

CHAPTER 9

DISCUSSION QUESTIONS

- Q9-1. The most frequently used documents in the procurement and use of materials are purchase requisitions, purchase orders, receiving reports, materials requisitions, bills of materials, and materials ledger records.
- Q9-2. The invoice should be routed to the Accounting Department immediately upon receipt. A copy of the purchase order and a copy of the receiving report with an inspection report should be compared by the accounting clerk. When the invoice is found to be correct in all aspects or has been adjusted for errors or rejects, the accounting clerk approves the invoice, attaches it to the underlying documents if they are in hard-copy form, and sends these documents to another clerk for the preparation of the voucher.
- Q9-3. Inventoriable cost should include all costs incurred to get the product ready for sale to the customer. It includes not only the net purchase price but also the other associated costs, such as freight-in, incurred up to the time products are ready for sale to the customer.
- Q9-4. No, administration costs are assumed to expire with the passage of time and do not attach to the product. Furthermore, administrative costs do not relate directly to inventories, but are incurred for the benefit of all functions of the business.
- Q9-5. The three key questions to answer in designing an inventory control system are:
(a) how much to order—economic order quantity
(b) when to order—order point
(c) safety stock required
- Q9-6. The firm benefits from these techniques by having a consistent, standardized approach to its inventory management. Inventory costs and service to customers will be optimally balanced.
- Q9-7. The purpose of an economic order quantity model is to determine the optimum quantity to order or produce when filling inventory needs. The optimum quantity is defined as that quantity that minimizes the cost of inventory management.
- Q9-8. The decision concerning how much to order or produce at a given time involves a compromise between inventory carrying costs and ordering or setup costs. Examples of inventory carrying costs are: interest on the money invested in inventories that could have been invested elsewhere, property tax and insurance, warehousing or storage, handling, deterioration, and obsolescence. Ordering costs include the cost of preparing the requisition and purchase order, receiving the order, and accounting for the order. Setup costs involve the costs of setting up equipment to make the actual production runs. For all these costs, only those that vary with activity are relevant to the EOQ model.
- Q9-9. The consequences of maintaining inadequate inventory levels include higher purchasing, handling, and transportation costs, loss of quantity discounts, production disruptions, inflation-related price increases when purchases are deferred, and lost sales and customer goodwill.
- Measurement of the costs of lost orders and lost repeat business is not easy because measurement may be largely subjective. On the other hand, the other factors listed can be measured with fair certainty and greater ease.
- Q9-10. In computing optimum production run size, CO represents an estimate of the setup cost and CU is the variable manufacturing cost per unit.
- Q9-11. (a) The order point is the low point of stock level that, when reached, means a replenishing order should be placed.
(b) Lead time is the interval between placing an order and delivery of the ordered goods.
(c) Safety stock is the minimum inventory that provides a cushion against reasonably expected maximum demands and against variations in lead time.
- Q9-12. Materials requirements planning (MRP) is a computer simulation that integrates each product's bill of materials, inventory status, and manufacturing process into a feasible production plan.

Q9-13. Effective utilization of capital, which includes investment in inventory, is the responsibility of general management; therefore, the primary interest is in financial control. Although general or top-level management is interested in providing customers with good products and services, the scheduling of production involves unit control primarily and is the responsibility of production and purchasing departments.

Q9-14. In the control of materials, the opposing needs are the maintenance of an inventory of sufficient size and diversity for efficient operations, and the maintenance of an investment in inventory at a level that will maximize earnings and minimize costs.

Q9-15. When a relatively few materials items account for a considerable portion of total inventory investment, selective control is indicated. High value items would be under tight control, while low-value items would be under simple physical controls.

Automatic control refers to ordering when a materials record shows that the balance on hand has dropped to the order point. At this time, the quantity to order is automatic, having been determined by balancing the cost to order with the cost to carry inventory. Automatic control is most effective in companies that use an EDP system.

Q9-16. Appendix The average cost method assumes that each batch taken from the storeroom is composed of uniform quantities from each shipment in stock at the date of issue. The fifo method is based on the assumption that the first goods received are the first issued. The lifo method is based on the assumption that the latest goods received are the first issued.

Q9-17. Appendix In an inflationary economy, lifo provides a better matching of current costs with current revenue because costs of inventory issued are at more recent purchase prices. Net cash inflow is generally increased because taxable income is generally decreased, resulting in payment of lower income tax.

Q9-18. Appendix Fifo. The higher costs of the earlier purchases would be charged against cost of goods sold.

