CHAPTER 9

**INVENTORY COSTING AND CAPACITY ANALYSIS**

**9-1** No. Differences in operating income between variable costing and absorption costing are due to accounting for fixed *manufacturing* costs. Under variable costing, only variable manufacturing costs are included as inventoriable costs. Under absorption costing, both variable and fixed manufacturing costs are included as inventoriable costs. Fixed marketing and distribution costs are not accounted for differently under variable costing and absorption costing.

**9-2** The term *direct costing* is a misnomer for variable costing for two reasons:

a. Variable costing does not include all direct costs as inventoriable costs. Only variable direct manufacturing costs are included. Any fixed direct manufacturing costs and any direct nonmanufacturing costs (either variable or fixed) are excluded from inventoriable costs.

b. Variable costing includes as inventoriable costs not only direct manufacturing costs but also some indirect costs (variable indirect manufacturing costs).

**9-3** No. The difference between absorption costing and variable costs is due to accounting for fixed manufacturing costs. As service or merchandising companies have no fixed manufacturing costs, these companies do not make choices between absorption costing and variable costing.

**9-4** The main issue between variable costing and absorption costing is the proper timing of the release of fixed manufacturing costs as costs of the period:

a. at the time of incurrence, or

b. at the time the finished units to which the fixed overhead relates are sold.

Variable costing uses (a) and absorption costing uses (b).

**9-5** No. A company that makes a variable-cost/fixed-cost distinction is not forced to use any specific costing method. The Stassen Company example in the text of Chapter 9 makes a variable-cost/fixed-cost distinction. As illustrated, it can use variable costing, absorption costing, or throughput costing.

 A company that does not make a variable-cost/fixed-cost distinction cannot use variable costing or throughput costing. However, it is not forced to adopt absorption costing. For internal reporting, it could, for example, classify all costs as costs of the period in which they are incurred.

**9-6** Variable costing does not view fixed costs as unimportant or irrelevant, but it maintains that the distinction between behaviors of different costs is crucial for certain decisions. The planning and management of fixed costs is critical, irrespective of what inventory costing method is used.

**9-7** Under absorption costing, heavy reductions of inventory during the accounting period might combine with low production and a large production volume variance. This combination could result in lower operating income even if the unit sales level rises.

**9-8** (a) The factors that affect the breakeven point under variable costing are

1. fixed (manufacturing and operating) costs.

2. contribution margin per unit.

(b) The factors that affect the breakeven point under absorption costing are

1. fixed (manufacturing and operating) costs.

2. contribution margin per unit.

3. production level in units in excess of breakeven sales in units.

4. denominator level chosen to set the fixed manufacturing cost rate.

**9-9** Examples of dysfunctional decisions managers may make to increase reported operating income are:

a. Plant managers may switch production to those orders that absorb the highest amount of fixed manufacturing overhead, irrespective of the demand by customers.

b. Plant managers may accept a particular order to increase production even though another plant in the same company is better suited to handle that order.

c. Plant managers may defer maintenance beyond the current period to free up more time for production.

**9-10** Approaches used to reduce the negative aspects associated with using absorption costing include:

a. Change the accounting system:

* Adopt either variable or throughput costing, both of which reduce the incentives of managers to produce for inventory.
* Adopt an inventory holding charge for managers who tie up funds in inventory.

b. Extend the time period used to evaluate performance. By evaluating performance over a longer time period (say, three to five years), the incentive to take short-run actions that reduce long-term income is lessened.

1. Include nonfinancial as well as financial variables in the measures used to evaluate performance.

**9-11** The *theoretical capacity* and *practical capacity* denominator-level concepts emphasize what a plant can supply. The *normal capacity utilization* and *master-budget capacity utilization* concepts emphasize what customers demand for products produced by a plant.

**9-12** The *downward demand spiral* is the continuing reduction in demand for a company’s product that occurs when the prices of competitors’ products are not met, and (as demand drops further) higher and higher unit costs result in more and more reluctance to meet competitors’ prices. Pricing decisions need to consider competitors and customers as well as costs.

**9-13** No. It depends on how a company handles the production-volume variance in the end-of-period financial statements. For example, if the adjusted allocation-rate approach is used, each denominator-level capacity concept will give the same financial statement numbers at year-end.

**9-14** For tax reporting in the United States, the IRS requires only that indirect production costs are “fairly” apportioned among all items produced. Overhead rates based on normal or master-budget capacity utilization, as well as the practical capacity concept, are permitted. At year-end, proration of any variances between inventories and cost of goods sold is required (unless the variance is immaterial in amount).

**9-15** No. The costs of having too much capacity/too little capacity involve revenue opportunities potentially forgone as well as costs of money tied up in plant assets.

**9-16** (30 min.) **Variable and absorption costing, explaining operating-income differences.**

1.Key inputs for income statement computations are

|  |  |  |
| --- | --- | --- |
|  | **April** | **May** |
| Beginning inventoryProductionGoods available for saleUnits soldEnding inventory | 0500500350150 | 150400550520 30 |

The budgeted fixed cost per unit and budgeted total manufacturing cost per unit under absorption costing are

|  |  |  |
| --- | --- | --- |
|  | **April** | **May** |
| (a) Budgeted fixed manufacturing costs(b) Budgeted production (c) = (a) ÷ (b) Budgeted fixed manufacturing cost per unit (d) Budgeted variable manufacturing cost per unit (e) = (c) + (d) Budgeted total manufacturing cost per unit | $2,000,000500$4,000$10,000$14,000 | $2,000,000500$4,000$10,000$14,000 |

(a) Variable costing

|  |  |  |
| --- | --- | --- |
|  | **April 2014** | **May 2014** |
| Revenuesa  |  | $8,400,000 |  | $12,480,000 |
| Variable costs |  |  |  |  |
|  Beginning inventory | $ 0 |  | $1,500,000 |  |
|  Variable manufacturing costsb |  5,000,000 |  |  4,000,000 |  |
|  Cost of goods available for sale | 5,000,000 |  | 5,500,000 |  |
|  Deduct ending inventoryc |  (1,500,000) |  |  (300,000) |  |
|  Variable cost of goods sold | 3,500,000 |  | 5,200,000 |  |
|  Variable operating costsd |  1,050,000 |  |  1,560,000 |  |
|  Total variable costs |  |  4,550,000 |  |  6,760,000 |
| Contribution margin |  | 3,850,000 |  | 5,720,000 |
| Fixed costs |  |  |  |  |
|  Fixed manufacturing costs | 2,000,000 |  | 2,000,000 |  |
|  Fixed operating costs |  600,000 |  |  600,000 |  |
|  Total fixed costs |  |  2,600,000 |  |  2,600,000 |
| Operating income |  | $1,250,000 |  | $3,120,000 |

a $24,000 × 350; $24,000 × 520 c $10,000 × 150; $10,000 × 30

b $10,000 × 500; $10,000 × 400 d $3,000 × 350; $3,000 × 520

 (b) Absorption costing

|  |  |  |
| --- | --- | --- |
|  | **April 2014** | **May 2014** |
| Revenuesa |  | $8,400,000 |  | $12,480,000 |
| Cost of goods sold |  |  |  |  |
|  Beginning inventory | $ 0 |  | $2,100,000 |  |
|  Variable manufacturing costsb | 5,000,000 |  | 4,000,000 |  |
| Allocated fixed manufacturing costsc |  2,000,000 |  |  1,600,000 |  |
| Cost of goods available for sale | 7,000,000 |  | 7,700,000 |  |
| Deduct ending inventoryd |  (2,100,000) |  |  (420,000)  |  |
| Adjustment for prod.-vol. variancee |  0 |  |  400,000 U |  |
|  Cost of goods sold |  |  4,900,000 |  |  7,680,000 |
| Gross margin |  | 3,500,000 |  | 4,800,000 |
| Operating costs |  |  |  |  |
| Variable operating costsf | 1,050,000 |  | 1,560,000 |  |
| Fixed operating costs |  600,000 |  |  600,000 |  |
| Total operating costs |  |  1,650,000 |  |  2,160,000 |
| Operating income |  | $1,850,000 |  | $ 2,640,000 |

a $24,000 × 350; $24,000 × 520 d $14,000 × 150; $14,000 × 30

b $10,000 × 500; $10,000 × 400 e $2,000,000 – $2,000,000; $2,000,000 – $1,600,000

c $4,000 × 500; $4,000 × 400 f $3,000 × 350; $3,000 × 520

2. –  = – 

April:

 $1,850,000 – $1,250,000 = ($4,000 × 150) – ($0)

 $600,000 = $600,000

May:

 $2,640,000 – $3,120,000 = ($4,000 × 30) – ($4,000 × 150)

 – $480,000 = $120,000 – $600,000

 – $480,000 = – $480,000

The difference between absorption and variable costing is due solely to moving fixed manufacturing costs into inventories as inventories increase (as in April) and out of inventories as they decrease (as in May).

