CHAPTER 3

PREDETERMINED OVERHEAD RATES, FLEXIBLE BUDGETS, AND ABSORPTION/VARIABLE COSTING

EXERCISES

11. a. (1) At any level, the variable cost is \$2 per machine hour. Since four hours are needed to make one unit, the variable rate is \$8 per unit. At production of 10,000 units, the fixed rate is \$325,000 ÷ 10,000 or \$32.50 per unit.

(2) At any level, the variable cost is \$2 per machine hour. At production of 10,000 units, the fixed rate per machine hour = \$32.50 ÷ 4 = \$8.125 per machine hour.

b. (1) Combined rate = \$8 + \$32.50 = \$40.50 per unit

(2) Combined rate = \$2 + \$8.125 = \$10.125 per unit

c. At actual production of 11,000 units and applying OH on units of production:

	Expected = Actual	Applied	Under/Over Applied
VOH (11,000 × \$8)	\$ 88,000	(11,000 × \$8) = \$ 88,000	\$ 0
FOH	325,000	(11,000 × \$32.50) = 357,500	32,500 overapp.

12. a. Applied VOH = 900 × \$8 = \$7,200

b. Applied FOH = 900 × \$32.50 = \$29,250

c. VOH: Actual VOH – Applied VOH = \$7,500 – \$7,200 = \$300 underapplied
FOH: Actual FOH – Applied FOH = \$26,500 – \$29,250 = \$2,750 overapplied

14. a. Jan. \$180,000 × 2.50 = \$450,000
Feb. \$165,000 × 2.50 = \$412,500
Mar. \$170,000 × 2.50 = \$425,000

b.

Jan. Actual – Applied = \$440,000 – \$450,000 =	\$10,000 overapplied
Feb. Actual – Applied = \$420,400 – \$412,500 =	\$ 7,900 underapplied
Mar. Actual – Applied = \$421,000 – \$425,000 =	\$ 4,000 overapplied
Total for quarter	\$ 6,100 overapplied

15. a. (\$600,400 + \$199,600) ÷ (10,000 + 40,000) = \$800,000 ÷ 50,000 = \$16.00 per DLH

b. (\$600,400 + \$199,600) ÷ (76,000 + 4,000) = \$800,000 ÷ 80,000 = \$10.00 per MH

c. Assembly: \$600,400 ÷ 76,000 = \$7.90 per MH
Finishing: \$199,600 ÷ 40,000 = \$4.99 per DLH

d. Overhead assigned using answer from (a): 1 × \$16.00 = \$16.00
Overhead assigned using answer from (b): 5 × \$10.00 = \$50.00
Overhead assigned using answer from (c): (5 × \$7.90) + (1 × \$4.99)

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= $39.50 + $4.99 = $44.49

21 a.

	MHs	Total Cost	=	Variable Cost	+	Fixed Cost
High activity	34,000	$12,200		$5,440		$6,760
Low activity	31,000	11,720		4,960		6,760
Differences	3,000	$ 480				

Variable rate = $480 ÷ 3,000 MHs = $0.16 per MH
High activity variable cost = 34,000 × $0.16 = $5,440
Low activity variable cost = 31,000 × $0.16 = $4,960
Fixed cost at high activity = $12,200 – $5,440 = $6,760
Fixed cost at low activity = $11,720 – $4,960 = $6,760
Budget formula: TC = FC + VC(X)
TC = $6,760 + $0.16 MH

b. TC = $6,760 + $0.16(31,250) = $6,760 + $5,000 = $11,760

22. a.

	Shipments Received	Cost of Reports
High activity	60	$202
Low activity	35	142
Differences	25	$ 60

Variable cost = $60 ÷ 25 = $2.40
Fixed cost (high point) = $202 – (60 × $2.40) = $58
y = $58 + $2.40X

b. *y* = $58 + ($2.40 × 72)
y = $230.80

c. The most significant problem is that 72 shipments is far larger than the largest number of shipments in the data used to develop the equation. Thus, 72 may be outside of the relevant range for the equation. Other concerns are those associated with use of the high–low method including only two of the seven data points were used to develop the equation.

23. a.

	MHs	Total Cost	=	Variable Cost	+	Fixed Cost
High activity	9,000	$ 880		$(1,620)		$2,500
Low activity	3,000	1,960		(540)		2,500
Differences	6,000	$(1,080)				

Variable rate = $(1,080) ÷ 6,000 MHs = $(0.18) per MH

High activity variable cost = 9,000 × $(0.18) = $(1,620)
Low activity variable cost = 3,000 × $(0.18) = $(540)
Fixed cost at low activity = $1,960 – $(540) = $2,500
Total maintenance cost = $2,500 – $0.18 MH

b. The variable cost component is negative, which implies that, as the number of machine hours increases, the amount of maintenance costs declines. Such a relationship is implausible. One explanation that would account for the perceived inverse relationship would be that the company performs the maintenance chores

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when there is idle time available. As business activity increases, less and less time is available to perform maintenance activities.

c. For a cost prediction formula to work effectively, a positive relationship between the activity measure and the cost pool is not required. Thus, the formula developed in (a) might function effectively. However, one cannot interpret the parameters of the model (–\$0.18, \$2,500) as variable and fixed costs, respectively.

