Additional Summary Notes

Chapter 12: Inventory Management

DISCUSSION QUESTIONS

1. The four types of inventory are:

- Raw material—items that are to be converted into product
- Work-in-process (WIP)—items that are in the process of being converted
- Finished goods—completed items for which title has not been transferred
- MRO—(maintenance, repair, and operating supplies)—items that are necessary to keep the transformation process going

2. The advent of low-cost computing should not be seen as obviating the need for the ABC inventory classification scheme. Although the cost of *computing* has decreased considerably, the cost of *data acquisition* has not decreased in a similar fashion. Business organizations still have many items for which the cost of data acquisition for a "perpetual" inventory system is still considerably higher than the cost of the item.

3. The purpose of the ABC system is to identify those items that require more attention due to cost or volume.

4. Types of costs—*holding cost*: the cost of capital invested and space required; *shortage cost*: the cost of lost sales or customers who never return; the cost of lost goodwill; *ordering cost*: the costs associated with ordering, transporting, and receiving the items; *unit cost*: the actual cost of the item.

5. Assumptions of EOQ model:

- demand is known and constant over time;
- lead time is known and constant;
- receipt of inventory is instantaneous;
- quantity discounts are not possible;
- the only variable costs are the costs of placing an order or setting up production and the cost of holding or storing inventory over time; and,
- if orders are placed at the right time, stockouts or shortages can be completely avoided.

6. The EOQ increases as demand increases or as the setup cost increases; it decreases as the holding cost increases. The changes in the EOQ are proportional to the square root of the changes in the parameters.

7. Price times quantity is not variable in the EOQ model but is variable in the discount model. When quality discounts are available, the unit purchase price of the item depends on the order quantity.

8. Advantages of cycle counting:

1. Eliminating the shutdown and interruption of production necessary for annual physical inventories
2. Eliminating annual inventory adjustments
3. Providing trained personnel to audit the accuracy of inventory
4. Allowing the cause of errors to be identified and remedial action to be taken
5. Maintaining accurate inventory records

9. A decrease in setup time decreases the cost per order, encourages more and smaller orders, and thus decreases the EOQ.

10. Discount points below the EOQ have higher inventory costs, and the prices are no lower than at the EOQ. Points above the EOQ have higher inventory costs than the corresponding price break point or EOQ at prices that are no lower than either of the price breaks or the EOQ. (It depends on whether there exists a discount point above the EOQ.)

END-OF-CHAPTER PROBLEMS

12.1 An ABC system generally classifies the top 70% of dollar volume items as A, the next 20% as B, and the remaining 10% as C items. Similarly, A items generally constitute 20% of total number of items, B items are 30%, and C items are 50%.

Item Code Number		Average Dollar	Volume	Percent of Total $ Volume
1289	→	400 × 3.75 =	1,500.00	44.5%
2347	→	300 × 4.00 =	1,200.00	35.6%
2349	→	120 × 2.50 =	300.00	8.9%
2363	→	75 × 1.50 =	112.50	3.3%
2394	→	60 × 1.75 =	105.00	3.1%
2395	→	30 × 2.00 =	60.00	1.8%
6782	→	20 × 1.15 =	23.00	0.7%
7844	→	12 × 2.05 =	24.60	0.7%
8210	→	8 × 1.80 =	14.40	0.4%
8310	→	7 × 2.00 =	14.00	0.4%
9111	→	6 × 3.00 =	18.00	0.5%
			$3,371.50	100% (rounded)

The company can make the following classifications:

Item A: 1289, 2347 (18% of items; 80.1% of dollar-volume).
Item B: 2349, 2363, 2394, 2395 (36% of items; 17.1% of dollar-volume).
Item C: 6782, 7844, 8210, 8310, 9111 (45% of items; 2.8% of dollar-volume).

12.11 Southeastern Bell stocks a certain switch connector as its central warehouse for supplying field service offices. The yearly demand for those connectors is 15,000 units. Southeastern estimates its annual holding cost for this item to be $25 per unit. The cost to place and process an order from the supplier is $75. The company operates 300 days per year, and the lead time to receive an order from the supplier is 2 working days.

$D = 15{,}000$, $H = \$25$/unit/year, $S = \$75$

(a) $\text{EOQ} = \sqrt{\dfrac{2DS}{H}} = \sqrt{\dfrac{2 \times 15{,}000 \times 75}{25}} = 300 \text{ units}$

(b) Annual holding costs = $(Q/2) \times H = (300/2) \times 25 = \$3{,}750$

(c) Annual ordering costs = $(D/Q) \times S = (15{,}000/300) \times 75 = \$3{,}750$

(d) $\text{ROP} = d \times L = \left(\dfrac{15{,}000 \text{ units}}{300 \text{ days}}\right) \times 2 \text{ days} = 100 \text{ units}$

12.15 Joe Henry's machine shop uses 2,500 brackets during the course of a year. These brackets are purchased from a supplier 90 miles away. The following information is known about the brackets: Annual demand = 2,500; Holding cost per bracket per year = $1.50; Order cost per order = $18.75; Lead time = 2 days; Working days per year = 250.