**9-17** (20 min.) **Throughput costing (continuation of Exercise 9-16).**

|  |  |  |
| --- | --- | --- |
| 1. | **April 2014** | **May 2014** |
| Revenuesa |  | $8,400,000 |  | $12,480,000 |
| Direct material cost of goods soldBeginning inventoryDirect materials in goods manufacturedb | $ 0 3,350,000 |  | $1,005,000 2,680,000 |  |
| Cost of goods available for saleDeduct ending inventoryc | 3,350,000 (1,005,000) |  | 3,685,000 (201,000) |  |
|  Total direct material cost of goods soldThroughput marginOther costs |  2,345,0006,055,000 |  |  3,484,0008,996,000 |
| Manufacturing costs | 3,650,000d |  | 3,320,000e |  |
| Other operating costs |  1,650,000f |  |  2,160,000g |  |
| Total other costsOperating income |  |  5,300,000$ 755,000 |  |  5,480,000$ 3,516,000 |

a $24,000 × 350; $24,000 × 520 e ($3,300 × 400) + $2,000,000

b $6,700 × 500; $6,700 × 400 f ($3,000 × 350) + $600,000

c $6,700 × 150; $6,700 × 30 g ($3,000 × 520) + $600,000

d ($3,300 × 500) + $2,000,000

1. Operating income under:

|  |  |  |
| --- | --- | --- |
|  | **April** | **May** |
| Variable costingAbsorption costingThroughput costing | $1,250,0001,850,000755,000 | $3,120,0002,640,0003,516,000 |

In April, throughput costing has the lowest operating income, whereas in May throughput costing has the highest operating income. Throughput costing puts greater emphasis on sales as the source of operating income than does either absorption or variable costing.

3. Throughput costing puts a penalty on production without a corresponding sale in the same period. Costs other than direct materials that are variable with respect to production are expensed in the period of incurrence, whereas under variable costing they would be capitalized. As a result, throughput costing provides less incentive to produce for inventory than either variable costing or absorption costing.

**9-18** (40 min.) **Variable and absorption costing, explaining operating-income differences.**

1. Key inputs for income statement computations are:

|  |  |  |  |
| --- | --- | --- | --- |
|  | **January** | **February** | **March** |
| Beginning inventoryProductionGoods available for saleUnits soldEnding inventory | 0 1,4001,400 1,300 100 | 100 1,3751,475 1,375 100 | 100 1,4301,530 1,455 75 |

 The budgeted fixed manufacturing cost per unit and budgeted total manufacturing cost per unit under absorption costing are:

|  |  |  |  |
| --- | --- | --- | --- |
|  | **January** | **February** | **March** |
| (a) Budgeted fixed manufacturing costs(b) Budgeted production(c) = (a) ÷ (b) Budgeted fixed manufacturing cost per unit(d) Budgeted variable manufacturing cost per unit(e) = (c) + (d) Budgeted total manufacturing cost per unit | $490,0001,400$350$950$1,300 | $490,0001,400$350$950$1,300 | $490,0001,400$350$950$1,300 |

(a) Variable Costing

|  |  |  |  |
| --- | --- | --- | --- |
|  | **January 2014** | **February 2014** | **March 2014** |
| Revenuesa |  | $4,550,000 |  | $4,812,500 |  | $5,092,500 |
| Variable costsBeginning inventoryb | $ 0 |  | $ 95,000 |  | $ 95,000 |  |
| Variable manufacturing costsc |  1,330,000 |  | 1,306,250 |  |  1,358,500 |  |
| Cost of goods available for saleDeduct ending inventoryd |  1,330,000 (95,000) |  | 1,401,250 (95,000) |  | 1,453,500 (71,250) |  |
| Variable cost of goods soldVariable operating costse Total variable costs |  1,235,000 942,500 |  2,177,500 | 1,306,250 996,875 |  2,303,125 | 1,382,250 1,054,875 |  2,437,125 |
| Contribution marginFixed costsFixed manufacturing costsFixed operating costs Total fixed costsOperating income | 490,000 120,000 | 2,372,500 610,000$1,762,500 | 490,000 120,000 | 2,509,375 610,000$1,899,375 |  490,000 120,000 |  2,655,375 610,000$2,045,375 |

a $3,500 × 1,300; $3,500 × 1,375; $3,500 × 1,455

b $? × 0; $950 × 100; $950 × 100

c $950 × 1,400; $950 × 1,375; $950 × 1,430

d $950 × 100; $950 × 100; $950 × 75

e $725 × 1,300; $725 × 1,375; $725 × 1,455

(b) Absorption Costing

|  |  |  |  |
| --- | --- | --- | --- |
|  | **January 2014** | **February 2014** | **March 2014** |
| RevenuesaCost of goods soldBeginning inventoryb | $ 0 | $4,550,000 | $ 130,000 | $4,812,500 | $ 130,000 | $5,092,500 |
| Variable manufacturing costsc | 1,330,000 |  |  1,306,250 |  |  1,358,500 |  |
| Allocated fixed manufacturing costsd |  490,000 |  |  481,250 |  |  500,500 |  |
| Cost of goods available for sale | 1,820,000 |  | 1,917,500 |  |  1,989,000 |  |
| Deduct ending inventorye |  (130,000) |  |  (130,000) |  |  (97,500) |  |
| Adjustment for prod. vol. var.f |  0 |  |  8,750 U |  |  (10,500) F |  |
|  Cost of goods sold |  |  1,690,000 |  |  1,796,250 |  |  1,881,000 |
| Gross margin |  | 2,860,000 |  | 3,016,250 |  | 3,211,500 |
| Operating costs |  |  |  |  |  |  |
| Variable operating costsg | 942,500 |  | 996,875 |  |  1,054,875 |  |
| Fixed operating costs |  120,000 |  |  120,000 |   |  120,000 |  |
|  Total operating costs |  |  1,062,500 |  |  1,116,875 |  |  1,174,875 |
| Operating income |  | $1,797,500 |  | $1,899,375 |  | $2,036,625 |

a $3,500 × 1,300; $3,500 × 1,375; $3,500 × 1,455

b $?× 0; $1,300 × 100; $1,300 × 100

c $950 × 1,400; $950 × 1,375; $950 × 1,430

d $350 × 1,400; $350 × 1,375; $350 × 1,430

e $1,300 × 100; $1,300 × 100; $1,300 × 75

f $490,000 – $490,000; $490,000 – $481,250; $490,000 – $500,500

g $725 × 1,300; $725 × 1,375; $725 × 1,455

2. – = –

###### January: $1,797,500 – $1,762,500 = ($350 × 100) – $0

 $35,000 = $35,000

###### February: $1,899,375 – $1,899,375 = ($350 × 100) – ($350 × 100)

 $0 = $0

March: $2,036,625 – $2,045,375 = ($350 × 75) – ($350 × 100)

 – $8,750 = – $8,750

The difference between absorption and variable costing is due solely to moving fixed manufacturing costs into inventories as inventories increase (as in January) and out of inventories as they decrease (as in March).

**9-19** (20–30 min.) **Throughput costing** **(continuation of Exercise 9-18).**

1.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **January** | **February** | **March** |
| RevenuesaDirect material cost of goods soldBeginning inventoryb | $ 0 | $4,550,000 | $55,000 | $4,812,500 | $ 55,000 | $5,092,500 |
| Direct materials in goods manufacturedcCost of goods available for saleDeduct ending inventoryd Total direct material cost of goods sold |  770,000770,000 (55,000) |  715,000 |  756,250811,250 (55,000) |  400,000 |  786,500841,500 (41,250) |  800,250 |
| Throughput margin |  | 3,835,000 |  | 4,056,250 |  | 4,292,250 |
| Other costsManufacturingeOperatingf Total other costsOperating income | 1,050,000 1,062,500 |  2,112,500$1,722,500 | 1,040,000 1,116,875 |  2,156,875$1,899,375 |  1,062,000 1,174,875 |  2,236,875$2,055,375 |

a $3,500 × 1,300; $3,500 × 1,375; $3,500 × 1,455

b $? × 0; $550 × 100; $550 × 100

c $550 × 1,400; $550 × 1,375; $550 × 1,430

d $550 × 100; $550 × 100; $550 ×75

e ($400 × 1,400) + $490,000; ($400 × 1,375) + $490,000; ($400 × 1,430) + $490,000

f ($725 × 1,300) + $120,000; ($725 × 1,375) + $120,000; ($725 × 1,455) + $120,000

2. Operating income under:

|  |  |  |  |
| --- | --- | --- | --- |
|  | **January** | **February** | **March** |
| Variable costingAbsorption costingThroughput costing | $1,762,5001,797,5001,722,500 | $1,899,3751,899,3751,899,375 | $2,045,3752,036,6252,055,375 |

Throughput costing puts greater emphasis on sales as the source of operating income than does absorption or variable costing. Accordingly, income under throughput costing is highest in periods where the number of units sold is relatively large (as in March) and lower in periods of weaker sales (as in January).

3. Throughput costing puts a penalty on producing without a corresponding sale in the same period. Costs other than direct materials that are variable with respect to production are expensed when incurred, whereas under variable costing they would be capitalized as an inventoriable cost.

**9-20** (40 min) **Variable versus absorption costing.**

1.