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Q9-19. Appendix (a) fifo
(b) fifo
(c) fifo
(d) lifo
(e) fifo
(f) lifo

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EXERCISES

E9-1

(1) Freight allocated to materials based on cost:

$$\frac{\$280}{\$17,500} = \$0.016 \text{ per dollar of cost}$$

Part A:	\$ 8,600	×	\$0.016	=	\$137.60
Part B:	5,060	×	.016	=	80.96
Part C:	<u>3,840</u>	×	.016	=	<u>61.44</u>
	<u>\$17,500</u>				<u>\$280.00</u>

(2) Freight allocated to materials based on shipping weight:

$$\frac{\$280}{1\,400 \text{ kilograms}} = \$0.20$$

Part A:	630kg	×	\$0.20	=	\$126
Part B:	440	×	.20	=	88
Part C:	<u>330</u>	×	.20	=	<u>66</u>
	<u>1 400kg</u>				<u>\$280</u>

E9-2

Units

September production		4,200
October production		4,400
November production		4,700
Desired Inventory, November 30		<u>3,600</u>
Total to be provided		16,900
Quantity on hand, September 1	4,400	
On order for September delivery	3,600	
On order for October delivery	<u>4,500</u>	<u>12,500</u>
Quantity to order for November delivery		<u>4,400</u>

E9-3

(1) Forecast usage:		
January	4,800 units	
February	5,000	
March	<u>5,600</u>	
	15,400 units	
Desired March 31 inventory level		
(6,000 × 80%)	<u>4,800</u>	
Total to be provided		20,200 units
Scheduled supply:		
January 1 inventory	6,000 units	
On order:		
January delivery	3,800	
February delivery	<u>4,600</u>	14,400
Quantity to order for March delivery		<u>5,800</u> units
(2)		
January 1 inventory	6,000 units	
On order for January and February delivery	<u>8,400</u>	
		14,400 units
Forecast usage—January and February	<u>9,800</u>	
(a) March 1 inventory	4,600 units	
To order for March delivery (requirement (1))	<u>5,800</u>	
		10,400 units
Forecast usage—March	<u>5,600</u>	
(b) March 31 inventory	<u>4,800</u>	units

E9-4

$$(1) \quad EOQ = \sqrt{\frac{2 \times 100 \times \$5}{\$55 \times 15\%}} = \sqrt{\frac{1,000}{8.25}} = \sqrt{121} = 11 \text{ units}$$

$$(2) \quad EOQ = \sqrt{\frac{2 \times 2,250 \times \$12}{\$3 \times 20\%}} = \sqrt{\frac{54,000}{.60}} = \sqrt{90,000} = 300 \text{ Ajets}$$

$$(3) \quad EOQ = \sqrt{\frac{2 \times (1,200 \times 3) \times \$200}{\$25}} = \sqrt{\frac{1,440,000}{25}} \\ = \sqrt{57,600} = 240 \text{ units}$$

E9-4 (Continued)

$$(4) \quad (a) \quad \text{EOQ} = \sqrt{\frac{2 \times 25,000 \times \$20}{\$8 \times 25\%}} = \sqrt{\frac{1,000,000}{2}} = \sqrt{500,000} \\ = 707 \text{ cartons}$$

$$(b) \quad \frac{\text{Annual required units}}{\text{Economic order quantity}} = \frac{25,000}{707} = 35 \text{ orders per year}$$

$$\frac{365 \text{ days}}{35 \text{ orders}} = 10.4 \text{ or every 10 days orders should be placed}$$

$$(5) \quad (a) \quad \text{EOQ} = \sqrt{\frac{2 \times 18,000 \times \$15}{\$15 \times 20\%}} = \sqrt{\frac{540,000}{3}} \\ = \sqrt{180,000} = 424$$

$$(b) \quad \frac{18,000}{424} = 42.45 \text{ or approximately 42 orders per year}$$

$$\frac{365 \text{ days}}{42 \text{ orders}} = 8.7 \text{ or approximately one order every 9 days}$$

$$(c) \quad \text{EOQ} = \sqrt{\frac{2 \times 18,000 \times \$15}{\$6 \times 20\%}} = \sqrt{\frac{540,000}{1.20}} \\ = \sqrt{450,000} = 671$$

$$(6) \quad (a) \quad \text{EOQ} = \sqrt{\frac{2 \times 18,000 \times \$15}{\$7.50 \times 20\%}} = \sqrt{\frac{540,000}{1.5}} = \sqrt{360,000} \\ = 600 \text{ units}$$

$$(b) \quad \frac{18,000}{600} = 30 \text{ orders per year} \\ \frac{365 \text{ days in year}}{30 \text{ orders per year}} = 12.167 \text{ or approximately one order every 12 days}$$

$$(c) \quad \text{EOQ} = \sqrt{\frac{2 \times 18,000 \times \$15}{\$2.50 \times 20\%}} = \sqrt{\frac{540,000}{.50}} = \sqrt{1,080,000} \\ = 1,039 \text{ units}$$

