

PROBLEMS

1. a. Determine an A-B-C classification for these items:

Item	Unit Cost	Annual Volume (00)
1	\$100	25
2	80	30
3	15	60
4	50	10
5	11	70
6	60	85
7	10	60

- b. Find the EOQ given this information: $D = 4,500$ units/year, $S = \$36$, and $H = \$10$ per unit per year.
 c. Find the economic production quantity given this information.

$D = 18,000$ units/year, $S = \$100$, $H = \$40$ per unit per year, $p = 120$ units per day, and $u = 90$ units/day

2. a. The following table contains figures on the monthly volume and unit costs for a random sample of 16 items from a list of 2,000 inventory items at a health care facility. Develop an A-B-C classification for these items.

Item	Unit Cost	Usage	Item	Unit Cost	Usage
K34	\$10	200	F99	20	60
K35	25	600	D45	10	550
K36	36	150	D48	12	90
M10	16	25	D52	15	110
M20	20	80	D57	40	120
Z45	80	200	N08	30	40
F14	20	300	P05	16	500
F95	30	800	P09	10	30

- b. Given the monthly usages in the following table, classify the items in A, B, and C categories according to dollar usage.

Item	Usage	Unit Cost
4021	90	\$1,400
9402	300	12
4066	30	700
6500	150	20
9280	10	1,020
4050	80	140
6850	2,000	10
3010	400	20
4400	5,000	5

- c. Determine the percentage of items in each category and the annual dollar value for each category for part b.
3. A bakery buys flour in 25-pound bags. The bakery uses 1,215 bags a year. Ordering cost is \$10 per order. Annual carrying cost is \$75 per bag.
- Determine the economic order quantity.
 - What is the average number of bags on hand?
 - How many orders per year will there be?
 - Compute the total cost of ordering and carrying flour.
 - If holding costs were to increase by \$9 per year, how much would that affect the minimum total annual cost?
4. A large law firm uses an average of 40 boxes of copier paper a day. The firm operates 260 days a year. Storage and handling costs for the paper are \$30 a year per box, and it costs approximately \$60 to order and receive a shipment of paper.

- a. What order size would minimize the sum of annual ordering and carrying costs?
- b. Compute the total annual cost using your order size from part *a*.
- c. Except for rounding, are annual ordering and carrying costs always equal at the EOQ?
- d. The office manager is currently using an order size of 200 boxes. The partners of the firm expect the office to be managed "in a cost-efficient manner." Would you recommend that the office manager use the optimal order size instead of 200 boxes? Justify your answer.

Garden Variety Flower Shop uses 750 clay pots a month. The pots are purchased at \$2 each. Annual carrying costs per pot are estimated to be 30 percent of cost, and ordering costs are \$20 per order. The manager has been using an order size of 1,500 flower pots.

- a. What additional annual cost is the shop incurring by staying with this order size?
- b. Other than cost savings, what benefit would using the optimal order quantity yield?

A produce distributor uses 800 packing crates a month, which it purchases at a cost of \$10 each. The manager has assigned an annual carrying cost of 35 percent of the purchase price per crate. Ordering costs are \$28. Currently, the manager orders once a month. How much could the firm save annually in ordering and carrying costs by using the EOQ?

A manager receives a forecast for next year. Demand is projected to be 600 units for the first half of the year and 900 units for the second half. The monthly holding cost is \$2 per unit, and it costs an estimated \$55 to process an order.

- a. Assuming that monthly demand will be level during each of the six-month periods covered by the forecast (e.g., 100 per month for each of the first six months), determine an order size that will minimize the sum of ordering and carrying costs for each of the six-month periods.
- b. Why is it important to be able to assume that demand will be level during each six-month period?
- c. If the vendor is willing to offer a discount of \$10 per order for ordering in multiples of 50 units (e.g., 50, 100, 150), would you advise the manager to take advantage of the offer in either period? If so, what order size would you recommend?

A food processor uses approximately 27,000 glass jars a month for its fruit juice product. Because of storage limitations, a lot size of 4,000 jars has been used. Monthly holding cost is 18 cents per jar, and reordering cost is \$60 per order. The company operates an average of 20 days a month.

- a. What penalty is the company incurring by its present order size?
- b. The manager would prefer ordering 10 times each month but would have to justify any change in order size. One possibility is to simplify order processing to reduce the ordering cost. What ordering cost would enable the manager to justify ordering every other day (i.e., 10 times a month)?