Beginning Inventory + 2014 Production = 2014 Sales + Ending Inventory

 85,000 units + 2014 Production = 345,400 units + 34,500 units

 2014 Production = 294,900 units

# Income Statement for the Zwatch Company, Variable Costing

**for the Year Ended December 31, 2014**

|  |  |  |
| --- | --- | --- |
| Revenues: $22 × 345,400 |  | $7,598,800 |
| Variable costs |  |  |
|  Beginning inventory: $5.10 × 85,000 | $ 433,500 |  |
|  Variable manufacturing costs: $5.10 × 294,900 |  1,503,990 |  |
|  Cost of goods available for sale | 1,937,490 |  |
|  Deduct ending inventory: $5.10 × 34,500 |  (175,950) |  |
|  Variable cost of goods sold | 1,761,540 |  |
|  Variable operating costs: $1.10 × 345,400 |  379,940 |  |
|  Adjustment for variances |  0 |  |
|  Total variable costs |  |  2,141,480 |
| Contribution margin |  | 5,457,320 |
| Fixed costs |  |  |
|  Fixed manufacturing overhead costs | 1,440,000 |  |
|  Fixed operating costs |  1,080,000 |  |
|  Total fixed costs |  |  2,520,000 |
| Operating income |  | $2,937,320 |

Absorption Costing Data

Fixed manufacturing overhead allocation rate =

 Fixed manufacturing overhead/Denominator level machine-hours = $1,440,0006,000

 = $240 per machine-hour

Fixed manufacturing overhead allocation rate per unit =

 Fixed manufacturing overhead allocation rate/standard production rate = $240 50

 = $4.80 per unit

**Income Statement for the Zwatch Company, Absorption Costing**

**for the Year Ended December 31, 2014**

|  |  |  |
| --- | --- | --- |
| Revenues: $22 × 345,400 |  | $7,598,800 |
| Cost of goods sold |  |  |
|  Beginning inventory ($5.10 + $4.80) × 85,000 | $ 841,500 |  |
|  Variable manuf. costs: $5.10 × 294,900 | 1,503,990 |  |
|  Allocated fixed manuf. costs: $4.80 × 294,900 |  1,415,520 |  |
|  Cost of goods available for sale | $3,761,010 |  |
|  Deduct ending inventory: ($5.10 + $4.80) × 34,500 | (341,550) |  |
|  Adjust for manuf. variances ($4.80 × 5,100)a |  24,480 U |  |
|  Cost of goods sold |  |  3,443,940 |
| Gross margin |  | 4,154,860 |
| Operating costs |  |  |
|  Variable operating costs: $1.10 × 345,400 | $ 379,940 |  |
|  Fixed operating costs |  1,080,000 |  |
|  Total operating costs |  |  1,459,940 |
| Operating income |  | $2,694,920 |

a Production volume variance = [(6,000 hours × 50) – 294,900] × $4.80

 = (300,000 – 294,900) × $4.80

 = $24,480

1. Zwatch’s operating margins as a percentage of revenues are

|  |  |
| --- | --- |
| Under variable costing: |  |
|  Revenues |  $7,598,800 |
|  Operating income |  2,937,320 |
|  Operating income as percentage of revenues |  38.7% |
|  |  |
| Under absorption costing: |  |
|  Revenues |  $7,598,800 |
|  Operating income |  2,694,920 |
|  Operating income as percentage of revenues |  35.5% |

3. Operating income using variable costing is about 9 percent higher than operating income calculated using absorption costing.

Variable costing operating income – Absorption costing operating income =

 $2,937,320 – $2,694,920 = $242,400

Fixed manufacturing costs in beginning inventory under absorption costing –

Fixed manufacturing costs in ending inventory under absorption costing

 = ($4.80 × 85,000) – ($4.80 × 34,500) = $242,400

4. The factors the CFO should consider include

1. Effect on managerial behavior.
2. Effect on external users of financial statements.

I would recommend absorption costing because it considers all the manufacturing resources (whether variable or fixed) used to produce units of output. Absorption costing has many critics. However, the dysfunctional aspects associated with absorption costing can be reduced by

* Careful budgeting and inventory planning.
* Adding a capital charge to reduce the incentives to build up inventory.
* Monitoring nonfinancial performance measures.

**9-21** (10 min.) **Absorption and variable costing.**

The answers are 1(a) and 2(c). Computations:

|  |  |  |
| --- | --- | --- |
| 1.  **Absorption Costing**:RevenuesaCost of goods sold:Variable manufacturing costsbAllocated fixed manufacturing costscGross margin | $2,400,000 360,000 | $4,800,000 2,760,0002,040,000 |
| Operating costs:Variable operatingd Fixed operatingOperating income | 1,200,000 400,000 |  1,600,000$ 440,000 |

a $40 × 120,000

b $20 × 120,000

c Fixed manufacturing rate = $600,000 ÷ 200,000 = $3 per output unit

 Fixed manufacturing costs = $3 × 120,000

d $10 × 120,000

|  |  |  |
| --- | --- | --- |
| 2.  **Variable Costing**: |  |  |
| RevenuesaVariable costs:Variable manufacturing cost of goods soldb Variable operating costscContribution marginFixed costs:Fixed manufacturing costsFixed operating costsOperating income | $2,400,000 1,200,000 600,000 400,000 | $4,800,000 3,600,0001,200,000 1,000,000$ 200,000 |

a $40 × 120,000

b $20 × 120,000

c $10 × 120,000

**9-22** (40 min) **Absorption versus variable costing.**

1. The variable manufacturing cost per unit is $30 + $25 + $60 = $115.

|  |  |  |
| --- | --- | --- |
| **2014 Variable-Costing Based Income Statement** |  |  |
| Revenues (17,500  $450 per unit) |  | $7,875,000 |
| Variable costs |  |   |
|  Beginning inventory | $ 0 |   |
|  Variable manufacturing costs (18,000 units  $115 per unit) | 2,070,000 |   |
|  Cost of goods available for sale | 2,070,000 |   |
|  Deduct: Ending inventory (500 units  $115 per unit) |  (57,500) |   |
|  Variable cost of goods sold | 2,012,500 |   |
|  Variable marketing costs (17,500 units  $45 per unit) |  787,500 |   |
|  Total variable costs |  |  2,800,000 |
| Contribution margin |  | 5,075,500 |
| Fixed costs |  |   |
|  Fixed manufacturing costs |  1,200,000 |   |
|  Fixed administrative costs | 965,450 |   |
|  Fixed marketing | 1,366,400 |   |
|  Total fixed costs |  |  3,531,850 |
| Operating income |  | $1,543,150 |

2. Fixed manufacturing overhead rate = $1,200,000 / 20,000 units = $60 per unit

$=\$1,100,000 ÷20,000 units =\$55 per unit$

|  |  |
| --- | --- |
| **2014 Absorption-Costing Based Income Statement** |  |
| Revenues (17,500 units  $450 per unit) |  | $7,875,500 |
| Cost of goods sold |  |   |
|  Beginning inventory | $ 0 |   |
|  Variable manufacturing costs (18,000 units  $115 per unit) |  2,070,000 |   |
|  Allocated fixed manufacturing costs (18,000 units  $60 per unit) |  1,080,000 |  |
|  Cost of goods available for sale |  3,150,000 |   |
|  Deduct ending inventory [500 units  ($115 + $60) per unit] |  (87,500) |   |
|  Add unfavorable production volume variance |  120,000a U |  |
|  Cost of goods sold |  |  3,182,500 |
| Gross margin |  | 4,692,500 |
| Operating costs |  |   |
|  Variable marketing costs (17,500 units  $45 per unit) |  787,500 |   |
|  Fixed administrative costs |  965,450 |   |
|  Fixed marketing |  1,366,400 |   |
|  Total operating costs |  |  3,119,350 |
| Operating income |  | $1,573,150 |

a PVV = $1,200,000 budgeted fixed mfg. costs – $1,080,000 allocated fixed mfg. costs = $120,000 U

3. 2014 operating income under absorption costing is greater than the operating income under variable costing because in 2014 inventory increased by 500 units. As a result, under absorption costing, a portion of the fixed overhead remained in the ending inventory and led to a lower cost of goods sold (relative to variable costing). As shown below, the difference in the two operating incomes is exactly the same as the difference in the fixed manufacturing costs included in ending versus beginning inventory (under absorption costing).

|  |  |
| --- | --- |
| Operating income under absorption costing | $1,573,150 |
| Operating income under variable costing |  1,543,150 |
| Difference in operating income under absorption versus variable costing | $ 30,000 |
|   |   |
| Under absorption costing: |   |
|  Fixed mfg. costs in ending inventory (500 units  $60 per unit) | $ 30,000 |
|  Fixed mfg. costs in beginning inventory (0 units  $60 per unit) |  0 |
|  Change in fixed mfg. costs between ending and beginning inventory | $ 30,000 |
|  |  |

4. Relative to the alternative of using contribution margin (from variable costing), the absorption-costing based gross margin has some pros and cons as a performance measure for Regina’s supervisors. It takes into account both variable costs and fixed costs—costs that the supervisors should be able to control in the long run—and therefore is a more complete measure than contribution margin, which ignores fixed costs (and may cause the supervisors to pay less attention to fixed costs). The downside of using absorption-costing-based gross margin is the supervisor’s temptation to use inventory levels to control the gross margin—in particular, to shore up a sagging gross margin by building up inventories. This can be offset by specifying, or limiting, the inventory build-up that can occur, charging the supervisor a carrying cost for holding inventory, and using nonfinancial performance measures such as the ratio of ending to beginning inventory.

