year

(d) What are the total annual holding and setup costs?

(1) Total annual holding cost = (average inventory level) • (holding cost per unit per year)

$$\text{Since, average inventory level} = \frac{maximum\ level}{2}$$

$$= \frac{maximum\ level}{2} \bullet 2$$

$$= \frac{1095.44519}{2} \bullet 2$$

$$= \$\ 1095.45$$

(2) Total annual setup cost = $\frac{D}{Q} \bullet S$

$$= \frac{10{,}000}{1825.7419} \bullet (200)$$

$$= \$\ 1095.45$$

Question 2: The annual demand, ordering cost, and the annual inventory carrying cost rate for a certain item are D= 600 units, S= $20/order and I = 30% of item price. Price is established by the following schedule. What should the order quantity be in order to minimize the total annual cost?

Quantity	1 to 49	50 to 249	250 and up
Price	$5.00 per unit	$4.50 per unit	$4.10 per unit

From question given that D = 600 units

S = $20 X 0.3 = $6

Price range	Initial price (1 to 49)	Discount price 1 (50 to 249)	Discount price 2 250 and up
Price per unit (P)	$5	$4.5	$4.1
$Q^* = \frac{\sqrt{2DS}}{IP}$	126.49 units	133.33 units	139.69 units
Order quantity	Infeasible	133.33 units	250 units
Annual set up cost = $\frac{D}{Q}S$	-	$90	$48
Annual holding cost = $\frac{Q}{2}IP$	-	$90	$153.75
Unit cost	-	$2700	$2460
Total cost (T)	-	$2880	$2661.75

In order to minimize the annual cost, the firm should order 250 units which cost $4.10 per unit.

Question 3: Central University uses $123,000 of a particular toner cartridge for laser printers in the student computer labs each year. The purchasing director of the university estimates the ordering cost at $45 and thinks that the university can hold this type of inventory at an annual storage cost of 22% of the purchase price. How many months' supply should the purchasing director order at one time to minimize the total annual cost of purchasing and carrying?

Data:

D = $123,000

I = 0.22 (22%)

S = $45

Unit = Dollars ($)

Unit Price(P) = 1 Unit/dollar

Calculate EOQ [Economic Order Quantity]:

$$\text{EOQ} = Q^* = \sqrt{\frac{2DS}{IP}} = \sqrt{\frac{(2)(123{,}000)(45)}{(0.22)(1)}} = 7093.53 \approx 7094 \text{ units}$$

Converting one-year usage to one-month usage:

$$\frac{D}{12} = \frac{123{,}000}{12} = \$10{,}250$$

Month's usage:

$$\frac{Q^*}{\frac{D}{12}} = \frac{7{,}094}{10{,}250} = 0.69 \text{ month } (\approx 3 \text{ weeks})$$

Order Cycles:

$$\frac{D}{Q} = \frac{123{,}000}{7{,}094} = 17.34 \text{ orders}$$

The purchasing director of the Central University should order at 0.69 month (or ≈3 weeks) to minimize the total annual cost of purchasing and carrying.

Question 4: The soft goods department of a large department store sells 175 units per month of a certain large bath towel. The unit cost of a towel to the store id $2.50 and the cost of placing an order has been estimated to be $12.00. The store uses an inventory carrying charge of I = 27% per year.

At first the problem has given

Annual demand in units for the inventory item (D) = 175 units X 12 months = 2,100 units

Holding or carrying cost per unit per year (H) = $2.5 per unit X 0.27 = $0.675 per unit (Need to multiplied 2.5 by 0.27 because the store inventory carrying charge I = 27% per year)

Setup or ordering cost for each order (S) = $12 per unit

Determine

(a) The optimal order quantity
To find optimal order quantity is to find EOQ or Q*

$$Q^* = \sqrt{\frac{2DS}{H}} = \sqrt{\frac{2\ X\ 2100\ X\ 12}{2.5\ X\ 0.27}} = \sqrt{\frac{50{,}400}{0.675}} = 273.25 \text{ units}$$

So the optimal order quantity is 273.25 units

(b) The order frequency

To find order frequency is to find expected number of orders per annual (N)

The order frequency = N = $\frac{Demand}{Order\ quantity}$ = $\frac{D}{Q*}$

N = $\frac{2100}{273.25}$ = 7.685 or around 8 orders per year

In one year, the soft goods department need to order 8 orders per year.