E9-4 (Continued)

$$(7) \quad (a) \quad \text{EOQ} = \sqrt{\frac{2 \times 48,000 \times \$10}{\$20 \times 12\%}} = \sqrt{\frac{960,000}{2.40}} = \sqrt{400,000}$$

$$= 632 \text{ dozen baseballs}$$

$$\frac{*.40}{\$20} + 10\% \text{ return on investment} = 12\%$$

$$(b) \quad \text{Annual ordering cost} = \frac{\text{RU} \times \text{CO}}{\text{EOQ}} = \frac{48,000 \times \$10}{800} = \$600$$

$$\text{Annual carrying cost} = \frac{\text{CU} \times \text{CC} \times \text{EOQ}}{2}$$

$$= \frac{\$20 \times 12\% \times 800}{2} = \underline{960}$$

$$\text{Total annual inventory cost to sell 48,000 dozen baseballs} \dots\dots\dots \underline{\underline{\$1,560}}$$

$$(8) \quad \text{EOQ} = \sqrt{\frac{2 \times 5,000 \times \$1,000}{\$8 \times 20\%}} = \sqrt{\frac{10,000,000}{1.6}}$$

$$= \sqrt{6,250,000} = 2,500 \text{ columns}$$

$$(9) \quad (a) \quad \text{EOQ} = \sqrt{\frac{2 \times 12,000 \times \$16}{\$9 \times 20\%}} = \sqrt{\frac{384,000}{1.80}} = \sqrt{213,333}$$

$$= 462 \text{ units}$$

(b) The frequency of order placement:

$$\frac{12,000 \text{ annual usage}}{462 \text{ EOQ}} = 26 \text{ orders per year}$$

$$\frac{365 \text{ days}}{26 \text{ orders}} = 14 \text{ days}$$

$$(c) \quad \text{EOQ} = \sqrt{\frac{2 \times 8,000 \times \$16}{\$9 \times 22\%}} = \sqrt{\frac{256,000}{1.98}} = \sqrt{129,293}$$

$$= 360 \text{ units}$$

E9-4 (Concluded)

$$(10) \quad (a) \quad EOQ = \sqrt{\frac{2 \times 500 \times \$6}{\$10 \times .25}} = \sqrt{\frac{6,000}{2.50}} = \sqrt{2,400} = 49 \text{ units}$$

$$\frac{500 \times \$6}{49} + \frac{\$10 \times .25 \times 49}{2}$$

$$= \$61.22 + \$61.25 = \$122.47 \text{ total ordering and carrying cost per year}$$

$$(b) \quad 49 + (49 \times .10) = 54 \text{ units per order}$$

$$\frac{500 \times \$6}{54} + \frac{\$10 \times .25 \times 54}{2} = \$55.56 + \$67.50 = \$123.06$$

The effect is small because the total cost curve is relatively flat around the optimum level.

- (11) To compare the two alternatives, the carrying cost and the production initiation cost must be calculated for each alternative. These two amounts are calculated as follows:

Carrying cost = Annual cost of carrying (20%) \times manufacturing cost (\$50) \times average annual inventory.

Production initiation cost = Number of runs \times cost to initiate a run (\$300)

Current situation: 2 production runs of 3,000 units per run

Average inventory: $3,000 \text{ units} \div 2 = 1,500 \text{ units}$

Present costs:

Carrying cost $(.20 \times \$50 \times 1,500)$	\$15,000
Production initiation cost $(2 \times \$300)$	600
	<u>\$15,600</u>

Proposed situation:

The EOQ formula can be used to determine production run quantities by substituting cost per order with production initiation cost.

Production quantity:

$$\sqrt{\frac{2 \times 6,000 \times \$300}{\$50 \times .2}}$$

$$= \sqrt{\frac{3,600,000}{10}} = \sqrt{360,000} = 600 \text{ units}$$

Average inventory: $600 \div 2 = 300 \text{ units}$

Number of runs: $6,000 \div 600 = 10 \text{ runs}$

Proposed costs:	Carrying cost $(.20 \times \$50 \times 300)$	\$3,000
	Production initiation cost $(10 \times \$300)$	3,000
		<u>\$6,000</u>
	Expected annual savings	<u>\$9,600</u>

E9-5

- (1)
- $$EOQ = \sqrt{\frac{2 \times (12 \times 1,500) \times \$50}{\$3 \times .40}} = \sqrt{\frac{1,800,000}{1.20}} = \sqrt{1,500,000} = 1,225 \text{ units}$$
- (2) Lots of 2,000 units should be ordered, based on the following computations:

QUANTITATIVE DATA

Order size.....	1,225 units	2,000 units
Number of orders per year.....	14.7	9
Average inventory	612.5 units	1,000 units

COST DATA

Cost of placing orders at \$50	\$735	\$450
Cost of carrying inventory:		
612.5 × \$3.00 × .40.....	735	
1,000 × \$2.85 × .40.....		1,140
Discounts lost (12 × 1,500 × \$3 × .05).....	<u>2,700</u>	
Cost to order and carry	<u>\$4170</u>	<u>\$1,590</u>

