Chapter 6
Variable Costing and Segment Reporting: Tools for Management

Solutions to Questions

6-1 Absorption and variable costing differ in how they handle fixed manufacturing overhead. Under absorption costing, fixed manufacturing overhead is treated as a product cost and hence is an asset until products are sold. Under variable costing, fixed manufacturing overhead is treated as a period cost and is immediately expensed on the income statement.

6-2 Selling and administrative expenses are treated as period costs under both variable costing and absorption costing.

6-3 Under absorption costing, fixed manufacturing overhead costs are included in product costs, along with direct materials, direct labor, and variable manufacturing overhead. If some of the units are not sold by the end of the period, then they are carried into the next period as inventory. When the units are finally sold, the fixed manufacturing overhead cost that has been carried over with the units is included as part of that period's cost of goods sold.

6-4 Absorption costing advocates argue that absorption costing does a better job of matching costs with revenues than variable costing. They argue that all manufacturing costs must be assigned to products to properly match the costs of producing units of product with the revenues from the units when they are sold. They believe that no distinction should be made between variable and fixed manufacturing costs for the purposes of matching costs and revenues.

6-5 Advocates of variable costing argue that fixed manufacturing costs are not really the cost of any particular unit of product. If a unit is made or not, the total fixed manufacturing costs will be exactly the same. Therefore, how can one say that these costs are part of the costs of the products? These costs are incurred to have the capacity to make products during a particular period and should be charged against that period as period costs according to the matching principle.

6-6 If production and sales are equal, net operating income should be the same under absorption and variable costing. When production equals sales, inventories do not increase or decrease and therefore under absorption costing fixed manufacturing overhead cost cannot be deferred in inventory or released from inventory.

6-7 If production exceeds sales, absorption costing will usually show higher net operating income than variable costing. When production exceeds sales, inventories increase and under absorption costing part of the fixed manufacturing overhead cost of the current period is deferred in inventory to the next period. In contrast, all of the fixed manufacturing overhead cost of the current period is immediately expensed under variable costing.

6-8 If fixed manufacturing overhead cost is released from inventory, then inventory levels must have decreased and therefore production must have been less than sales.

6-9 Under absorption costing net operating income can be increased by simply increasing the level of production without any increase in sales. If production exceeds sales, units of product are added to inventory. These units carry a portion of the current period's fixed manufacturing overhead costs into the inventory account, reducing the current period's reported

expenses and causing net operating income to increase.

6-10 Differences in reported net operating income between absorption and variable costing arise because of changing levels of inventory. In Lean Production, goods are produced strictly to customers' orders. With production tied to sales, inventories are largely (or entirely) eliminated. If inventories are completely eliminated, they cannot change from one period to another and absorption costing and variable costing will report the same net operating income.

6-11 A segment is any part or activity of an organization about which a manager seeks cost, revenue, or profit data. Examples of segments include departments, operations, sales territories, divisions, and product lines.

6-12 Under the contribution approach, costs are assigned to a segment if and only if the costs are traceable to the segment (i.e., could be avoided if the segment were eliminated). Common costs are not allocated to segments under the contribution approach.

6-13 A traceable fixed cost of a segment is a cost that arises specifically because of the existence of that segment. If the segment were eliminated, the cost would disappear. A common fixed cost, by contrast, is a cost that supports more than one segment, but is not traceable in whole or in part to any one of the segments. If the departments of a company are treated as segments, then examples of the traceable fixed costs of a department would include the salary of the department's supervisor and depreciation of machines used exclusively by the department. Examples of common fixed costs would include the salary of the general counsel of the entire company, the lease cost of the headquarters building, corporate image advertising, and depreciation of machines shared by several departments.

6-14 The contribution margin is the difference between sales revenue and variable expenses. The segment margin is the amount remaining after deducting traceable fixed expenses from the contribution margin. The contribution margin is useful as a planning tool for many decisions, particularly those in which fixed costs don't change. The segment margin is useful in assessing the overall profitability of a segment.

6-15 If common fixed costs were allocated to segments, then the costs of segments would be overstated and their margins would be understated. As a consequence, some segments may appear to be unprofitable and managers may be tempted to eliminate them. If a segment were eliminated because of the existence of arbitrarily allocated common fixed costs, the overall profit of the company would decline and the common fixed cost that had been allocated to the segment would be reallocated to the remaining segments—making them appear less profitable.

