Answers to Problems

1. $EOQ = \sqrt{\frac{2DC_o}{C_h}}$

$D = 40{,}000$

$C_o = \$25$

$C_h = \$10(.20) = \$2$

$$EOQ = \sqrt{\frac{2(40{,}000)(\$25)}{\$2}}$$

$$= \sqrt{1{,}000{,}000}$$

$$= 1000 \text{ units}$$

Fast-Mart should order 1,000 units each time to minimize total annual variable costs.

3. $EOQ = \sqrt{\frac{2DC_o}{C_h}}$

$D = 100{,}000$

$C_o = \$100$

$C_h = \$3.75(.10) = \$.375$

$$EOQ = \sqrt{\frac{2(100{,}000)(\$100)}{\$.375}}$$

$$= \sqrt{53{,}333{,}333}$$

$= 7{,}303$ gallons

Fill-er-Up should order 7,303 gallons at a time.

5. $C_h = .25$ (price per barrel), v = price per barrel.

$C_o = \$100$

$D = 10{,}000$ barrels

At \$102 per barrel $C_h = .25 (\$102) = \$25.5$

$$EOQ = \sqrt{\frac{2(10{,}000)(\$100)}{\$25.5}}$$

$$= \sqrt{78{,}431.4}$$

= 280 barrels

This is infeasible because 3000 barrels must be ordered to get the price of $102 per barrel. Thus, we calculate total annual variable costs with an order of 3000 barrels.

Total annual variable costs

$$= \frac{Q}{2}C_h + \frac{D}{Q}C_o + Dv$$

= (3000/2)($25.5) + (10,000/3000)($100) + 10,000($102)

= $38,250 + $333.33 + $1,020,000

= $1,058,583.30

At $105 per barrel C_h = .25($105) = $26.25

$$EOQ = \sqrt{\frac{2(10{,}000)(\$100)}{\$26.25}}$$

$$= \sqrt{76{,}190.5}$$

= 276 barrels

Because this is also infeasible, we calculate the total cost of ordering 1000 barrels at a time.

Total annual
variable cost= (1000/2)($26.25) + (10,000/1000)($100) + 10,000($105)

= $13,125 + $1000 + $1,050,000

= $1,064,125

At $110 per barrel C_h = .25($110) = $27.5

$$EOQ = \sqrt{\frac{2(10{,}000)(\$100)}{\$27.50}}$$

$$= \sqrt{72727{,}27}$$

= 270 barrels

This quantity is feasible so we calculate total costs for ordering 270 barrels each time.

Total annual
variable cost = (270/2)($27.50) + (10,000/270)($100) + 10,000($110)

= $3,712.5 + $3,703.70 + $1,100,000

= $1,107,416.20

Order Quantity	Total Annual Variable Costs
3000	$1,058,583.30
1000	1,064,125.00
270	1,107,416,20

The lowest cost if given by ordering 3000 barrels each time.

7. Cost of ordering EOQ quantities:

Total annual
variable costs = (3849/2)($.00675) + (50,000/3849)($1) + 50,000($.027)

(order 3849)= $12.99 + $12.99 + 1350

= 1375.98

Cost of ordering one week's worth at a time:

1 week's worth of buns = 50,000/52 = 962 buns per week
Holding cost, C_h = .25($.030) = $.0075

Total annual
variable costs = (962/2)($.0075) + (50,000/962)($1) + 50,000($.030)

= $3.61 + $51.98 + $1500

= $1555.59

With an order of a week's worth of buns, total annual variable costs increase $179.60 or 13.05%.

9. Review interval of one week will produce an average order size of:

EOQ = .019(1000) = 19

Costs of ordering every 1.66 weeks:

Total annual
variable costs = (32/2)($10) + (1000/32)($5)

= $160 + $156.25

= $316.25

Costs of ordering every week:

Total annual
variable costs = (19/2)($10) + (1000/19)($5)

= $95 + $263.16

= $358.16

Extra cost incurred equals $41.91 per year or 13.25% over total annual cost of ordering EOQ quantities.

11. Periodic review:

Service level = 90%; z factor = 1.28

Safety stock = (1.28)50

= 64 tires

Continuous review:

Service level = 90%, z factor = 1.28

Safety stock = (1.28)10

= 12.8 or 13 tires

13. a. Based on the original conditions,

$$EOQ = \sqrt{\frac{2DC_o}{C_h}} = \sqrt{\frac{2(1,225)(\$50)}{.25(100)}} = 70$$

After the changes, the new EOQ will be:

$$\sqrt{\frac{2(1,225)(\$40)}{.20(100)}} = 70$$

Thus the changes have balanced out and EOQ did not change.

b. Total annual variable costs before the change will be:

= (70/2)(.25)($100) + (1,225/70)($50) = $1,750

After the changes, the total annual variable costs become:

(70/2)(.20)($100) + (1,225/70)($40) = $1,400

Thus although the EOQ has not changed, the result has been a decrease in total annual variable costs of $350 (enough to pay for 3.5 sofas!).

15.

Item #	Value	Annual Usage	Dollar-usage	Rank
209	$14.76	2,000	$29,520	6
4914	5.98	15,000	89,700	4
37	1.15	297,000	341,550	2
387	6.48	6,000	38,880	5
3290	2.17	6,000	13,020	9
235	75.00	300	22,500	7
48	23.95	7,000	167,650	3
576	4.32	5,000	21,600	8
14	932.00	1,000	932,000	1
		Total	$1,656,420	

Arranged by Rank Order

Item #	Rank	Dollar-usage	% Total	Cumulative Percent	Class
14	1	$932,000	56.26	56.26	A
37	2	341,550	20.62	76.88	A
48	3	167,650	10.12	87.00	B
4914	4	89,700	5.42	92.42	B
387	5	38,880	2.35	94.77	C
209	6	29,520	1.78	96.55	C
235	7	22,500	1.36	97.91	C
576	8	21,600	1.30	99.21	C
3290	9	13,020	0.79	100.00	C

Using the rule that about 30% of all items go in class B and 50% in class C we could assign item 387 to either B or C. However, its dollar-usage is much closer to that of the other class C items than to the class B items. Therefore, it has been put into class C.