(c) The annual holding and setup cost

At first find Annual holding cost

Annual holding cost = (Average inventory level) X (Holding cost per unit per year)

= ($\frac{order\ quantity}{2}$) X Holding cost per unit per year

= ($\frac{Q}{2}$) X H

= ($\frac{273.25\ units}{2}$) X (2.5 X 0.27)

= 136.625 units X \$0.675
= \$92.222

Annual holding cost is \$92.222

Annual setup cost = ($\frac{annual\ demand}{Number\ of\ units\ in\ each\ order}$) X (Setup or order cost per order)

= ($\frac{D}{Q}$) X S

= ($\frac{2100\ units}{273.25\ units}$) X \$12

= 7.685 X \$12
= \$92.223

Annual setup cost is \$92.223

If, through automation of the purchasing process, the ordering cost can be cut to \$4.00, what will be

(d) The new economic order quantity

To find new economic order quantity is find the optimal order quantity when ordering cost (S) is change to \$4.00

Find Q* = $\sqrt{\frac{2DS}{H}}$ = $\sqrt{\frac{2\ X\ 2100\ X\ 4}{2.5\ X\ 0.27}}$ = $\sqrt{24888.88}$ = 157.762 units

So new economic order quantity is 157.762 units

(e) The order frequency

The order frequency = N = $\frac{Demand}{Order\ quantity}$ = $\frac{D}{Q*}$

N = $\frac{2100}{157.762}$ = 13.311 orders per year

In one year, the soft goods department need to order 14 orders per year

(f) Annual holding and setup cost

At first find Annual holding cost

Annual holding cost = (Average inventory level) X (Holding cost per unit per year)

$= (\frac{order\ quantity}{2})$ X Holding cost per unit per year

$= (\frac{Q}{2})$ X H

$= (\frac{157.76\ units}{2})$ X (2.5 X 0.27)

= 78.881 X $0.675

= $53.245

Annual holding cost is $53.245

Annual setup cost = $(\frac{annual\ demand}{Number\ of\ units\ in\ each\ order})$ X (Setup or order cost per order)

$= (\frac{D}{Q})$ X S

$= (\frac{2100\ units}{157.76\ units})$ X $4

= $53.245

Annual setup cost is $53.245

Question 5: A firm that make electronic circuits has been ordering a certain raw material 250 ounces at a time. The firm estimates that carrying cost is I = 30% per year, and that ordering cost is about $20 per order. The current price of the ingredient is $200 per ounce. The assumption of the basic EOQ model are thought to apply. For what value of annual demand is their action optimal?

From the problem given that Q* = 250 ounces at a time

H = $200 X 0.30 = $60 per unit per year

S = $20 per order

Annual demand that is there is their action optimal is to find D

Base on EOQ model : $Q^* = \sqrt{\frac{2DS}{H}}$

$= \sqrt{\frac{2\ X\ D\ X\ 20}{200\ X\ 0.30}}$

$250 = \sqrt{\frac{40D}{60}}$

$250^2 = (\sqrt{\frac{40D}{60}})^2$

$62{,}500 = \frac{40D}{60}$

3,750,000 = 40D

D = 93,750

So, the annual demand is 93,750 units for the inventory item.

Question 6:

A printing company estimates that it will require 1,000 reams of a certain type of paper in a given period. The cost of carrying one unit in inventory for that period is 50 cents. The company buys the paper from a wholesaler in the same town, sending its own truck to pick up the orders at a fixed cost of $20.00 per trip. Treating this cost as the order cost,

(a) What is the optimum number of reams to buy one time?

(b) How many times should lots of this size bought during this period?

(c) What is the minimum cost (holding and set up) of maintaining inventory on this item for period?

(d) Of this total cost, how much is carrying cost and how much is ordering cost?

(a) The optimum number of reams to buy at one time = economic order quantity (EOQ)

EOQ = Q* = $\sqrt{\frac{2DS}{H}}$

D = annual demand in units for the inventory system
S = setup/ordering cost for each order
H = holding/carrying cost per unit per year

Q* = $\sqrt{\frac{(2)(1000)(20)}{0.5}}$

Q* = 282.84

Q* ≈ 283 units

(b) Expected number of orders = N

N = $\frac{D}{Q}$

N = $\frac{1000}{282.84}$

N = 3.54

N ≈ 4 orders per year

(c) The minimum cost of maintaining inventory on this item for the period = total cost (TC)

TC = carrying cost + setup cost

TC = 70.71 + 70.71

TC = $141.42

(d) Carrying cost = $(\frac{Q}{2})(H)$

Carrying cost = $(\frac{282.84}{2})(0.5)$

Carrying cost = $70.71

Setup cost = $(\frac{D}{Q})(S)$

Setup cost = $\left(\frac{1000}{282.84}\right)(20)$

Setup cost = $70.71

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