6-16 There are often limits to how far down an organization a cost can be traced. Therefore, fixed costs that are traceable to a segment may become common as that segment is divided into smaller segment units. For example, the costs of national TV and print advertising might be traceable to a specific product line, but be a common fixed cost of the geographic sales territories in which that product line is sold.

6-17 No, a company should not allocate its common fixed costs to business segments. These costs are not traceable to individual segments and will not be affected by segment-level decisions.

The Foundational 15

1. and 2.

The unit product costs under variable costing and absorption costing are computed as follows:

	Variable Costing	*Absorption Costing*
Direct materials	$24	$24
Direct labor	14	14
Variable manufacturing overhead	2	2
Fixed manufacturing overhead ($800,000 ÷ 40,000 units)	—	20
Unit product cost	$40	$60

3. and 4.

The total contribution margin and net operating income (loss) under variable costing are computed as follows:

Sales (35,000 units × $80 per unit)		$2,800,000
Variable expenses:		
Variable cost of goods sold (35,000 units × $40 per unit)	$1,400,000	
Variable selling and administrative (35,000 units × $4 per unit)	140,000	1,540,000
Contribution margin		1,260,000
Fixed expenses:		
Fixed manufacturing overhead	800,000	
Fixed selling and administrative	496,000	1,296,000
Net operating loss		$ (36,000)

The Foundational 15 (continued)

5. and 6.

The total gross margin and net operating income under absorption costing are computed as follows:

Sales (35,000 units × $80 per unit).....	$2,800,000
Cost of goods sold (35,000 units × $60 per unit)....	2,100,000
Gross margin.....	700,000
Selling and administrative expenses [(35,000 units × $4 per unit) + $496,000].....	636,000
Net operating income.....	$ 64,000

7. The difference between the absorption and variable costing net operating incomes is explained as follows:

Manufacturing overhead deferred in (released from) inventory = Fixed manufacturing overhead in ending inventory – Fixed manufacturing overhead in beginning inventory = ($20 per unit × 5,000 units) – $0 = $100,000

Variable costing net operating loss (see requirement 4).....	$(36,000)
Add fixed manufacturing overhead cost deferred in inventory under absorption costing.....	100,000
Absorption costing net operating income (see requirement 6)	$ 64,000

8. The break-even point in units is computed as follows:

Profit = Unit CM × Q – Fixed expenses
$0 = ($80 – $44) × Q – $1,296,000
$0 = ($36) × Q – $1,296,000
$36Q = $1,296,000
Q = $1,296,000 ÷ $36
Q = 36,000 units

The break-even point is above the actual sales volume; however, in question 6, the absorption costing net operating income is $64,000. This counter-intuitive result emerges because $100,000 of fixed manufacturing overhead is deferred in inventory under absorption costing.

The Foundational 15 (continued)

9. The break-even point of 36,000 units would remain the same. This occurs because the contribution margin per unit is the same regardless of whether a unit is sold in the East or West region. The total fixed cost also remains unchanged so the break-even point stays at 36,000 units.

10. and 11.

The variable costing net operating income would be the same as the answer to question 4 as shown below:

Sales		$2,800,000
Variable expenses:		
Variable cost of goods sold (35,000 units × $40 per unit)	$1,400,000	
Variable selling and administrative (35,000 units × $4 per unit)	140,000	1,540,000
Contribution margin		1,260,000
Fixed expenses:		
Fixed manufacturing overhead	800,000	
Fixed selling and administrative	496,000	1,296,000
Net operating loss		$ (36,000)

When the number of units produced equals the number of units sold, absorption costing net operating income equals the variable costing net operating income. Therefore, the answer to question 11 is that the absorption costing net operating loss would be $36,000 (assuming that none of the intermediate calculations are rounded).

12. Absorption costing income will be lower than variable costing income. The variable costing income statement will only include the fixed manufacturing overhead costs incurred during the second year of operations, whereas the absorption costing cost of goods sold will include all of the fixed manufacturing overhead costs incurred during the second year of operations plus some of the fixed manufacturing overhead costs that were deferred in inventory at the end of the prior year.

The Foundational 15 (continued)

13. The segment margins for the East and West regions are computed as follows:

	Total Company	*East*	*West*
Sales*.....	$2,800,000	$2,000,000	$800,000
Variable expenses**.....	1,540,000	1,100,000	440,000
Contribution margin.....	1,260,000	900,000	360,000
Traceable fixed expenses.....	400,000	150,000	250,000
Region segment margin.....	860,000	$ 750,000	$110,000
Common fixed expenses not traceable to regions ($800,000 + $96,000).....	896,000		
Net operating loss.....	$ (36,000)		

* East: 25,000 units × $80 per unit = $2,000,000;
West: 10,000 units × $80 per unit = $800,000.
** East: 25,000 units × $44 per unit = $1,100,000;
West: 10,000 units × $44 per unit = $440,000.