**9-23** (40 min.) **Variable and absorption costing, sales, and operating-income changes.**

Note: In some print versions of the text, the adjustment for production-volume variance for 2014 is listed as (260,600) rather than (260,000) and the gross margin is listed as 468,600 rather than 468,000.

1. Smart Safety’s annual fixed manufacturing costs are $1,300,000. It allocates $25 of fixed manufacturing costs to each unit produced. Therefore, it must be using $1,300,000  $25 = 52,000 units (annually) as the denominator level to allocate fixed manufacturing costs to the units produced.

We can see from Smart Safety’s income statements that it disposes of any production volume variance against cost of goods sold. In 2014, 62,400 units were produced instead of the budgeted 52,000 units. This resulted in a favorable production volume variance of $260,000 F [(62,400 – 52,000) units  $25 per unit], which, when written off against cost of goods sold, increased gross margin by that amount.

1. The breakeven calculation, same for each year, is shown below:

|  |  |  |  |
| --- | --- | --- | --- |
| **Calculation of breakeven volume** |  **2013** |  **2014** |  **2015** |
| Selling price ($2,236,00052,000; $2,236,000  59,000; $2,683,000  62,400) | $43 | $43 | $43 |
| Variable cost per unit (all manufacturing) |  14 |  14 |  14 |
| Contribution margin per unit | $29 | $29 | $29 |
| Total fixed costs (fixed mfg. costs + fixed selling & admin. costs) | $1,508,000 | $1,508,000 | $1,508,000 |
| Breakeven quantity = Total fixed costs  contribution margin per unit | 52,000 | 52,000 | 52,000 |

3.

|  |
| --- |
| **Variable Costing** |
|   |  **2013** |  **2014** |  **2015** |
| Sales (units) |  52,000 |  52,000 |  62,400 |
| Revenues | $2,236,000 | $2,236,000 | $2,683,000 |
| Variable cost of goods sold  |  |  |  |
|  Beginning inventory $14  0; 0; 10,400 | 0 | 0 | 145,600 |
|  Variable manuf. costs $14  52,000; 62,400; 52,000 | 728,000 | 873,600 | 728,000 |
|  Deduct ending inventory $14  0; 10,400; 0  |  0 |  (145,600) |  0 |
|  Variable cost of goods sold |  728,000 |  728,000 |  873,600 |
| Contribution margin | $1,508,000 | $1,508,000 | $1,809,600 |
| Fixed manufacturing costs | $1,300,000 | $1,300,000 | $1,300,000 |
| Fixed selling and administrative expenses |  208,000 |  208,000 |  208,000 |
| Operating income | $ 0 | $ 0 | $ 301,600 |
|   |   |   |   |
| **Explaining variable costing operating income** |  |  |   |
| Contribution margin ($26 contribution margin per unit  sales units) | $1,508,000 | $1,508,000 | $1,809,600 |
| Total fixed costs |  1,508,000 |  1,508,000 |  1,508,000 |
| Operating income | $ 0 | $ 0 | $ 301,600 |

4.

|  |  |  |  |
| --- | --- | --- | --- |
| **Reconciliation of absorption/variable costing** **operating incomes** | **2013** | **2014** | **2015** |
| (1) Absorption costing operating income | $0 | $260,000 | $ 41,600 |
| (2) Variable costing operating income |  0 |  0 |  301,600 |
| (3) Difference in operating incomes = (1) – (2) | $0 | $260,000 | $(260,000) |
| (4) Fixed mfg. costs in ending inventory under absorption costing (ending inventory in units  $25 per unit)  | $0 | $260,000 |  $ 0 |
| (5) Fixed mfg. costs in beginning inventory under absorption costing (beginning inventory in units  $25 per unit)  |  0 |  0 |  260,000 |
| (6) Difference = (4) – (5) | $0 | $260,000 | $(260,000) |

In the table above, row (3) shows the difference between the operating income under absorption costing and the operating income under variable costing, for each of the three years. In 2013, the difference is $0; in 2014, absorption costing income is greater by $260,000; and in 2015, it is less by $260,000. Row (6) above shows the difference between the fixed costs in ending inventory and the fixed costs in beginning inventory under absorption costing; this figure is $0 in 2013, $260,000 in 2014, and –$260,000 in 2015. Row (3) and row (6) explain and reconcile the operating income differences between absorption costing and variable costing.

 Stuart Weil is surprised at the non-zero, positive net income (reported under absorption costing) in 2014, when sales were at the ‘breakeven volume’ of 52,000; further, he is concerned about the drop in operating income in 2015, when, in fact, sales increased to 62,400 units. In 2014, starting with zero inventories, 62,400 units were produced and 52,000 were sold, i.e., at the end of the year, 10,400 units remained in inventory. These 10,400 units had each absorbed $25 of fixed costs (total of $260,000), which would remain as assets on Smart Safety’s balance sheet until they were sold. Cost of goods sold, representing only the costs of the 52,000 units sold in 2014, was accordingly reduced by $260,000, the production volume variance, resulting in a positive operating income even though sales were at breakeven levels. The following year, in 2015, production was 52,000 units, sales were 62,400 units, i.e., all of the fixed costs that were included in 2014 ending inventory flowed through COGS in 2015. Contribution margin in 2015 was $1,809,600 (62,400 units  $29), but in absorption costing, COGS also contains the allocated fixed manufacturing costs of the units sold, which were $1,560,000 (62,400 units  $25), resulting in an operating income of $41,600 = 1,809,600 – $1,560,000 – $208,000 (fixed sales and admin.) Hence the drop in operating income under absorption costing, even though sales were greater than the computed breakeven volume: inventory levels decreased sufficiently in 2015 to cause 2015’s operating income to be lower than 2014 operating income.

 Note that beginning and ending with zero inventories during the 2013–2015 period, under both costing methods, Smart Safety’s total operating income was $301,600.

9-24 (10 min.) Capacity management, denominator-level capacity concepts.

1. a, b
2. a
3. d
4. c, d
5. c
6. d
7. a
8. b (or a)
9. b
10. c, d
11. a, b

**9-25** (20 min.) **Denominator-level problem.**

1. Budgeted fixed manufacturing overhead costs rates:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| DenominatorLevel CapacityConcept |  | Budgeted Fixed**Manufacturing****Overhead per**Period |  | Budgeted**Capacity**Level |  | Budgeted Fixed**Manufacturing****Overhead Cost**Rate |
| Theoretical |  | $ 6,480,000 |  | 5,400 |  | $ 1,200.00 |
| Practical |  | 6,480,000 |  | 3,840 |  | 1,687.50 |
| Normal |  | 6,480,000 |  | 3,240 |  | 2,000.00 |
| Master-budget |  | 6,480,000 |  | 3,600 |  |  1,800.00 |

The rates are different because of varying denominator-level concepts. Theoretical and practical capacity levels are driven by supply-side concepts, i.e., “how much can I produce?” Normal and master-budget capacity levels are driven by demand-side concepts, i.e., “how much can I sell?” (or “how much should I produce?”)

2. The variances that arise from use of the theoretical or practical level concepts will signal that there is a divergence between the supply of capacity and the demand for capacity. This is useful input to managers. As a general rule, however, it is important not to place undue reliance on the production volume variance as a measure of the economic costs of unused capacity.

3. Under a cost-based pricing system, the choice of a master-budget level denominator will lead to high prices when demand is low (more fixed costs allocated to the individual product level), further eroding demand; conversely, it will lead to low prices when demand is high, forgoing profits. This has been referred to as the downward demand spiral—the continuing reduction in demand that occurs when the prices of competitors are not met and demand drops, resulting in even higher unit costs and even more reluctance to meet the prices of competitors. The positive aspects of the master-budget denominator level are that it is based on demand for the product and indicates the price at which all costs per unit would be recovered to enable the company to make a profit. Master-budget denominator level is also a good benchmark against which to evaluate performance.

**9-26** (30 min.) **Variable and absorption costing and breakeven points.**

1. Production = Sales + Ending Inventory – Beginning Inventory

 = 242,400 + 24,800 − 32,600

 = 234,600 ICs.

2. Breakeven point in ICs:

1. Variable Costing:

Q = 

Q = 

Q = 

Q = 224,400 ICs.

b. Absorption costing:

 Fixed manufacturing cost rate = $1,876,800 ÷ 234,600 = $8 per IC

 Q = 

 Q = 

 Q = 

 Q = 

 23 Q − 8 Q = $3,284,400

 15 Q = $3,284,400

 Q = 218,960 ICs.