E9-6

- (1) Ordering and carrying costs under current policy:

$$\left(\frac{12}{2} \times \$380 \right) + \left(\$1 \times \frac{500}{2} \right) = \$2,280 + \$250 = \$2,530$$

- (2) Economic order quantity and the related ordering and carrying costs:

$$\sqrt{\frac{2 \times 3,000 \times \$380}{\$1}} = \sqrt{2,280,000} = 1,510 \text{ units}$$

$$\left(\frac{3,000}{1,510} \times \$380 \right) + \left(\$1 \times \frac{1,510}{2} \right) = \$755 + \$755 = \$1,510 \text{ related ordering and carrying costs}$$

E9-6 (Concluded)

- (3) The company should decide to order in quantities of 3,000 units, based on the following computations:

QUANTITATIVE DATA

Order size.....	1,510 units	3,000 units
Number of orders per year.....	1.9868	1
Average inventory.....	755 units	1,500 units

COST DATA

Cost of placing orders at \$380.....	\$ 755	\$ 380
Cost of carrying inventory:		
\$1 × 755.....	755	
(\$1 – \$.05) × 1,500.....		1,425
Discount lost (3,000 × \$5 × .05).....	<u>750</u>	
Cost to order and carry.....	<u>\$2,260</u>	<u>\$1,805</u>

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E9-7 9,600 ÷ 240 = 40 units daily usage

Normal lead time usage (20 days × 40 units).....	800
Safety stock ((35 days – 20 days) × 40 units).....	<u>600</u>
Order point.....	<u>1,400</u>

E9-8

- (1) Maximum use per day..... 600 units
 Normal use per day..... 500
 Safety stock (maximum)..... 100 units × 5 days of lead time = 500 units
- (2) Normal use per day (500) × days of lead time (5)..... 2,500 units
 Safety stock..... 500
 Order point..... 3,000 units
- (3) Order point..... 3,000 units
 Normal use during lead time (500 × 5)..... 2,500
 On hand at time order received..... 500 units
 Quantity ordered..... 3,500
 Normal maximum inventory..... 4,000 units

E9-8 (Concluded)

(4)	Order point	3,000 units
	Minimum use during lead time (100×5).....	<u>500</u>
	On hand at time order received	2,500 units
	Quantity ordered	<u>3,500</u> units
	Absolute maximum inventory	<u>6,000</u> units

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E9-9

(1)	Maximum use per day.....	200 units
	Normal use per day.....	<u>120</u>
	Safety stock (maximum).....	80 units \times 12 days of lead time = 960 units
(2)	Normal use per day (120) \times days of lead time (12)	1,440 units
	Safety stock	<u>960</u>
	Order point	<u>2,400</u> units
(3)	Order point	2,400 units
	Normal use during lead time (120×12)	<u>1,440</u>
	On hand at time order received	960 units
	Quantity ordered	<u>3,000</u>
	Normal maximum inventory	<u>3,960</u> units
(4)	Order point	2,400 units
	Minimum use during lead time (80×12).....	<u>960</u>
	On hand at time order received	1,440 units
	Quantity ordered	<u>3,000</u>
	Absolute maximum inventory	<u>4,440</u> units

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E9-10

Safety Stock Level (Units)	Annual Number of Orders	Probability of Stockout	Expected Annual Stockouts	Cost per Stockout	Annual Stockout Cost	Annual Safety Stock Carrying Cost (\$1 per unit)	Annual Combined Cost
10	5	.4	2	\$75	\$150.00	\$10	\$160.00
20	5	.2	1	75	75.00	20	95.00
40	5	.08	.4	75	30.00	40	70.00
80	5	.04	.2	75	15.00	80	95.00

The recommended level of safety stock is 40 units.

E9-11 APPENDIX

(1) Average costing:

Date	Received			Issued			Inventory		
	Quan- tity	Unit Cost	Total Cost	Quan- tity	Unit Cost	Total Cost	Quan- tity	Unit Cost	Balance
Jan. 1							500	\$1.20	\$ 600
6	200	\$1.25	\$250				700	1.21	850
10	400	1.30	520				1,100	1.25	1,370
15				560	\$1.25	\$700	540	1.25	670
25	500	1.40	700				1,040	1.32	1,370
27				400	1.32	528	640	1.32	842

(2) Fifo costing:

Date	Received			Issued			Inventory			
	Quan- tity	Unit Cost	Total Cost	Quan- tity	Unit Cost	Total Cost	Quan- tity	Unit Cost	Total Cost	Balance
Jan. 1							500	\$1.20	\$600	\$ 600
6	200	\$1.25	\$250				500	1.20	600	
							200	1.25	250	850
10	400	1.30	520				500	1.20	600	
							200	1.25	250	
							400	1.30	520	1,370
15				500	\$1.20	\$600	140	1.25	175	
				60	1.25	75	400	1.30	520	695
25	500	1.40	700				140	1.25	175	
							400	1.30	520	
							500	1.40	700	1,395
27				140	1.25	175	140	1.30	182	
				260	1.30	338	500	1.40	700	882