14. Diego has apparently determined that the total *gross margin* in the West region equals $200,000. As computed in requirement 1, the unit product cost under absorption costing is $60; therefore, the gross margin per unit is $20 ($80 – $60). The West region's total gross margin of $200,000 (10,000 units × $20 per unit) is less than its traceable fixed expenses of $250,000. This mode of analysis creates the illusion that the West region should be discontinued.

    The correct way to answer this question is to focus on the information in the contribution format segmented income statements as follows:

Forgone segment margin in the West region.....	$(110,000)
Additional contribution margin in East region*.....	45,000
Decrease in profits if the West region is dropped.....	$ (65,000)

    *$900,000 × 5% = $45,000.

The Foundational 15 (continued)

15. The profit impact is computed as follows:

Additional advertising……..	$(30,000)
Additional contribution margin in the West region*……	72,000
Increase in profits…….	$ 42,000

*$360,000 × 20% = $72,000.

Problem 6-18 (45 minutes)

1. The break-even point in units sold can be computed using the contribution margin per unit as follows:

Selling price per unit	$58
Variable cost per unit ($20 + $12 + $4 + $2)	38
Contribution margin per unit	$20

   Break-even unit sales = Fixed expenses ÷ Unit contribution margin
   = ($960,000 + $240,000) ÷ $20 per unit
   = $1,200,000 ÷ $20 per unit
   = 60,000 units

2.
   a. Under variable costing, only the variable manufacturing costs are included in product costs.

	Year 1	*Year 2*	*Year 3*
Direct materials	$20	$20	$20
Direct labor	12	12	12
Variable manufacturing overhead	4	4	4
Variable costing unit product cost	$36	$36	$36

   Note that selling and administrative expenses are not treated as product costs; that is, they are not included in the costs that are inventoried. These expenses are always treated as period costs.

Problem 6-18 (continued)

2.

b. The variable costing income statements appear below:

	Year 1	*Year 2*	*Year 3*
Sales (@ $58 per unit)	$3,480,000	$2,900,000	$3,770,000
Variable expenses:			
Variable cost of goods sold @ $36 per unit	2,160,000	1,800,000	2,340,000
Variable selling and administrative @ $2 per unit	120,000	100,000	130,000
Total variable expenses	2,280,000	1,900,000	2,470,000
Contribution margin	1,200,000	1,000,000	1,300,000
Fixed expenses:			
Fixed manufacturing overhead	960,000	960,000	960,000
Fixed selling and administrative	240,000	240,000	240,000
Total fixed expenses	1,200,000	1,200,000	1,200,000
Net operating income (loss)	$ 0	$ (200,000)	$ 100,000

3.

a. The unit product costs under absorption costing:

	Year 1	*Year 2*	*Year 3*
Direct materials	$20	$20.00	$20
Direct labor	12	12.00	12
Variable manufacturing overhead	4	4.00	4
Fixed manufacturing overhead	*16	**12.80	***24
Absorption costing unit product cost	$52	$48.80	$60

* $960,000 ÷ 60,000 units = $16 per unit.

** $960,000 ÷ 75,000 units = $12.80 per unit.

*** $960,000 ÷ 40,000 units = $24 per unit.

Problem 6-18 (continued)

3.

b. The absorption costing income statements appear below:

	Year 1	*Year 2*	*Year 3*
Sales	$3,480,000	$2,900,000	$3,770,000
Cost of goods sold	3,120,000	2,440,000	3,620,000
Gross margin	360,000	460,000	150,000
Selling and administrative expenses ($2 per unit + $240,000)	360,000	340,000	370,000
Net operating income (loss)	$ 0	$ 120,000	$ (220,000)

Cost of goods sold computations:
Year 1: 60,000 units × $52 per unit = $3,120,000
Year 2: 50,000 units × $48.80 per unit = $2,440,000
Year 3: (25,000 × $48.80 per unit) + (40,000 × $60 per unit) = $3,620,000

4.