3. If direct materials costs increase from $13 to $15 per IC, this will lower the unit contribution margin from $23 in 2013 to $21 in 2014.

 a. Variable Costing:

 Q = 

 = 245,772 ICs (rounded up)

 b. Absorption Costing:

 Q = 

 $21 Q = $3,284,400 + $8 Q

 $13 Q = $3,284,400

 Q = 252,647 ICs (rounded up)

**9-27** (40 min.) **Variable costing versus absorption costing.**

1. Absorption Costing:

**Mavis Company Income Statement**

**For the Year Ended December 31, 2014**

Revenues (540,000 × $5.00) $2,700,000

Cost of goods sold:

Beginning inventory (30,000 × $3.70a) $ 111,000

Variable manufacturing costs (550,000 × $3.00) 1,650,000

Allocated fixed manufacturing costs (550,000 × $0.70) 385,000

Cost of goods available for sale 2,146,000

Deduct ending inventory (40,000 × $3.70) (148,000)

Add adjustment for prod.-vol. variance (50,000b × $0.70) 35,000 U

 Cost of goods sold 2,033,000

Gross margin 667,000

Operating costs:

Variable operating costs (540,000 × $1) 540,000

Fixed operating costs 120,000

 Total operating costs 660,000

Operating income $ 7,000

a $3.00 + ($7.00 ÷ 10) = $3.00 + $0.70 = $3.70

b [(10 units per mach. hr. × 60,000 mach. hrs.) – 550,000 units)] = 50,000 units unfavorable

2. Variable Costing:

**Mavis Company Income Statement**

**For the Year Ended December 31, 2014**

Revenues (540,000 × $5.00) $2,700,000

Variable cost of goods sold:

Beginning inventory (30,000 × $3.00) $ 90,000

Variable manufacturing costs

 (550,000 × $3.00) 1,650,000

Cost of goods available for sale 1,740,000

Deduct ending inventory (40,000 × $3.00) (120,000)

 Variable cost of goods sold 1,620,000

Variable operating costs 540,000

Contribution margin 540,000

Fixed costs:

Fixed manufacturing overhead costs 420,000

Fixed operating costs 120,000

 Total fixed costs 540,000

Operating income $ 0

3.The difference in operating income between the two costing methods is:

 =

 $7,000 – $0 = [(40,000 × $0.70) – (30,000 × $0.70)]

 $7,000 = $28,000 – $21,000

 $7,000 = $7,000

The absorption-costing operating income exceeds the variable costing figure by $7,000 because of the increase of $7,000 during 2014 of the amount of fixed manufacturing costs in ending inventory vis-à-vis beginning inventory.

4.



1. Absorption costing is more likely to lead to buildups of inventory than does variable costing. Absorption costing enables managers to increase reported operating income by building up inventory, which reduces the amount of fixed manufacturing overhead included in the current period’s cost of goods sold.

 Ways to reduce this incentive include:

1. Carefully plan budget and inventory.
2. Change the accounting system to variable costing or throughput costing.
3. Incorporate a carrying charge for carrying inventory.
4. Use a longer time period to evaluate performance than a quarter or a year.
5. Include nonfinancial as well as financial measures when evaluating management performance.

**9-28** (40 min.) **Variable costing and absorption costing, the All-Fixed Company.**

This problem always generates active classroom discussion.

1. The treatment of fixed manufacturing overhead in absorption costing is affected primarily by what denominator level is selected as a base for allocating fixed manufacturing costs to units produced. In this case, is 10,000 tons per year, 20,000 tons, or some other denominator level the most appropriate base?

 We usually place the following possibilities on the board or overhead projector and then ask the students to indicate by vote how many used one denominator level versus another. Incidentally, discussion tends to move more clearly if variable-costing income statements are discussed first because there is little disagreement as to computations under variable costing.

1. Variable-Costing Income Statement:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | **2012** | **2013** | **Together** |
| Revenues (and contribution margin) |  |  $300,000 |  $300,000 |  $600,000 |
| Fixed costs: |  |  |  |  |
| Manufacturing costs |  $280,000 |  |  |  |
| Operating costs  |  40,000 |  320,000 |  320,000 |  640,000 |
| Operating income |  |  $ (20,000) |  $ (20,000) |  $ (40,000) |
|  |  |  |  |  |

b. Absorption-Costing Income Statement:

The ambiguity about the 10,000- or 20,000-unit denominator level is intentional. IF YOU WISH, THE AMBIGUITY MAY BE AVOIDED BY GIVING THE STUDENTS A SPECIFIC DENOMINATOR LEVEL IN ADVANCE.

Alternative 1. Use 20,000 units as a denominator; fixed manufacturing overhead per unit is $280,000 ÷ 20,000 = $14.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **2012** | **2013** | **Together** |
| Revenues |  $300,000 |  $ 300,000 | $600,000 |
| Cost of goods sold |  |  |  |
|  Beginning inventory | 0 | 140,000\* | 0 |
|  Allocated fixed manufacturing costs at $14 |  280,000 |  — |  280,000 |
|  Deduct ending inventory |  (140,000) |  — |  — |
|  Adjustment for production-volume variance |  0 |  280,000 U |  280,000 U |
|  Cost of goods sold |  140,000 |  420,000 |  560,000 |
| Gross margin | 160,000 | (120,000) | 40,000 |
| Operating costs |  40,000 |  40,000 |  80,000 |
| Operating income |  $120,000 | $(160,000)  | $ (40,000) |

 \* Inventory carried forward from 2012 and sold in 2013.

Alternative 2. Use 10,000 units as a denominator; fixed manufacturing overhead per unit is $280,000 ÷ 10,000 = $28.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **2012** | **2013** | **Together** |
| Revenues |  $300,000 |  $300,000 | $600,000 |
| Cost of goods sold |  |  |  |
|  Beginning inventory | 0 | 280,000\* | 0 |
|  Allocated fixed manufacturing costs at $28 |  560,000 |  — |  560,000 |
|  Deduct ending inventory |  (280,000) |  — |  — |
|  Adjustment for production-volume variance | (280,000) F |  280,000 U |  0 |
|  Cost of goods sold |  0 |  560,000 |  560,000 |
| Gross margin | 300,000 | (260,000) | 40,000 |
| Operating costs |  40,000 |  40,000 |  80,000 |
| Operating income |  $260,000 |  $(300,000) |  $ (40,000) |

 \*Inventory carried forward from 2012 and sold in 2013.

 Note that operating income under variable costing follows sales and is not affected by inventory changes.

 Note also that students will understand the variable-costing presentation much more easily than the alternatives presented under absorption costing.

2.  =  = 

 = 10,667 (rounded) tons per year or 21,334 for two years.

 If the company could sell 667 more tons per year at $30 each, it could get the extra $20,000 contribution margin needed to break even.

 Most students will say that the breakeven point is 10,667 tons per year under both absorption costing and variable costing. The logical question to ask a student who answers 10,667 tons for variable costing is: “What operating income do you show for 2012 under absorption costing?” If a student answers $120,000 (alternative 1 above), or $260,000 (alternative 2 above), ask: “But you say your breakeven point is 10,667 tons. How can you show an operating income on only 10,000 tons sold during 2012?”

 The answer to the above dilemma lies in the fact that operating income is affected by both sales and production under absorption costing.

 Given that sales would be 10,000 tons in 2012, solve for the production level that will provide a breakeven level of zero operating income. Using the formula in the chapter, sales of 10,000 units, and a fixed manufacturing overhead rate of $14 (based on $280,000 ÷ 20,000 units denominator level = $14):

Let P = Production level

= 

 10,000 tons = 

 $300,000 = $320,000 + $140,000 – $14P

 $14P = $160,000

 P = 11,429 units (rounded)

Proof:

 Gross margin, 10,000 × ($30 – $14) $160,000

 Production-volume variance,

 (20,000 – 11,429) × $14 $119,994

 Marketing and administrative costs 40,000 159,994

 Operating income (due to rounding) $ 6

Given that production would be 20,000 tons in 2012, solve for the breakeven unit sales level. Using the formula in the chapter and a fixed manufacturing overhead rate of $14 (based on a denominator level of 20,000 units):

 Let N = Breakeven sales in units

 N = 

 N = 

 $30N = $320,000 + $14N – $280,000

 $16N = $40,000

 N = 2,500 units

Proof:

 Gross margin, 2,500 × ($30 – $14) $40,000

 Production-volume variance $ 0

 Marketing and administrative costs 40,000 40,000

 Operating income $ 0

We find it helpful to put the following comparisons on the board:

 Variable costing breakeven = f(sales)

 = 10,667 tons

 Absorption costing breakeven = f(sales and production)

 = f(10,000 and 11,429)

 = f(2,500 and 20,000)

3. Absorption costing inventory cost: Either $140,000 or $280,000 at the end of 2012 and zero at the end of 2013.

 Variable costing: Zero at all times. This is a major criticism of variable costing and focuses on the issue of the definition of an asset.

4. Operating income is affected by both production and sales under absorption costing. Hence, most managers would prefer absorption costing because their performance in any given reporting period, at least in the short run, is influenced by how much production is scheduled near the end of a period.

**9-29** (30–35 min.) **Comparison of variable costing and absorption costing.**

1. Because production volume variance is unfavorable, the budgeted fixed manufacturing overhead must be larger than the fixed manufacturing overhead allocated.

 = –

 $405,000 = $1,350,000 – Allocated

 Allocated = $945,000, which is 70% of $1,350,000

If 70 percent of the budgeted fixed costs were allocated, the plant must have been operating at 70 percent of denominator level in 2014.

