Two Methods for Carrying Cost

Carry cost (C_h) can be expressed either:

1. As a fixed cost, such as

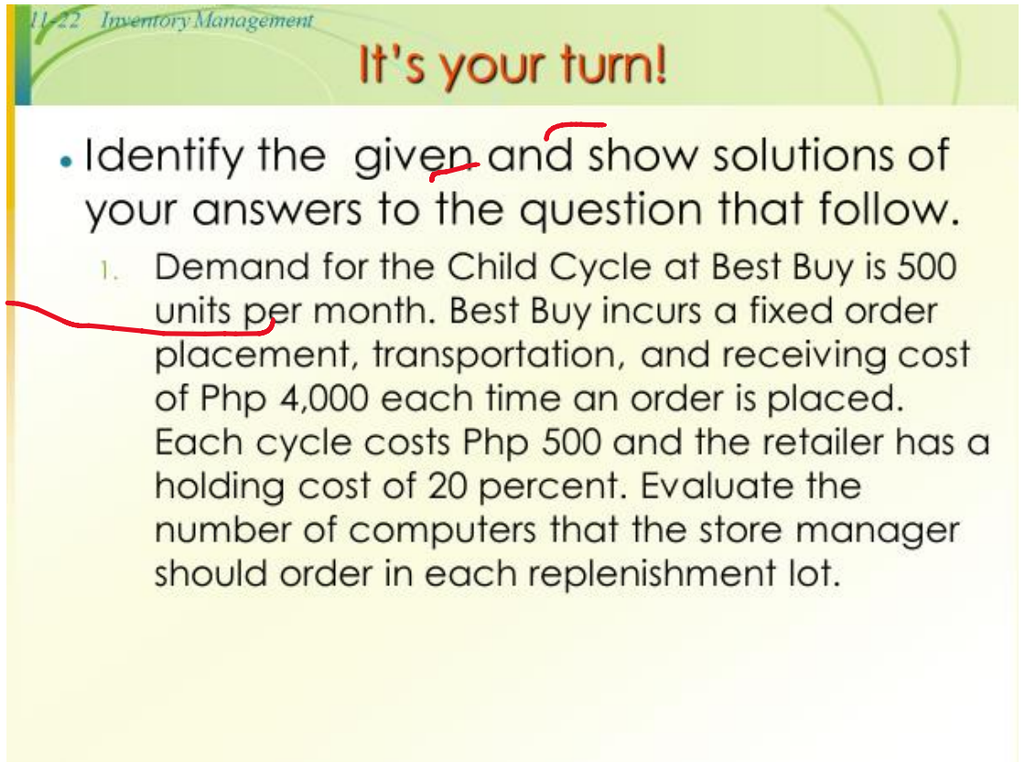
   C_h = \$0.50 per unit per year

2. As a percentage of the item's purchase cost (P)

   $C_h = I \times P$

   I = a percentage of the purchase cost

Economic Order Quantity (EOQ)



- **D** = Annual Demand rate = $500 * 12 = 6000\ cycles$
- **C_o** = Ordering Cost per order = $P4000$
- **C_h** = Holding Cost per unit per year = $C_h = I * P = 20\% * 500 = P100$
- **L** = Lead time = NA
- **W** = Working days per year = NA

Question: Evaluate the number of cycles that the store manager should order in each replenishment lot.

$$Q^* = \sqrt{\frac{2DC_o}{C_h}}$$

$$Q^* = \sqrt{\frac{2 * 6000 * 4000}{100}}$$

$$Q^* = 693\ cycles$$

How many times are we going to order in a year?

$$O = \frac{D}{Q} = \frac{6000}{693} = 9\ orders$$

How much is the total ordering cost?

$$Total\ C_o = O * Co = 9 * 4000 = P36{,}000$$

How many items on the average do we have in the warehouse?

$$I = \frac{BeginningInventory + EndingInventory}{2}$$

$$I = \frac{0 + 693}{2} = 347$$

How much is the holding cost?

$$TotalC_h = I * C_h$$

$$Total\ C_h =$$

$$Total\ C_h = 347 * 100 = 34700$$

How much is the inventory cost?

$$TotalC_I = TotalC_O + TotalC_h$$

$$Total\ C_I =$$

$$Total\ C_I = 36{,}000 + 34700 = P70{,}700$$

ECONOMIC PRODUCTION QUANTITY (EPQ)

- Brown Manufacturing produces commercial refrigeration units in batches. The firm's estimated demand for the year is 10,000 units. It costs about $100 to set the manufacturing process, and the carrying cost is about 50 cents per unit per year. When the production process has been set up, 80 refrigeration units can be manufactured daily. The demand during the production period has traditionally been 60 units per day. Brown operates its refrigeration unit production area 167 days per year.

$$D = 10{,}000\ units$$

$$Cs = \$100$$

$$Ch = \$0.50$$

$$p = 80\ units/day$$

$$d = 60\ units/day$$

Questions:

1.How many refrigeration units should Brown Manufacturing produce each batch?

$$Q^* = \sqrt{\frac{2DC}{C_h * \left(1 - \frac{d}{p}\right)}}$$

$$Q* = \sqrt{\frac{2 * 10000 * 100}{0.5 * \left(1 - \frac{60}{80}\right)}}$$

2*10000*100=/(0.5*(1-60/80))=sqrtroot

$$Q* = 4{,}000\ units$$

How long should the production part of the cycle last?

$$t = Q*/p$$

$$t = 4000/80$$

$$t = 50\ days$$

How many production runs (n) there will be in a year?

$$n = \frac{D}{Q*} = \frac{10{,}000}{4000} = 2.5\ production\ runs$$

Run is measured in terms of days; 1 prod run 50 days. In a year, the production area is in operation for only **125 days**.