E9-11 APPENDIX (Concluded)

(3) Lifo costing:

Date	Received			Issued			Inventory			
	Quan- tity	Unit Cost	Total Cost	Quan- tity	Unit Cost	Total Cost	Quan- tity	Unit Cost	Total Cost	Balance
Jan. 1							500	\$1.20	\$600	\$ 600
6	200	\$1.25	\$250				500	1.20	600	
							200	1.25	250	850
10	400	1.30	520				500	1.20	600	
							200	1.25	250	
							400	1.30	520	1,370
15				400	\$1.30	\$520	500	1.20	600	
				160	1.25	200	40	1.25	50	650
25	500	1.40	700				500	1.20	600	
							40	1.25	50	
							500	1.40	700	1,350
27				400	1.40	560	500	1.20	600	
							40	1.25	50	
							100	1.40	140	790

PROBLEMS

P9-1

- (1)
$$\frac{\text{Budgeted acquisition cost}}{\text{Budgeted purchases}} = \frac{\$ 18,000}{\$144,000} = 12.5\% \text{ applied acquisition costing rate for the month}$$
- (2)
$$\begin{array}{l} \$148,500 \text{ net purchases} \times 12.5\% \text{ applied} \\ \text{acquisition} = \$18,562.50 \text{ applied cost added} \\ \text{costing} \qquad \qquad \qquad \text{to materials} \\ \text{rate} \qquad \qquad \qquad \text{purchased during} \\ \qquad \qquad \qquad \text{the month} \end{array}$$
- (3) The overapplied acquisition cost of \$362.50 (\$18,562.50 applied cost – \$18,200 actual cost) should be credited to Cost of Goods Sold or prorated to Cost of Goods Sold and inventories.

P9-2

- (1)
$$\text{EOQ} = \sqrt{\frac{2 \times 24,000 \times \$1.20}{\$10 \times 10\%}} = \sqrt{\frac{57,600}{1}} = 240 \text{ units}$$
- (2)
$$\frac{\text{Annual requirements}}{\text{EOQ}} = \frac{24,000}{240} = 100 \text{ orders needed per year}$$
- (3)
$$\begin{aligned} & \frac{\text{EOQ}}{2} \left(\frac{\text{Carrying cost}}{\text{per unit}} \right) + \frac{\text{Annual requirements}}{\text{EOQ}} \left(\frac{\text{Ordering cost}}{\text{per order}} \right) \\ &= \frac{240}{2} (\$10 \times 10\%) + \frac{24,000}{240} (\$1.20) = \$120 + \$120 = \$240 \text{ total cost of} \\ & \qquad \qquad \qquad \text{ordering and carrying} \\ & \qquad \qquad \qquad \text{blades for the year} \end{aligned}$$
- (4) The next order should be placed in three days. This conclusion is arrived at as follows:
- (a) Number of days' supply in each order:
- $$\frac{\text{Days in year}}{\text{Orders per year}} = \frac{360}{100} = 3.6 \text{ days}$$
- (b) Number of days' supply left in inventory:
- $$\frac{\text{Units in inventory}}{\text{EOQ}} \times \text{Days' supply in each order} = \frac{400}{240} \times 3.6 \text{ days} = 6 \text{ days' supply left}$$
- (c) Days before next order should be placed:
- $$(\text{Days' supply left}) - (\text{Delivery lead time}) = 6 \text{ days} - 3 \text{ days} = 3$$

P9-2 (Concluded)

- (5) Some of the difficulties most firms have in attempting to apply the EOQ formula to inventory problems are:
- (a) Inventory is not always used at a constant rate; the constant usage assumption is implicit in the EOQ formula.
 - (b) The EOQ formula requires estimates of (1) annual requirements, (2) ordering cost, (3) purchase price per unit, and (4) cost of carrying inventories. These estimates may be extremely difficult to obtain with accuracy.

P9-3

(1)	Normal use per day (200) × days of lead time (10)	2,000 units
	Safety stock	<u>300</u>
	Order point	<u>2,300</u> units
(2)	Order point	2,300 units
	Normal use during lead time (200 × 10)	<u>2,000</u>
	On hand at time order received	300 units
	Quantity ordered	<u>4,000</u>
	Normal maximum inventory	<u>4,300</u> units
(3)	Order point	2,300 units
	Minimum use during lead time (150 × 10)	<u>1,500</u>
	On hand at time order received	800 units
	Quantity ordered	<u>4,000</u>
	Absolute maximum inventory	<u>4,800</u> units

- (4) Let S equal cost of storing one unit for one year.