2. The problem provides the beginning and ending inventory balances under both variable and absorption costing. Under variable costing, all fixed costs are written off as period costs, i.e., they are not inventoried. Under absorption costing, inventories include variable and fixed costs. Therefore the difference between inventory under absorption costing and inventory under variable costing is the amount of fixed costs included in the inventory.

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  | **Fixed Manuf.** |
|  | **Absorption** | **Variable** | **Overhead** |
|  | **Costing** | **Costing** | **in Inventory** |
| Inventories: |  |  |  |
|  December 31, 2013 |  $1,730,000 | $1,345,000 | $385,000 |
|  December 31, 2014 |  215,000 |  45,000 |  170,000 |

3. Note that the answer to (3) is independent of (1). The difference in operating income of $215,000 ($1,610,000 – $1,395,000) is explained by the release of $215,000 of fixed manufacturing costs when the inventories were decreased during 2014:

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  | **Fixed Manuf.** |
|  |  **Absorption** |  **Variable** | **Overhead** |
|  | Costing | **Costing** | **in Inventory** |
| Inventories: |  |  |  |
|  December 31, 2013 |  $1,730,000 | $1,345,000 | $385,000 |
|  December 31, 2014 |  215,000 |  45,000 |  170,000 |
| Release of fixed manuf. costs |  |  |  $215,000 |

The above schedule in this requirement is a formal presentation of the equation:

 =

 ($1,395,000 – $1,610,000) = ($170,000 – $385,000)

 – $215,000 = – $215,000

4. Under absorption costing, operating income is a function of both sales and production (i.e., change in inventory levels). During 2014, Gammaro experienced a severe decline in inventory levels: sales were probably higher than anticipated, production was probably lower than planned (at 70 percent of denominator level), resulting in much of the 2014 beginning inventory passing through cost of goods sold in 2014. This means that under absorption costing, large amounts of inventoried fixed costs have flowed through 2014 cost of goods sold, resulting in a smaller operating income than in 2013, despite an increase in sales volume.

**9-30** (30 min.) **Effects of differing production levels on absorption costing income: Metrics to minimize inventory buildups.**

1.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  |  | **26,000****Books** | **32,500****Books** | **33,800****Books** |

 Revenues $2,106,000 $2,106,000 $2,106,000

 Cost of goods sold 1,586,000a 1,586,000 1,586,000

 Production-volume variance 0b  (104,000)c (124,800)d

 Net cost of goods sold 1,586,000 1,482,000 1,461,200

 Gross Margin $ 520,000 $ 624,000 $ 644,800

 a Cost per unit = ($45 + $416,000/26,000 books sold) = $61 per book

 CGS = $61 × 26,000 = $1,586,000

 b volume variance = Budgeted fixed cost – fixed overhead rate × production

 $416,000 – ($16 × 26,000 books) = $0

 c volume variance = Budgeted fixed cost – fixed overhead rate × production

 $416,000 – ($16 × 32,500 books) = – $104,000

 d volume variance = Budgeted fixed cost – fixed overhead rate × production

 $416,000 – ($16 × 33,800 books) = – $124,800

2.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **26,000****Books** | **32,500****Books** | **33,800****Books** |

Beginning inventory 0 0 0

+ Production 26,000 books 32,500 books 33,800 books

 26,000 32,500 33,800

– Books sold 26,000 26,000 26,000

Ending inventory 0 books 6,500 books 7,800 books

× Cost per book × $61 × $61 × $61

Cost of Ending Inventory $0 $396,500 $475,800

3a.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **26,000****Books** | **32,500****Books** | **33,800****Books** |

Gross margin $520,000 $624,000 $644,800

 Less 10% × Ending inventory 0 (19,825) (23,790)

 Adjusted gross margin $520,000 $604,175 $621,010

While adjusting for ending inventory does to some degree mitigate the increase in inventory associated with excess production, it may be difficult to mechanically compensate for all of the increased income. In addition, it does nothing to hold the manager responsible for the poor decisions from the organization’s standpoint.

3b.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **26,000****Books** | **32,500****Books** | **33,800****Books** |

1) Inventory change:

End inventory ─ begin inventory 0 6,500 books 7,800 books

2) Excess production (%)

Production ÷ sales 26,000 ÷ 26,000 32,500 ÷ 26,000 33,800 ÷26,000

 1.0 1.25 1.3

* A ratio of ending inventory to beginning inventory, as suggested in the book, is not possible because beginning inventory was zero, so we substituted change in inventory level.

For these nonfinancial measures to be useful they must be incorporated into the reward function of the manager.

**9-31** (25–30 min.) **Alternative denominator-level capacity concepts, effect on operating income.**

1.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  | **Budgeted Fixed** |
|  | **Budgeted Fixed**  | **Days of**  | **Hours of**  |  | **Budgeted**  | **Manufacturing** |
| **Denominator-Level Capacity Concept** | **Manuf. Overhead per Period** | **Production per Period** | **Production per Day** | **Barrels** **per Hour** | **Denominator Level (Barrels)** | **Overhead Rate** **per Barrel** |
|  | **(1)** | **(2)** | **(3)** | **(4)** | **(5) = (2) (3) (4)** | **(6) = (1) (5)** |
| Theoretical capacity | $27,900,000 | 358 | 22 | 545 | 4,292,420 | $ 6.50 |
| Practical capacity |  27,900,000 | 348 | 20 | 510 | 3,549,600 |  7.86 |
| Normal capacity utilization |  27,900,000 | 348 | 20 | 410 | 2,853,600 |  9.78 |
| Master-budget utilization |  |  |  |  |  |  |
| (a) January–June 2014 |  13,950,000 | 174 | 20 | 315 | 1,096,200 |  12.73 |
| (b) July–December 2014 |  13,950,000 | 174 | 20 | 505 | 1,757,400 |  7.94 |

The differences arise for several reasons:

a. The theoretical and practical capacity concepts emphasize supply factors and are consequently higher, while normal capacity utilization and master-budget utilization emphasize demand factors.

b. The two separate six-month rates for the master-budget utilization concept differ because of seasonal differences in budgeted production.

2. Using column (6) from above,

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Per Barrel**  |  |  |
| **Denominator-Level****Capacity Concept**  | **Budgeted** **Fixed Mfg. Overhead** **Rate per Barrel****(6)** | **Budgeted Variable Mfg. Cost Rate****(7)** | **Budgeted Total Mfg****Cost Rate****(8) =** **(6) + (7)** | **Fixed Mfg.** **Overhead****Costs Allocated****(9) =** **2,670,000  (6)**  | **Fixed** **Mfg. Overhead Variance****(10) =** **$26,700,000 – (9)** |
| Theoretical capacity | $6.50 |  $30.20a | $36.70 | $17,355,000 | $9,345,000 | U |
| Practical capacity |  7.86 |  30.20 |  38.06 |  20,986,200 |  5,713,800 | U |
| Normal capacity utilization |  9.78 |  30.20 |  39.98 |  26,112,600 |  587,400 | U |

 a $80,634,000****2,670,000 barrels

# Absorption-Costing Income Statement

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Theoretical** **Capacity** | **Practical Capacity** | **Normal** **Capacity Utilization** |
| Revenues (2,460,000 bbls.  $47 per bbl.) | $115,620,000 | $115,620,000 | $115,620,000 |
| Cost of goods sold |  |  |  |
|  Beginning inventory |  0 |  0 |  0 |
|  Variable mfg. costs |  80,634,000 | 80,634,000 |  80,634,000 |
|  Fixed mfg. overhead costs allocated (2,670,000 units $6.50; $7.86; $9.78 per unit) |  17,355,000 |  20,986,200 |  26,112,600 |
|  Cost of goods available for sale |  97,989,000 |  101,620,200 |  106,746,600 |
|  Deduct ending inventory  (210,000 units  $36.70; $38.06; $39.98 per unit) |  (7,707,000) |  (7,992,600) |  (8,395,800) |
|  Adjustment for variances (add: all unfavorable) |  9,345,000 U |  5,713,800 U |  587,400U |
|  Cost of goods sold |  99,627,000 |  99,341,400 |  98,938,200 |
| Gross margin |  15,993,000 |  16,278,600 |  16,681,800 |
| Other costs |  0 |  0 |  0 |
| Operating income |  $ 15,993,000 |  $ 16,278,600 |  $ 16,681,800 |

**9-32** (20 min.) **Motivational considerations in denominator-level capacity selection (continuation of 9-31).**

1. If the plant manager gets a bonus based on operating income, he/she will prefer the denominator-level capacity to be based on normal capacity utilization (or master-budget utilization). In times of rising inventories, as in 2014, this denominator level will maximize the fixed overhead trapped in ending inventories and will minimize COGS and maximize operating income. Of course, the plant manager cannot always hope to increase inventories every period, but on the whole, he/she would still prefer to use normal capacity utilization because the smaller the denominator, the higher the amount of overhead costs capitalized for inventory units. Thus, if the plant manager wishes to be able to “adjust” plant operating income by building inventory, normal capacity utilization (or master-budget capacity utilization) would be preferred.

2. Given the data in this question, the theoretical capacity concept reports the lowest operating income and thus (other things being equal) the lowest tax bill for 2014. Castle Lager benefits by having deductions as early as possible. The theoretical capacity denominator-level concept maximizes the deductions for manufacturing costs.