On the average, how many items are kept in inventory?

$$\frac{Q}{2}\left(1 - \frac{d}{p}\right)$$

$$Ave.Inventory = \frac{4000}{2} * \left(1 - \frac{60}{80}\right)$$

$$Ave.Inventory = 500\ units$$

How much is the annual holding cost?

$$\frac{Q}{2}\left(1 - \frac{d}{p}\right)C_h$$

$$Annual\ Ch = \frac{4000}{2} * \left(1 - \frac{60}{80}\right) * 0.5 = \$250$$

How much is the annual set-up cost?

$$Annual\_Setup\_Cost = \frac{D}{Q}C_s$$

$$Annual\ Cs = \frac{10000}{4000} * 100 = \$250$$

How much is the total cost of inventory?

$$Total\ Inv\ Cost = 250 + 250 = \$500$$

Your turn!!!

- Flemming Accessories produces paper slicers used in offices and in art stores. The minislicer has been one of its most popular items. Annual demand is 6,750 units and is constant throughout the year. Kristen Flemming, owner of the firm, produces the minislicers in batches. On average, Kristen can manufacture 125 minislicers per day. Demand for these slicers during the production process is 30 per day. The set up cost for the equipment necessary to produce the minislicers is $150. Carrying cost are $1 per minislicer per year.
- How many minislicers should Kristen manufacture in each batch?
- How long should the production part of the cycle last?
- How many production runs there will be in a year?

QUANTITY DISCOUNT MODEL(QDM)

Steps:

1. For each discount price (C), compute *EOQ, Q**
2. ***If EOQ (Q*) < minimum for discount, adjust the quantity to Q = minimum for discount***
3. For each EOQ or adjusted Q, compute Total Cost
4. Select the Q* with the lowest total cost

- Brass Department Store stocks toy race cars. Recently, the store was given a quantity discount schedule for the cars; this quantity discount schedule is shown below. The normal cost for the toy race cars is $5. The ordering cost is **$49** per order, the annual demand is **5,000** race cars, and the inventory carrying charge as percentage of cost, I, is **20%**. What order quantity will minimize the total inventory cost?

Discount Number	Unit Price (C)	Order Quantity (Q)	Compute EOQ $EOQ = Q^* = \sqrt{\frac{2DC_o}{IC}}$	Adjusted Q	Material Cost DC	Ordering Cost $\frac{D}{Q}C_o$	Holding Cost $\frac{Q}{2}C_h$	Total Cost $Total\_Cost = DC + \frac{D}{Q}C_o + \frac{Q}{2}C_h$
1(0%	$5	700	$Q^* = \sqrt{\frac{2 * 5000 * 49}{20\% * 5}} = 700\ cars/order$	700 cars /order	$5000 * 5 = \$25{,}000$	$\frac{5000}{700} * 49 = \$350$	$\frac{700}{2} * (20\% * \$5 = \$350$	$= 25{,}000 + 350 + 350 = \$25{,}700$

2 (4%)	**$4.80**	**1000**	$Q^* = \sqrt{\frac{2 * 5000 * 49}{20\% * 4.80}}$ **= 715 *cars/order***	**1000 Cars/ order**	$5000 * \$4.80 = \$24,00$	$\frac{5000}{1000} * 49 = \$245$	$\frac{1000}{2} * (20\% * \$4.80) = 480$	$24,000 + 245 + 480 = \$24,725$
3 (5%)	**$4.75**	2000	$Q^* = \sqrt{\frac{2 * 5000 * 49}{20\% * 4.75}}$ $= 719\ cars/order$	2000 cars /ord er	$5000 * \$4.75 = \$23,750$	$\frac{5000}{2000} * 49 = \$122.5$	$\frac{2000}{2} * (20\% * \$4.75) = \$950$	$= \$23,750 + \$122.50 + \$950 = \$24,822.50$

Conclusion: We buy by 1000 cars/order because the total cost is $24,725, the lowest cost for the 3 discount offers.

*****Note: If *EOQ* < *minimum for discount*, adjust the quantity to Q = minimum for discount**

Your turn!!!

Dorsey Distributors has an annual demand for metal detector of 1,400. The cost of a typical detector to Dorsey is $400. Carrying cost is estimated to be 20% of the unit cost, and the ordering cost is $25 per order. If Dorsey orders in quantities of 300 or more, it can get a 5% discount on the cost of the detectors. **Should Dorsey take the quantity discount?** Assume that the demand is constant. *Hint: To determine which is the best decision, compare Total Cost without discount and with discount.*