$$\begin{aligned}
 \text{EOQ} &= \sqrt{\frac{2 \times \text{RU} \times \text{CO}}{\text{CU} \times \text{CC}}} \\
 4,000 &= \sqrt{\frac{2 \times (200 \times 250) \times \$80}{S}} \\
 4,000 &= \sqrt{\frac{8,000,000}{S}} \\
 16,000,000 &= \frac{8,000,000}{S} \\
 S &= \frac{8,000,000}{16,000,000} = \$0.50
 \end{aligned}$$

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P9-4

<div>Units of Safety Stock</div>	<div>Carrying Cost per Unit</div>	<div>Safety Stock Carrying Cost</div>	<div>Orders per Year</div>	<div>Probability of Running out of Safety Stock</div>	<div>Stockout Cost per Occurrence</div>	<div>Stockout Cost</div>	<div>Total Cost</div>
10	\$3	\$ 30	5	50%	\$80	\$200	\$230
20	3	60	5	40	80	160	220
30	3	90	5	30	80	120	210
40	3	120	5	20	80	80	200
50	3	150	5	10	80	40	190
55	3	165	5	3	80	12	177
							lowest cost

P9-5 APPENDIX

(1) Fifo:

Date	Received			Issued			Inventory			
	Quan- tity	Unit Cost	Total Cost	Quan- tity	Unit Cost	Total Cost	Quan- tity	Unit Cost	Total Cost	Balance
March 1							750	\$20.00	\$15,000	\$15,000
3	400	\$19.50	\$ 7,800				750	20.00	15,000	
							400	19.50	7,800	22,800
5				600	\$20.00	\$12,000	150	20.00	3,000	
							400	19.50	7,800	10,800
12	350	21.50	7,525				150	20.00	3,000	
							400	19.50	7,800	
							350	21.50	7,525	18,325
15				150	20.00	3,000	50	19.50	975	
				350	19.50	6,825	350	21.50	7,525	8,500
18	500	22.00	11,000				50	19.50	975	
							350	21.50	7,525	
							500	22.00	11,000	19,500
22				50	19.50	975				
				350	21.50	7,525	500	22.00	11,000	11,000
26	550	21.00	11,550				500	22.00	11,000	
							550	21.00	11,550	22,550
28				500	22.00	11,000				
				150	21.00	3,150	400	21.00	8,400	8,400
31	200	20.00	4,000				400	21.00	8,400	
							200	20.00	4,000	12,400

P9-5 APPENDIX (Continued)

(2) Lifo:

Date	Received			Issued			Inventory			
	Quan- tity	Unit Cost	Total Cost	Quan- tity	Unit Cost	Total Cost	Quan- tity	Unit Cost	Total Cost	Balance
March 1							750	\$20.00	\$15,000	\$15,000
3	400	\$19.50	\$ 7,800				750	20.00	15,000	
							400	19.50	7,800	22,800
5				400	\$19.50	\$ 7,800				
				200	20.00	4,000	550	20.00	11,000	11,000
12	350	21.50	7,525				550	20.00	11,000	
							350	21.50	7,525	18,525
15				350	21.50	7,525				
				150	20.00	3,000	400	20.00	8,000	8,000
18	500	22.00	11,000				400	20.00	8,000	
							500	22.00	11,000	19,000
22				400	22.00	8,800	400	20.00	8,000	
							100	22.00	2,200	10,200
26	550	21.00	11,550				400	20.00	8,000	
							100	22.00	2,200	
							550	21.00	11,550	21,750
28				550	21.00	11,550				
				100	22.00	2,200	400	20.00	8,000	8,000
31	200	20.00	4,000				400	20.00	8,000	
							200	20.00	4,000	12,000

P9-5 APPENDIX (Concluded)

(3) Average:

Date	Received			Issued			Inventory		
	Quan- tity	Unit Cost	Total Cost	Quan- tity	Unit Cost	Total Cost	Quan- tity	Unit Cost	Balance
March 1							750	\$20.000	\$15,000.00
3	400	\$19.50	\$ 7,800				1,150	19.826	22,800.00
5				600	\$19.826	\$11,895.60	550	19.826	10,904.40
12	350	21.50	7,525				900	20.477	18,429.40
15				500	20.477	10,238.50	400	20.477	8,190.90
18	500	22.00	11,000				900	21.323	19,190.90
22				400	21.323	8,529.20	500	21.323	10,661.70
26	550	21.00	11,550				1,050	21.154	22,211.70
28				650	21.154	13,750.10	400	21.154	8,461.60
31	200	20.00	4,000				600	20.769	12,461.60

P9-6 APPENDIX

- (1) Cost of the ending inventory under the fifo method when a periodic inventory system is used:

100 units	@	\$17	=	\$1,700
100	@	14	=	1,400
100	@	12	=	<u>1,200</u>
				<u><u>\$4,300</u></u>

- (2) Cost of the ending inventory under the lifo method:

- (a) When a periodic inventory system is used:

200 units	@	\$10	=	\$2,000
100	@	11	=	<u>1,100</u>
				<u><u>\$3,100</u></u>

- (b) When a perpetual inventory system is used:

Date	Received			Issued			Inventory			
	Quan- tity	Unit Cost	Total Cost	Quan- tity	Unit Cost	Total Cost	Quan- tity	Unit Cost	Total Cost	Balance
Jan. 1							200	\$10	\$2,000	\$2,000
12	100	\$11	\$1,100				200	10	2,000	
							100	11	1,100	3,100
Feb. 1				100	\$11	\$1,100				
				100	10	1,000	100	10	1,000	1,000
April 16	200	12	2,400				100	10	1,000	
							200	12	2,400	3,400
May 1				100	12	1,200	100	10	1,000	
							100	12	1,200	2,200
July 15	100	14	1,400				100	10	1,000	
							100	12	1,200	
							100	14	1,400	3,600
Nov. 10				100	14	1,400	100	10	1,000	
							100	12	1,200	2,200
Dec. 5	100	17	1,700				100	10	1,000	
							100	12	1,200	
							100	17	1,700	3,900

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P9-7 APPENDIX

(1) (a) Average method:

Date	Received			Issued			Inventory		
	Quan- tity	Unit Cost	Total Cost	Quan- tity	Unit Cost	Total Cost	Quan- tity	Unit Cost	Balance
Jan. 2	2,000	\$5	\$10,000				2,000	\$5.000	\$10,000.00
15				500	\$5.000	\$2,500.00	1,500	5.000	7,500.00
31				700	5.000	3,500.00	800	5.000	4,000.00
Feb. 2	1,200	6	7,200				2,000	5.600	11,200.00
15				600	5.600	3,360.00	1,400	5.600	7,840.00
28				900	5.600	5,040.00	500	5.600	2,800.00
Mar. 2	1,500	8	12,000				2,000	7.400	14,800.00
15				600	7.400	4,440.00	1,400	7.400	10,360.00
31				800	7.400	5,920.00	600	7.400	4,440.00
Apr. 2	1,900	7	13,300				2,500	7.096	17,740.00
15				700	7.096	4,967.20	1,800	7.096	12,772.80
30				700	7.096	4,967.20	1,100	7.096	7,805.60

P9-7 APPENDIX (Continued)

(b) First-in, first-out method:

Date	Received			Issued			Inventory			
	Quan- tity	Unit Cost	Total Cost	Quan- tity	Unit Cost	Total Cost	Quan- tity	Unit Cost	Total Cost	Balance
Jan. 2	2,000	\$5	\$10,000				2,000	\$5		\$10,000
15				500	\$5	\$2,500	1,500	5		7,500
31				700	5	3,500	800	5		4,000
Feb. 2	1,200	6	7,200				800	5	\$ 4,000	
15				600	5	3,000	1,200	6	7,200	11,200
28				200	5	1,000	200	5	1,000	
				700	6	4,200	1,200	6	7,200	8,200
Mar. 2	1,500	8	12,000				500	6	3,000	
15				500	6	3,000	1,500	8	12,000	15,000
31				100	8	800	1,400	8		11,200
				800	8	6,400	600	8		4,800
Apr. 2	1,900	7	13,300				600	8	4,800	
15				600	8	4,800	1,900	7	13,300	18,100
30				100	7	700	1,800	7		12,600
				700	7	4,900	1,100	7		7,700

P9-7 APPENDIX (Concluded)

(c) Last-in, first-out method:

Date	Received			Issued			Inventory			
	Quan- tity	Unit Cost	Total Cost	Quan- tity	Unit Cost	Total Cost	Quan- tity	Unit Cost	Total Cost	Balance
Jan. 2	2,000	\$5	\$10,000				2,000	\$5		\$10,000
15				500	\$5	\$2,500	1,500	5		7,500
31				700	5	3,500	800	5		4,000
Feb. 2	1,200	6	7,200				800	5	\$ 4,000	
15				600	6	3,600	1,200	6	7,200	11,200
							800	5	4,000	
							600	6	3,600	7,600
28				600	6	3,600				
				300	5	1,500	500	5		2,500
Mar. 2	1,500	8	12,000				500	5	2,500	
15				600	8	4,800	1,500	8	12,000	14,500
							500	5	2,500	
							900	8	7,200	9,700
31				800	8	6,400	500	5	2,500	
							100	8	800	3,300
Apr. 2	1,900	7	13,300				500	5	2,500	
15				700	7	4,900	100	8	800	
							1,200	7	8,400	11,700
30				700	7	4,900	500	5	2,500	
							100	8	800	
							500	7	3,500	6,800

(2)

	Average	Fifo	Lifo
Sales (5,500 units @ \$10).....	\$55,000.00	\$55,000	\$55,000
Cost of goods sold:			
Purchases.....	\$42,500.00	\$42,500	\$42,500
Less inventory, April 30.....	<u>7,805.60</u>	<u>7,700</u>	<u>6,800</u>
	\$34,694.40	\$34,800	\$35,700
Gross profit	<u>\$20,305.60</u>	<u>\$20,200</u>	<u>\$19,300</u>

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CASES

C9-1

- (1) (a) Topp Desk Company would be attempting to minimize total setup cost and total carrying cost.