3. The IRS may restrict the flexibility of a company in several ways:

a. Restrict the denominator-level concept choice (to say, practical capacity).

b. Restrict the cost line items that can be expensed rather than inventoried.

c. Restrict the ability of a company to use shorter write-off periods or more accelerated write-off periods for inventoriable costs.

d. Require proration or allocation of variances to represent actual costs and actual capacity used.

**9-33** (25 min.) **Denominator-level choices, changes in inventory levels, effect on operating income.**

1.

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  | **Normal** |
|  | **Theoretical** | **Practical** | **Capacity** |
|  | **Capacity** | **Capacity** | **Utilization** |
| Denominator level in units | 275,000 |   | 265,000 |   | 233,200 |   |
| Budgeted fixed manuf. costs | $2,915,000 |   | $2,915,000 |   | $2,915,000 |   |
| Budgeted fixed manuf. cost allocated per unit | $ 10.60 |   | $ 11.00 |   | $ 12.50 |   |
| Production in units | 235,000 |   | 235,000 |   | 235,000 |   |
| Allocated fixed manuf. costs (production in units  budgeted fixed manuf. cost allocated per unit) | $2,491,000 |   | $2,585,000 |   | $2,937,500 |   |
| Production volume variance (budgeted fixed manuf. costs – allocated fixed manuf. costs)a | $ 424,000 | U | $ 330,000 | U | $ 22,500 | F |

 aPVV is unfavorable if budgeted fixed manuf. costs are greater than allocated fixed costs

2.

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  | **Normal** |
|  | **Theoretical** | **Practical** | **Capacity** |
|  | **Capacity** | **Capacity** | **Utilization** |
| Units produced | 235,000 | 235,000 | 235,000 |
| Budgeted fixed mfg. cost allocated per unit  | $10.60 | $11.00 | $12.50 |
| Budgeted var. mfg. cost per unit | $ 5.00 | $ 5.00 | $ 5.00 |
| Budgeted cost per unit of inventory or production | $15.60 | $16.50 | $17.50 |
|   |   |   |   |
| **ABSORPTION-COSTING BASED INCOME STATEMENTS** |   |   |   |
| Revenues ($39 selling price per unit  units sold) | $9,750,000 | $9,750,000 | $9,750,000 |
| Cost of goods sold |   |   |   |
|  Beginning inventory (35,000 units  budgeted cost per unit of inventory) | 651,000 | 665,000 | 717,500 |
|  Variable manufacturing costs  (235,000 units $8 per unit) | 1,880,000 | 1,880,000 | 1,880,000 |
|  Allocated fixed manufacturing overhead (235,000 units  budgeted fixed mfg. cost allocated per unit) |  2,491,000 |  2,585,000 |  2,937,000 |
|  Cost of goods available for sale | 5,022,000 | 5,130,000 | 5,535,000 |
|  Deduct ending inventory (20,000b units  budgeted cost per unit of inventory) | (372,000)  | (380,000) | (410,000) |
|  Adjustment for production-volume variance |  424,000 U |  330,000 U |  (22,500) F |
|  Total cost of goods sold |  5,074,000 |  5,080,000 |  5,102,500 |
| Gross margin | 4,676,000 | 4,670,000 | 4,647,500 |
| Operating costs |  200,000 |  200,000 |  200,000 |
| Operating income | $4,476,000 | $4,470,000 | $4,447,500 |
|   |   |   |   |

bEnding inventory = Beginning inventory + production – sales = 35,000 + 235,000 – 250,000 = 20,000 units

 20,000 × $18.60; 20,000 × $19.00; 20,000 ×$20.50

3.Donaldson’s 2014 beginning inventory was 35,000 units; its ending inventory was 20,000 units. So, during 2014, there was a drop of 15,000 units in inventory levels (matching the 15,000 more units sold than produced). The smaller the denominator level, the larger is the budgeted fixed cost allocated to each unit of production, and when those units are sold (all the current production is sold, and then some), the larger is the cost of each unit sold, and the smaller is the operating income. Normal capacity utilization is the smallest capacity of the three; hence, in this year, when production was less than sales, the absorption-costing based operating income is the smallest when normal capacity utilization is used as the denominator level.

4.

|  |  |  |  |
| --- | --- | --- | --- |
| **Reconciliation** |   |   |   |
| Theoretical Capacity Operating Income—Practical Capacity Operating Income | $6,000 |
| Decrease in inventory level during 2014 | 15,000 |  |   |
| Fixed mfg cost allocated per unit under practical capacity—fixed mfg. cost allocated per unit under theoretical capacity ($11 – $10.60) | $0.40 |  |   |
| Additional allocated fixed cost included in COGS under practical capacity = 15,000 units  $0.40 per unit = | $6,000 |

More fixed manufacturing costs are included in inventory under practical capacity, so when inventory level decreases (as it did in 2014), more fixed manufacturing costs are included in COGS under practical capacity than under theoretical capacity, resulting in a lower operating income.

**9-34** (60 min.) **Variable and absorption costing and breakeven points**

1.

|  |  |  |
| --- | --- | --- |
| **2014 Variable-Costing Based Operating Income Statement** |  |  |
| Revenues (995 boards  $750 per board) |  | $746,250 |
| Variable costs |  |   |
|  Beginning inventory (240 boards  $325 per board) | $ 78,000 |   |
|  Variable manufacturing costs (900 boards  $325 per board) |  292,500 |   |
|  Cost of goods available for sale | 370,500 |   |
|  Deduct: Ending inventory (145 boards  $325 per board) |  (47,125) |   |
|  Variable cost of goods sold | 323,375 |   |
|  Variable shipping costs (995 boards  $15 per board) |  14,925 |   |
|  Total variable costs |  |  338,300 |
| Contribution margin |  | 407,950 |
| Fixed costs |  |   |
|  Fixed manufacturing costs |  280,000 |   |
|  Fixed selling and administrative |  112,000 |   |
|  |  |  |
|  Total fixed costs |  |  392,000 |
| Operating income |  | $ 15,950 |

2.

|  |  |
| --- | --- |
| **2014 Absorption-Costing Based Operating Income Statement** |  |
|  |  |  |
| Revenues (995 boards  $750 per board) |  |  $746,250 |
| Cost of goods sold |  |   |
|  Beginning inventory (240 boards  $605a per board) | $145,200 |   |
|  Variable manufacturing costs (900 boards  $325 per board) |  292,500 |   |
|  Allocated fixed manufacturing costs (900 boards  $280 per board) |  252,000 |  |
|  Cost of goods available for sale |  689,700 |   |
|  Deduct ending inventory (145 boards  $605 per board) |  (87,725) |   |
|  |  |  |
|  Cost of goods sold at standard cost | 601,975 |   |
|  Production-volume variance [$280  (1,000 – 900)] |  28,000 | U 629,975 |
| Gross margin |  |  116,275 |
| Operating costs |  |   |
|  Variable shipping costs (995 boards  $15 per board) |  14,925 |   |
|  Fixed selling and administrative |  112,000 |   |
|  |  |  |
|  Total operating costs |  |  126,925 |
| Operating income |  |  $(10,650)  |
|  |   |  |

aFixed manufacturing cost per unit = Fixed manufacturing cost/denominator level of production

 = $280,000/1,000 snowboards

 = $280 per snowboard

$280 fixed manufacturing cost + $325 variable manufacturing cost = $605 per board

1. Breakeven point in units:

a. Variable Costing:

*Q* = 

*Q* = 

*Q* = 

*Q* = 956 snowboards

 b. Absorption costing:

 Fixed manufacturing cost rate = $280,000 ÷ 1,000 = $280 per snowboard

 

 *Q* = 

 $410*Q* = $392,000 + $280*Q* – $252,000 $\$392,000+\$280Q-\$252,000$

 $410*Q* − $280*Q* = $392,000 – $252,000

 $130*Q* = $140,000

 *Q* = 1,077 snowboards

1. Proof of breakeven point:

a. Variable Costing:

Revenues, $750  956 units $717,000

 Variable costs, $340  956 325,040

 Contribution margin, $410  956 392,000

 Fixed costs 391,960

 Operating income $ 40\*

b. Absorption costing:

 Revenues, $750  1,077 units $807,750

 Cost of goods sold:

 Cost of goods @ standard cost, $605  1,077 units 651,585

 Production-volume variance, $280  (1,000 – 900) 28,000U 679,585

 Gross margin 128,165

 Variable shipping costs, $15  1,077 units 16,155

 Fixed selling and administrative costs 112,000 128,155

 Operating income $ 10\*

 \*This is not zero due to rounding to 956 and 1,077 whole units sold.

5. If $20,000 of fixed administrative costs were reclassified as production costs, there would be no change in breakeven sales using variable costing. This is because all fixed costs, regardless of whether they are for production or administrative activities, are treated the same way in a variable costing system. However, this is not true for absorption costing. The change in classification would impact the fixed manufacturing overhead rate that is applied to units of production. If sales and production are unequal, the additional fixed overhead would either increase or decrease breakeven sales.

6. The additional $30 per unit variable production cost will cause unit contribution margin to decrease from $410 to $380. This decrease will cause the breakeven point to increase.