24. a.

	MHs	Total Cost	=	Variable Cost	+	Fixed Cost
High activity	1,900	\$1,160		\$760		\$400
Low activity	1,250	900		500		400
Differences	650	\$ 260				

Variable rate = \$260 ÷ 650 MHs = \$0.40 per MH
Cost formula: y = \$400 + \$0.40 MH

b.

	1,325	1,500	1,675
Variable utility cost @ \$0.40 per MH	\$ 530	\$ 600	\$ 670
Fixed utility cost	400	400	400
Expected total utility cost	\$ 930	\$1,000	\$1,070

29. a.

Ingredients	\$ 228,800
Labor	104,000
Variable overhead	197,600
Total variable cost	\$ 530,400
Divided by units	÷ 104,000
Variable cost per unit	\$ 5.10
Total variable cost	\$ 530,400
Fixed overhead	98,800
Total cost	\$ 629,200
Divided by units	÷ 104,000
Absorption cost per unit	\$ 6.05

b. Variable cost of goods sold = 100,000 × \$5.10 = \$510,000

c. Absorption cost of goods sold = 100,000 × \$6.05 = \$605,000

d. Ending inventory (variable costing) = 4,000 × \$5.10 = \$20,400
Ending inventory (absorption costing) = 4,000 × \$6.05 = \$24,200

e. Fixed overhead charged to expense (variable costing) = \$98,800
Fixed overhead charged to expense (absorption costing) = \$95,000

30. a.

Income – Variable costing	\$188,000
Deduct increase in CGS [FOH out of inventory (\$8 × 9,600)]	(76,800)
Income – Absorption costing	\$111,200

b.

Income – Variable costing	\$188,000
Add decrease in CGS [FOH inventoried (\$8 × 3,000)]	24,000
Income – Absorption costing	\$212,000

32. a. Budgeted fixed overhead = \$0.40 × 100,000 = \$40,000

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b.

Actual (and budgeted) fixed overhead	$40,000
Applied fixed overhead (45,000 × $0.40)	18,000
Underapplied fixed overhead (absorption)	$22,000

There is no underapplied or overapplied fixed overhead under variable costing because fixed overhead is not applied to units of product.

c.

Direct material	$3.60
Direct labor	1.00
Variable overhead	0.60
Cost per unit (variable)	$5.20
Fixed overhead	0.40
Cost per unit (absorption)	$5.60

d.

Absorption cost of goods sold (48,750 × $5.60)		$273,000
Plus underapplied overhead (55,000 × $0.40)		22,000
Adjusted cost of goods sold		$295,000
Selling and administrative costs:		
Variable (48,750 × $0.40)	$ 19,500	
Fixed	150,000	169,500
Total expense (absorption)		$464,500

Variable cost of goods sold (48,750 × $5.20)	$253,500
Variable selling expenses (48,750 × $0.40)	19,500
Fixed overhead	40,000
Fixed selling and administrative expenses	150,000
Total expense (variable)	$463,000

e. Income is higher under variable costing because the sales level is greater than the production level. Income will be higher by the fixed overhead per unit ($0.40) times the change in inventory (3,750 unit decline) or $1,500.

34. a.

x	*y*	*xy*	x^2
50	$ 175	$ 8,750	2,500
44	162	7,128	1,936
40	154	6,160	1,600
35	142	4,970	1,225
53	185	9,805	2,809
58	200	11,600	3,364
60	202	12,120	3,600
340	$1,220	$60,533	17,034

$\overline{x} = 340 \div 7 = 48.57$

$\overline{y} = \$1{,}220 \div 7 = \$174.29$

$$b = \frac{\sum xy - n(\overline{x})(\overline{y})}{\sum x^2 - n(\overline{x})^2} = \frac{\$60{,}533 - 7(48.57)(\$174.29)}{17{,}034 - 7(48.57)(48.57)} = \frac{\$1{,}276.14}{520.69} = \$2.45$$

$a = \overline{y} - b\overline{x} = \$174.29 - 2.45(48.57) = \$55.29$

y = $55.29 + $2.45 (# of shipments)

b. y = $55.29 + $2.45(165) = $459.54

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Note that one would be cautious to use this prediction because 165 may be substantially greater than the relevant range of activity.

35.

x	y	xy	x^2
200	$ 300	$ 60,000	40,000
325	440	143,000	105,625
400	480	192,000	160,000
410	490	200,900	168,100
525	620	325,500	275,625
680	790	537,200	462,400
820	840	688,800	672,400
900	900	810,000	810,000
4,260	$4,860	$2,957,400	2,694,150

$\overline{x} = 4{,}260 \div 8 = 532.60$

$\overline{y} = \$4{,}860 \div 8 = \$607.50$

$$b = \frac{\sum xy - n(\overline{x})(\overline{y})}{\sum x^2 - n(\overline{x})^2} = \frac{\$2{,}957{,}400 - 8(532.50)(\$607.50)}{2{,}694{,}150 - 8(532.50)(532.50)} = \frac{\$369{,}450}{425{,}700} = \$0.87$$

$a = \overline{y} - b\overline{x} = \$607.50 - \$0.87(532.50) = \$144.23$

y = $144.23 + $0.87 MH

43. a.