(b) Variable manufacturing costs per unit:

Direct materials	\$ 30
Direct labor	14
Variable factory overhead	<u>6</u>
Total variable manufacturing cost per unit	\$ 50
Number of desks destroyed.....	<u>× 12</u>
Total setup cost.....	<u><u>\$600</u></u>

Optimum production run:

$$\sqrt{\frac{2 \times 18,000 \text{ units} \times \$600 \text{ setup cost}}{\$50 * \times 10.8\%}} = \sqrt{\frac{21,600,000}{5.40}} =$$

$$\sqrt{4,000,000} = 2,000 \text{ desks}$$

*Variable manufacturing cost per unit

- (c) Number of production runs per year:
- $$\frac{\text{Annual demand}}{\text{Optimum production run}} = \frac{18,000}{2,000} = 9 \text{ production runs}$$

- (2) (a) The following factors affect the desired size of the safety stock for any inventory item.

- (1) Variability of product demand
- (2) Variability of lead time
- (3) Stockout costs
- (4) Carrying costs

- (b) The minimum safety stock level that could be maintained without being worse off than being unable to fill orders equal to an average day's demand is the level at which the safety stock carrying cost equals the cost of a stockout, i.e.,

$$\frac{\text{Stockout cost}}{\text{Per unit carrying cost}} = \frac{\$2,295}{\$50 \times 10.8\%} = \frac{\$2,295}{\$5.40} = 425 \text{ desks}$$

C9-2

(1) Equipment Maintenance Department costs:			
Salaries ($2 \times 5 \times \$9$).....	\$ 90.00		
Employee benefits ($\$90 \times 20\%$).....	<u>18.00</u>	\$108.00	
Production department costs:			
Salaries ($5 \times 5 \times \$7.50$).....	\$187.50		
Variable factory overhead:			
Direct labor hours base ($25 \times \$2.75$)	68.75		
Machine hours base ($1 \times \$5$)	<u>5.00</u>	261.25	
Direct materials ($\$200 - \50).....		<u>150.00</u>	
Estimate of Model JE 40 setup costs		<u>\$519.25</u>	

Explanation of costs:

- (a) The full cost of the maintenance salaries and employee benefits is included because the \$10.80 [$\$9.00 + (\$9.00 \times 20\%)$] incurred per labor hour is incurred solely for the purpose of effecting the changeover.
- (b) The other costs of the Equipment Maintenance Department are not included in the estimate because they are fixed costs of the department and will be incurred regardless of the maintenance workers' activities.
- (c) The salaries of the 5 production workers for the full 5 hours each are included in the setup cost because they must be in attendance all of the time, though they are needed only part of the time. If the workers could have been assigned to other jobs during the changeover, then the full amount would not be charged to setup.
- (d) The variable factory overhead costs of the production department applied on the direct labor hours base are incurred as a function of the direct labor hours; therefore, a full 25 hours of cost are assigned to the setup cost.
- (e) The variable factory overhead costs of the production department applied on the machine hours base are incurred as a function of the operation of the machinery; therefore, 1 hour is assigned to setup cost for the 1 hour the machinery is used in testing.
- (f) All production department fixed factory overhead costs (both those applied on the basis of direct labor and those applied on the basis of machine hours) are not included in the setup cost because they would be incurred regardless of the activity in the department.
- (g) The net materials cost of \$150 is included because it represents the unsalvageable portion of the materials used for the setup and not for the production of a salable desk.

C9-2 (Concluded)

- (2) The cost items that would be included in an estimate of Pointer Furniture Company's cost of carrying desks in inventory include:
- (a) All costs related to warehousing and handling the desks in inventory that vary in amount by the number of items stored.
 - (b) The cost of the funds committed to the investment in inventory.

C9-3

- (1) Circumstances necessary to shift raw materials inventory carrying costs to the supplier include:
- (a) Reliability of the supplier. Will the supplier ship products on a more rigorous timetable and be willing to keep inventory within its own storage facilities?
 - (b) Adequate alternative supply sources. A large number of qualified alternative suppliers will increase the possibility for favorable contract terms.
 - (c) Careful control of inventory requirements. Are production schedules clearly defined to reduce the potential for stockouts?
- (2) Circumstances necessary to shift finished goods inventory carrying costs to the customer include:
- (a) Understanding customers. Are customers willing to take the risk of inventory storage for an extended period of time?
 - (b) Closer production planning. Can production schedules be refined to such an extent that delays in the sale and distribution of the finished inventory are minimized?
 - (c) Careful control of inventory requirements. Are customer orders carefully monitored and anticipated to reduce the probability of finished goods stockouts?