(a) $Q = \sqrt{\frac{2DS}{H}} = \sqrt{\frac{2(2500)18.75}{1.50}}$

$= 250$ brackets per order

(b) Average inventory $= \frac{Q}{2} = \frac{250}{2} = 125$ units

Annual holding cost $= \frac{Q}{2}H = 125(1.50) = \$187.50$

(c) Number of orders $= \frac{D}{Q} = \frac{2500}{250} = 10$ orders/year

Annual order cost $= \frac{D}{Q}S = 10(18.75) = \$187.50$

(d) TC $= \frac{Q}{2}H + \frac{D}{Q}S = 187.50 + 187.50 = \$375/\text{year}$

(e) Time between orders $= \frac{\text{Working days}}{(D/Q)}$

$= \frac{250}{10} = 25$ days

(f) ROP $= dL = 10(2) = 20$ units (where 10 = daily demand)

$d = \frac{2500}{250} = 10$

12.19 Radovilky Manufacturing Company, in Hayward, California, makes flashing lights for toys. The company operates its production facility 300 days per year. It has orders for about 12,000 flashing lights per year and has the capability of producing 100 per day. Setting up the light production costs $50. The cost of each light is $1. The holding cost is $0.10 per light per year.

Production Order Quantity, non-instantaneous delivery.

(a) $D = 12{,}000/\text{yr}$

$H = \$.10/\text{light-yr}$

$S = \$50/\text{setup}$

$P = \$1.00/\text{light}$

$p = 100/\text{day}$

$$d = \frac{12{,}000/\text{yr}}{300\ \text{days/yr}} = 40/\text{day}$$

$$Q = \sqrt{\frac{2DS}{H\left(1 - \frac{d}{p}\right)}} = \sqrt{\frac{2(12{,}000)50}{.10\left(1 - \frac{40}{100}\right)}}$$

$= 4{,}472$ lights per run

(b) $$\text{Average holding cost/year} = \frac{Q}{2}\left[1 - \left(\frac{d}{p}\right)\right]H$$

$$= \frac{4{,}472}{2}\left[1 - \left(\frac{40}{100}\right)\right](.10) = \frac{\$26{,}832}{200} = \$134.16$$

(c) $$\text{Average setup cost/year} = \left(\frac{D}{Q}\right)S = \left(\frac{12{,}000}{4{,}472}\right)50$$

$= \$134.16$

(d) Total cost (including cost of goods)

$= PD + \$134.16 + \$134.16$

$= (\$1 \times 12{,}000) + \$134.16 + \$134.16$

$= \$12{,}268.32/\text{year}$

12.22 Bell Computers purchases integrated chips at $350 per chip. The holding cost is $35 per unit per year, the ordering cost is $120 per order, and sales are steady, at 400 per month. The company's supplier, Rich Blue Chip Manufacturing, Inc. decides to offer price concessions in order to attract larger orders. The price structure is shown below:

Rich Blue Chip's Price Structure

Quantity purchased	Price per unit
1-99 units	$350
100-199 units	$325
200 or more units	$300

D (Annual demand) = 400 × 12 = 4,800, P (Purchase price/Unit) = $350/unit, H (Holding cost /Unit) = $35/unit/year, S (Ordering cost/Order) = $120/order. So:

12.22 a) What is the optimal order quantity and the minimum annual cost for Bell Computers to order, purchase, and hold these integrated chip?

(a) $$Q = \sqrt{\frac{2DS}{H}} = \sqrt{\frac{2 \times 4,800 \times 120}{35}}$$

$$= 181.42 = 181 \text{ units(rounded).}$$

Thus, $$TC(\text{Total cost}) = PD + \frac{HQ}{2} + \frac{SD}{Q}$$

$$= (4,800 \times 325) + \left(\frac{35 \times 181}{2}\right) + \left(\frac{120 \times 4,800}{181}\right)$$

$$= \$1,560,000 + 3,168 + 3,182 = \$1,566,350,$$

where Price = $325/unit.

However, if Bell Computers orders 200 units, which is optional with the discount model, then:

$$TC = (4,800 \times 300) + \left(\frac{35 \times 200}{2}\right) + \left(\frac{120 \times 4,800}{200}\right)$$

Bell Computers should order 200 units for a minimum total cost of $1,446,380.

$$= 1,440,000 + 3,500 + 2,880 = \$1,446,380.$$

12.22 b) Bell computers wishes to use a 10% holding cost rather than the fixed $35 holding cost in 12.22 a). What is the optimal order quantity, and what is the optimal annual cost?

Step 1, under the lowest possible price of $300:

$$Q^*_{\$300} = \sqrt{\frac{2(4,800)(120)}{(0.10)(300)}} = 196 \text{ units}$$

Because 196 < 200, this EOQ is *infeasible* for the $300 price. So we compute the EOQ for the next-higher price of $325:

$$Q^*_{\$325} = \sqrt{\frac{2(4,800)(120)}{(0.10)(325)}} = 188 \text{ units}$$

Because 188 is between 100 and 199, this second EOQ is *feasible*. Thus, the best possible order quantities are 188 (the first feasible EOQ) and 200 (the price-break quantity for the lower price of $300).

Step 2 compute the total cost of the candidate order quantities:

$$TC_{188} = \frac{4,800}{188}(\$120) + \frac{188}{2}(0.10)(\$325) + \$325(4,800)$$
$$= \$3,064 + \$3,055 + \$1,560,000 = \$1,566,119$$
$$TC_{200} = \frac{4,800}{200}(\$120) + \frac{200}{2}(0.10)(\$300) + \$300(4,800)$$
$$= \$2,880 + \$3,000 + \$1,440,000 = \$1,445,880$$

The minimum order quantity is 200 units yet again because the overall annual cost of $1,445,880 is less than when ordering 188 units, which has an overall cost of $1,566,119.

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