	MHs	Total Cost	=	Variable Cost	+	Fixed Cost
High activity	2,700	$13,160		$8,640		$4,520
Low activity	(1,400)	(9,000)		4,480		4,520
Differences	1,300	$ 4,160				

Variable rate = $4,160 ÷ 1,300 MHs = $3.20 per MH

High activity variable cost = 2,700 × $3.20 = $8,640

Low activity variable cost = 1,400 × $3.20 = $4,480

Fixed cost at low activity = $9,000 – $4,480 = $4,520

Total R&M cost = $4,520 + $3.20 MH

b.

x	y	xy	x^2
1,400	$ 9,000	$ 12,600,000	1,960,000
1,900	10,719	20,366,100	3,610,000
2,000	10,900	21,800,000	4,000,000
2,500	13,000	32,500,000	6,250,000
2,200	11,578	25,471,600	4,840,000
2,700	13,160	35,532,000	7,290,000
1,700	9,525	16,192,500	2,890,000
2,300	11,670	26,841,000	5,290,000
16,700	$89,552	$191,303,200	36,130,000

$\overline{x} = 16{,}700 \div 8 = 2{,}087.50$

$\overline{y} = \$89{,}552 \div 8 = \$11{,}194$

$$b = \frac{\sum xy - n(\overline{x})(\overline{y})}{\sum x^2 - n(\overline{x})^2} = \frac{\$191{,}303{,}200 - 8(2{,}087.50)(\$11{,}194)}{36{,}130{,}000 - 8(2{,}087.50)(2{,}087.50)} = \frac{\$4{,}363{,}400}{1{,}268{,}750} = \$3.44$$

$a = \overline{y} - b\overline{x} = \$11{,}193.25 - \$3.44(2{,}087.50) = \$4{,}012.25$

y = $4,012.25 + $3.44 MH

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c. Part (b) computations provide the better answer. The least squares regression approach takes into consideration all of the available data and employs a mathematical algorithm to minimize the variance around the fitted regression line.

52. a.

x	y	xy	x^2
10	$ 8,000	$ 80,000	100
14	9,200	128,800	196
22	12,000	264,000	484
28	14,200	397,600	784
40	18,500	740,000	1,600
62	28,000	1,736,000	3,844
100	34,000	3,400,000	10,000
90	30,000	2,700,000	8,100
80	24,000	1,920,000	6,400
446	$177,900	$11,366,400	31,508

$\overline{x} = 446 \div 9 = 49.56$

$\overline{y} = \$177{,}900 \div 9 = \$19{,}766.67$

$$b = \frac{\sum xy - n(\overline{x})(\overline{y})}{\sum x^2 - n(\overline{x})^2} = \frac{\$11{,}366{,}400 - 9(49.56)(\$19{,}766.67)}{31{,}508 - 9(49.56)(49.56)} = \frac{\$2{,}549{,}675}{9{,}402.26} = \$271.18$$

$a = \overline{y} - b\overline{x} = \$19{,}766.67 - \$271.18(49.56) = \$6{,}327$

y = $6,327 + $271.18 (# of charters)

b.

x	y	xy	x^2
$ 12,000	$ 8,000	$ 96,000,000	144,000,000
18,000	9,200	165,600,000	324,000,000
26,000	12,000	312,000,000	676,000,000
36,000	14,200	511,200,000	1,296,000,000
60,000	18,500	1,110,000,000	3,600,000,000
82,000	28,000	2,296,000,000	6,724,000,000
120,000	34,000	4,080,000,000	14,400,000,000
100,000	30,000	3,000,000,000	10,000,000,000
96,000	24,000	2,304,000,000	9,216,000,000
$550,000	$177,900	$13,874,800,000	46,380,000,000

$\overline{x} = \$550{,}000 \div 9 = \$61{,}111.11$

$\overline{y} = \$177{,}900 \div 9 = \$19{,}766.67$

$$b = \frac{\sum xy - n(\overline{x})(\overline{y})}{\sum x^2 - n(\overline{x})^2} = \frac{\$13{,}874{,}800{,}000 - 9(61{,}111.11)(\$19{,}766.67)}{46{,}380{,}000{,}000 - 9(61{,}111.11)(61{,}111.11)}$$

$$= \frac{\$3{,}003{,}131{,}697.67}{12{,}768{,}890{,}111.11} = \$0.235$$

$a = \overline{y} - b\overline{x} = \$19{,}766.67 - \$0.235(61{,}111.11) = \$5{,}405.56$

y = $5,405.56 + $0.235 (gross receipts)

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