	Year 1	*Year 2*	*Year 3*
Units sold	60,000	50,000	65,000
Break-even point in units	60,000	60,000	60,000
Units above (below) break-even point	0	(10,000)	5,000
Variable costing net operating income (loss)	$0	$(200,000)	$ 100,000
Absorption costing net operating income (loss)	$0	$ 120,000	$(220,000)
Units sold	60,000	50,000	65,000

The absorption costing net operating incomes in years 2 and 3 are counterintuitive. In year 2, the number of units sold is below the break-even point; however, absorption costing reports a net

operating income greater than zero. In year 3, the number of units sold is above the break-even point; however, absorption costing reports a net operating income less than zero.

Problem 6-19 (30 minutes)

1. The unit product cost under variable costing is computed as follows:

Direct materials	$ 4
Direct labor	7
Variable manufacturing overhead	1
Variable costing unit product cost	$12

2. With this figure, the variable costing income statements can be prepared:

	Year 1	*Year 2*
Sales (@ $25 per unit)	$1,000,000	$1,250,000
Variable expenses:		
Variable cost of goods sold (@ $12 per unit)	480,000	600,000
Variable selling and administrative expenses (@ $2 per unit)	80,000	100,000
Total variable expenses	560,000	700,000
Contribution margin	440,000	550,000
Fixed expenses:		
Fixed manufacturing overhead	270,000	270,000
Fixed selling and administrative expenses	130,000	130,000
Total fixed expenses	400,000	400,000
Net operating income	$ 40,000	$ 150,000

Problem 6-19 (continued)

3. The reconciliation of absorption and variable costing follows:

	Year 1	*Year 2*
Units in beginning inventory	0	5,000
+ Units produced	45,000	45,000
− Units sold	40,000	50,000
= Units in ending inventory	5,000	0

	Year 1	*Year 2*
Fixed manufacturing overhead in ending inventory (5,000 units × $6 per unit)	$30,000	$ 0
Deduct: Fixed manufacturing overhead in beginning inventory (5,000 units × $6 per unit)		30,000
Manufacturing overhead deferred in (released from) inventory	$30,000	$(30,000)

	Year 1	*Year 2*
Variable costing net operating income (loss)	$40,000	$150,000
Add (deduct) fixed manufacturing overhead deferred in (released from) inventory under absorption costing	30,000	(30,000)
Absorption costing net operating income	$70,000	$120,000

Problem 6-20 (45 minutes)

1.

a. The unit product cost under absorption costing is:

Direct materials	$20
Direct labor	8
Variable manufacturing overhead	2
Fixed manufacturing overhead ($100,000 ÷ 10,000 units)	10
Absorption costing unit product cost	$40

b. The absorption costing income statement is:

Sales (8,000 units × $75 per unit)		$600,000
Cost of goods sold (8,000 units × $40 per unit)		320,000
Gross margin		280,000
Selling and administrative expenses [$200,000 + (8,000 units × $6 per unit)]		248,000
Net operating income		$ 32,000

2.

a. The unit product cost under variable costing is:

Direct materials	$20
Direct labor	8
Variable manufacturing overhead	2
Variable costing unit product cost	$30

b. The variable costing income statement is:

Sales (8,000 units × $75 per unit)		$600,000
Variable expenses:		
Variable cost of goods sold (8,000 units × $30 per unit)	$240,000	
Variable selling expenses (8,000 units × $6 per unit)	48,000	288,000
Contribution margin		312,000
Fixed expenses:		
Fixed manufacturing overhead	100,000	
Fixed selling and administrative expenses	200,000	300,000
Net operating income		$ 12,000

Problem 6-20 (continued)

3. The difference in the ending inventory relates to a difference in the handling of fixed manufacturing overhead costs. Under variable costing, these costs have been expensed in full as period costs. Under absorption costing, these costs have been added to units of product at the rate of $10 per unit ($100,000 ÷ 10,000 units produced = $10 per unit). Thus, under absorption costing a portion of the $100,000 fixed manufacturing overhead cost for the month has been added to the inventory account rather than expensed on the income statement:

Added to the ending inventory (2,000 units × $10 per unit)	$ 20,000
Expensed as part of cost of goods sold (8,000 units × $10 per unit)	80,000
Total fixed manufacturing overhead cost for the month	$100,000

Because $20,000 of fixed manufacturing overhead cost has been deferred in inventory under absorption costing, the net operating income reported under that costing method is $20,000 (= $32,000 – $12,000) higher than the net operating income under variable costing, as shown in parts (1) and (2) above.

Problem 6-21 (30 minutes)

1.