9. The Friendly Sausage Factory (FSF) can produce hot dogs at a rate of 5,000 per day. FSF supplies hot dogs to local restaurants at a steady rate of 250 per day. The cost to prepare the equipment for producing hot dogs is \$66. Annual holding costs are 45 cents per hot dog. The factory operates 300 days a year. Find the following:

- a. The optimal run size
- b. The number of runs per year
- c. How many days it takes to produce the optimal run quantity

10. A chemical firm produces sodium bisulfate in 100-pound bags. Demand for this product is 20 tons per day. The capacity for producing the product is 50 tons per day. Setup costs \$100, and storage and handling costs are \$5 per ton a year. The firm operates 200 days a year. (Note: 1 ton = 2,000 pounds.)

- a. How many bags per run are optimal?
- b. What would the average inventory be for this lot size?
- c. Determine the approximate length of a production run, in days.
- d. About how many runs per year would there be?
- e. How much could the company save annually if the setup cost could be reduced to \$25 per run?

11. A company is about to begin production of a new product. The manager of the department that will produce one of the components for the product wants to know how often the machine used to produce the item will be available for other work. The machine will produce the item at a rate of 200 units a day. Eighty units will be used daily in assembling the final product. Assembly will take place five days a week, 50 weeks a year. The manager estimates that it will take almost a full day to get the machine ready for a production run, at a cost of \$300. Inventory holding costs will be \$10 a year.

- a. What run quantity should be used to minimize total annual costs?
 - b. How many days does it take to produce the optimal run quantity?
 - c. What is the average amount of inventory?
 - d. If the manager wants to run another job between runs of this item, and needs a minimum of 10 days per cycle for the other work, will there be enough time?
 - e. Given your answer to part *d*, the manager wants to explore options that will allow this other job to be performed using this equipment. Name three options the manager can consider.
 - f. Suppose the manager decides to increase the run size of the new product. How many additional units would be needed to just accommodate the other job? How much will that increase the total annual cost?
12. A company that produces hair dryers buys some of the components, but it makes the heating element, which it can produce at the rate of 800 per day. Hair dryers are assembled daily, 250 days a year, at a rate of 300 per day. Because of the disparity between the production and usage rates, the heating elements are periodically produced in batches of 2,000 units.
- a. Approximately how many *batches* of heating elements are produced annually?
 - b. If production on a batch begins when there is no inventory of heating elements on hand, how much inventory will be on hand *two days later*?
 - c. What is the average inventory of elements, assuming each production cycle begins when there are none on hand?
 - d. The same equipment that is used to make the heating elements could also be used to make a component for another of the firm's products. That job would require four days, including setup. Setup time for making a batch of the heating elements is a half day. Is there enough time to do this job between production of batches of heating elements? Explain.
13. A mail-order house uses 18,000 boxes a year. Carrying costs are 60 cents per box a year, and ordering costs are \$96. The following price schedule applies. Determine the following:
- a. The optimal order quantity
 - b. The number of orders per year

Number of Boxes	Price per Box
1,000 to 1,999	\$1.25
2,000 to 4,999	1.20
5,000 to 9,999	1.15
10,000 or more	1.10

14. A jewelry firm buys semiprecious stones to make bracelets and rings. The supplier quotes a price of \$8 per stone for quantities of 600 stones or more, \$9 per stone for orders of 400 to 599 stones, and \$10 per stone for lesser quantities. The jewelry firm operates 200 days per year. Usage rate is 25 stones per day, and ordering costs are \$48.
- a. If carrying costs are \$2 per year for each stone, find the order quantity that will minimize total annual cost.
 - b. If annual carrying costs are 30 percent of unit cost, what is the optimal order size?
 - c. If lead time is six working days, at what point should the company reorder?
15. A manufacturer of exercise equipment purchases the pulley section of the equipment from a supplier who lists these prices: less than 1,000, \$5 each; 1,000 to 3,999, \$4.95 each; 4,000 to 5,999, \$4.90 each; and 6,000 or more, \$4.85 each. Ordering costs are \$50, annual carrying costs per unit are 40 percent of purchase cost, and annual usage is 4,900 pulleys. Determine an order quantity that will minimize total cost.
16. A company will begin stocking remote control devices. Expected monthly demand is 800 units. The controllers can be purchased from either supplier A or supplier B. Their price lists are as follows:

SUPPLIER A		SUPPLIER B	
Quantity	Unit Price	Quantity	Unit Price
1-199	\$14.00	1-149	\$14.10
200-499	13.80	150-349	13.90
500+	13.60	350+	13.70