	Total Company		*Sales Territory*			
			Northern		*Southern*	
	Amount	*%*	*Amount*	*%*	*Amount*	*%*
Sales	$750,000	100.0	$300,000	100	$450,000	100
Variable expenses	336,000	44.8	156,000	52	180,000	40
Contribution margin	414,000	55.2	144,000	48	270,000	60
Traceable fixed expenses	228,000	30.4	120,000	40	108,000	24
Territorial segment margin	186,000	24.8	$ 24,000	8	$162,000	36
Common fixed expenses*	150,000	20.0				
Net operating income	$ 36,000	4.8				

*378,000 – $228,000 = $150,000

	Northern Territory		*Product Line*			
			Paks		*Tibs*	
	Amount	*%*	*Amount*	*%*	*Amount*	*%*
Sales	$300,000	100.0	$50,000	100	$250,000	100
Variable expenses	156,000	52.0	11,000	22	145,000	58
Contribution margin	144,000	48.0	39,000	78	105,000	42
Traceable fixed expenses	70,000	23.3	30,000	60	40,000	16
Product line segment margin	74,000	24.7	$ 9,000	18	$ 65,000	26
Common fixed expenses*	50,000	16.7				

	Northern Territory		*Product Line*			
	Amount	*%*	*Paks Amount*	*%*	*Tibs Amount*	*%*
Sales territory segment margin	$ 24,000	8.0				

*$120,000 – $70,000 = $50,000

Problem 6-21 (continued)

2. Two insights should be brought to the attention of management. First, compared to the Southern territory, the Northern territory has a low contribution margin ratio. Second, the Northern territory has high traceable fixed expenses. Overall, compared to the Southern territory, the Northern territory is very weak.

3. Again, two insights should be brought to the attention of management. First, the Northern territory has a poor sales mix. Note that the territory sells very little of the Paks product, which has a high contribution margin ratio. This poor sales mix accounts for the low overall contribution margin ratio in the Northern territory mentioned in part (2) above. Second, the traceable fixed expenses of the Paks product seem very high in relation to sales. These high fixed expenses may simply mean that the Paks product is highly leveraged; if so, then an increase in sales of this product line would greatly enhance profits in the Northern territory and in the company as a whole.

Problem 6-22 (45 minutes)

1. a. and b.

	Absorption Costing	*Variable Costing*
Direct materials	$ 7	$ 7
Direct labor	10	10
Variable manufacturing overhead	5	5
Fixed manufacturing overhead ($315,000 ÷ 17,500 units)	18	—
Unit product cost	$40	$22

2.

	July	*August*
Sales	$900,000	$1,200,000
Variable expenses:		
Variable cost of goods sold @ $22 per unit	330,000	440,000
Variable selling and administrative expenses @ $3 per unit	45,000	60,000
Total variable expenses	375,000	500,000
Contribution margin	525,000	700,000
Fixed expenses:		
Fixed manufacturing overhead	315,000	315,000
Fixed selling and administrative expenses	245,000	245,000
Total fixed expenses	560,000	560,000
Net operating income (loss)	$ (35,000)	$ 140,000

3.

	July	*August*
Units in beginning inventory	0	2,500
+ Units produced	17,500	17,500
− Units sold	15,000	20,000
= Units in ending inventory	2,500	0
Fixed manufacturing overhead in ending inventory (2,500 units × $18 per unit)	$45,000	$ 0
− Fixed manufacturing overhead in beginning inventory (2,500 units × $18 per unit)	0	45,000

= Manufacturing overhead deferred in (released from) inventory.....	$45,000	$(45,000)

Problem 6-22 (continued)

	July	*August*
Variable costing net operating income (loss).....	$(35,000)	$140,000
Add (deduct) fixed manufacturing overhead deferred in (released from) inventory under absorption costing.....	45,000	(45,000)
Absorption costing net operating income....	$ 10,000	$ 95,000

4. As shown in the reconciliation in part (3) above, $45,000 of fixed manufacturing overhead cost was deferred in inventory under absorption costing at the end of July because $18 of fixed manufacturing overhead cost "attached" to each of the 2,500 unsold units that went into inventory at the end of that month. This $45,000 was part of the $560,000 total fixed cost that has to be covered each month in order for the company to break even. Because the $45,000 was added to the inventory account, and thus did not appear on the income statement for July as an expense, the company was able to report a small profit for the month even though it sold less than the break-even volume of sales. In short, only $515,000 of fixed cost ($560,000 – $45,000) was expensed for July, rather than the full $560,000 as presented in the break-even analysis. As stated in the text, this is a major problem with the use of absorption costing internally for management purposes. The method does not harmonize well with the principles of cost-volume-profit analysis, and can result in data that are unclear or confusing.