In the case of variable costing:

*Q* = $392,000 ÷ $380

*Q* = 1,032 units (rounded)

In the case of absorption costing:

$380Q = $392,000 + $280Q – $252,000

$380Q – $280Q = $392,000 – $252,000

$100Q = $140,000

 *Q* = 1,400 units

**9-35** (20 min.) **Downward demand spiral.**

1. Fixed manufacturing overhead rate = $= $$576,000/24,000 units = $24 per unit

Manufacturing cost per unit:

$20 direct materials + $35 direct mfg. labor + $9 var. mfg. OH + $24 fixed mfg. OH = $88

Selling price: $88 × 130% = $114.40

2. Fixed manufacturing overhead rate =$= $ $576,000/18,000 units = $32 per unit

Manufacturing cost per unit:

$20 direct materials + $35 direct mfg. labor + $9 var. mfg. OH + $32 fixed mfg. OH = $96

Selling price: $96 × 130% = $124.80

By using budgeted units produced, and not practical capacity, as the denominator level, Gostkowski is burdening its products with the cost of unused capacity. Apparently, the competitor has not done this, and because of its higher selling price, Gostkowski’s sales decline. Consequently, 2014 budgeted quantities are even lower, which increases the unit cost and selling price. This phenomenon is known as the downward demand spiral, and it causes Gostkowski to continually inflate its selling price, which in turn leads to progressively lower sales.

3. Fixed manufacturing overhead rate =$= $ $576,000/48,000 units = $12 per unit

Manufacturing cost per unit:

$20 direct materials + $35 direct mfg. labor + $9 var. mfg. OH + $12 fixed mfg. OH = $76

Selling price: $76 × 130% = $98.80

If Gostkowski had used practical capacity as its denominator level of activity, its initial selling price of $98.60 would have been virtually in line with the $98.40 selling price of Gostkowski’s competitor, and it would likely have resulted in higher sales. Using practical capacity will result in a higher unfavorable production-volume variance, which will most likely be written off to cost of goods sold and reduce operating income. However, as sales and production increase in future years and the company “grows into” its capacity, the amount of unused capacity will be lower, resulting in future cost savings.

**9-36** (35 min.) **Absorption costing and production volume variance—alternative capacity bases.**

1. Inventoriable cost per unit = Variable production cost + Fixed manufacturing overhead/Capacity

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Capacity Type** | **Capacity Level** | **Fixed Mfg. Overhead** | **Fixed Mfg. Overhead Rate** | **Variable Production Cost** | **Inventoriable Cost Per Unit** |
| Theoretical | 900,000 | $1,170,000 | $1.30 | $2.40 | $3.70 |
| Practical | 520,000 | $1,170,000 | $2.25 | $2.40 | $4.65 |
| Normal | 260,000 | $1,170,000 | $4.50 | $2.40 | $6.90 |
| Master Budget | 225,000 | $1,170,000 | $5.20 | $2.40 | $7.60 |

2. PLF’s actual production level is 300,000 bulbs. We can compute the production-volume variance as:

Production Volume Variance = Budgeted Fixed Mfg. Overhead

– (Fixed Mfg. Overhead Rate × Actual Production Level)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Capacity Type** | **Capacity Level** | **Fixed Mfg. Overhead** | **Fixed Mfg. Overhead Rate** | **Fixed Mfg. Overhead Rate × Actual Production** | **Production Volume Variance** |
| Theoretical | 900,000 | $1,170,000 | $1.30 | $ 390,000 | $780,000 U |
| Practical | 520,000 | $1,170,000 | $2.25 | $ 675,000 | $495,000 U |
| Normal | 260,000 | $1,170,000 | $4.50 | $1,350,000 | $180,000 F |
| Master Budget | 225,000 | $1,170,000 | $5.20 | $1,560,000 | $390,000 F |

3. Operating Income for PLF given production of 300,000 bulbs and sales of 225,000 bulbs @ $9.80 apiece:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  **Theoretical** |  **Practical** |  **Normal** | **Master Budget** |
| Revenue a | $2,205,000 |  $2,205,000 | $2,205,000 | $2,205,000 |
| Less: Cost of goods sold b |  832,500 |  1,046,250 |  1,552,500 | 1,710,000 |
| Production-volume variance |  780,000 U |  495,000 U |  (180,000) F |  (390,000) F  |
| Gross margin |  592,500 |  663,750 |  832,500 |  885,000 |
| Variable selling c |  45,000 |  45,000 |  45,000 |  45,000 |
| Fixed selling |  220,000 |  220,000 |  220,000 |  220,000 |
| Operating income | $ 327,500 |  $ 398,750 | $ 567,500 | $ 620,000 |

a225,000 × 9.80

b225,000 × 3.70, × 4.65, × 6.90, × 7.60

c225,000 × 0.20

**9-37** (35 min.) **Operating income effects of denominator-level choice and disposal of**

 **production-volume variance (continuation of 9-36).**

1. Because no beginning inventories exist, if PLF sells all 300,000 bulbs manufactured, its operating income will be the same under all four capacity options. Calculations are provided below:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  **Theoretical** |  **Practical** |  **Normal** |  **Master Budget** |
| Revenue a | $2,940,000 | $2,940,000 | $2,940,000 | $2,940,000 |
| Less: Cost of goods sold b | 1,110,000 | 1,395,000 | 2,070,000 | 2,280,000 |
| Less: Production volume variance |  780,000 U |  495,000 U |  (180,000) F |  (390,000) F |
| Gross margin | 1,050,000 | 1,050,000 | 1,050,000 | 1,050,000 |
| Variable selling c | 60,000 | 60,000 | 60,000 | 60,000 |
| Fixed selling |  220,000 |  220,000 |  220,000 |  220,000 |
| Operating income | $ 770,000 | $ 770,000 | $ 770,000 | $ 770,000 |

a300,000 × 9.80

b300,000 × 3.70, × 4.65, × 6.90, × 7.60

c300,000 × 0.20

2. If the manager of PLF produces and sells 300,000 bulbs, then all capacity levels will result in the same operating income of $770,000 (see requirement 1 above). If the manager of PLF is able to sell only 225,000 of the bulbs produced and if the production-volume variance is closed to cost of goods sold, then the operating income is given as in requirement 3 of 9-36. Both sets of numbers are reproduced below.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Theoretical** | **Practical** | **Normal** | **Master Budget** |
| Income with sales of 300,000 bulbs | $770,000 | $770,000 | $770,000 | $770,000 |
| Income with sales of 225,000 bulbs |  327,500 |  398,750 |  567,500 |  620,000 |
| Decrease in income when  |  |  |  |  |
|  there is over-production | $442,500 | $371,250 | $202,500 | $150,000 |

Comparing these results, it is clear that for a given level of overproduction relative to sales, the manager’s performance will appear better if he/she uses as the denominator a level that is lower. In this example, setting the denominator to equal the master budget (the lowest of the four capacity levels here), minimizes the loss to the manager from being unable to sell the entire production quantity of 300,000 bulbs.

3. In this scenario, the manager of PLF produces 300,000 bulbs and sells 225,000 of them, and the production volume variance is prorated. Given the absence of ending work in process inventory or beginning inventory of any kind, the fraction of the production volume variance that is absorbed into the cost of goods sold is given by 225,000/300,000 or 75%. The operating income under various denominator levels is then given by the following modification of the solution to requirement 3 of 9-36:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Theoretical** | **Practical** | **Normal** | **Master Budget** |
| Revenue | $2,205,000 | $2,205,000 | $2,205,000 | $2,205,000 |
| Less: Cost of goods sold |  832,500 |  1,046,250 | 1,552,500 | 1,710,000 |
| Less: Prorated production-volume variance a |  585,000 U |  371,250 U |  (135,000) F |  (292,500) F  |
| Gross margin |  787,500 |  787,500 |  787,500 |  787,500 |
| Variable selling b |  45,000 |  45,000 |  45,000 |  45,000 |
| Fixed selling |  220,000 |  220,000 |  220,000 |  220,000 |
| Operating income | $ 522,500 | $ 522,500 | $ 522,500 | $ 522,500 |

a (7/10) × 665,000, × 390,000, × 140,000, × (435,000)

b225,000 × 0.20

Under the proration approach, operating income is $522,500 regardless of the denominator initially used. Thus, in contrast to the case where the production volume variance is written off to cost of goods sold, there is no temptation under the proration approach for the manager to play games with the choice of denominator level.

* 1. (30 min.) **Variable and absorption costing, actual costing.**

1. Because no beginning inventories exist, the cost of the ending inventory must be the same as the cost of goods sold for the period. So, the unit cost of goods sold under variable costing is $7.15.

Variable cost of goods sold = Units sold × Unit variable cost of goods sold

 = 180,000 × $7.15

 = $1,287,000

Variable nonmanufacturing expenses = $0

Sales Revenues = $2,250,000

Contribution Margin = $2,250,000 (–) $1,287,000 (–) $0

 = $963,000

2. The profit under variable costing is given as $438,000. We just calculated the contribution margin of Iron City as $963,000. The difference, $525,000 ($963,000 – $438,000) must represent the total fixed costs incurred by Iron City in 2014.

Fixed marketing and administrative costs are given as $295,000. The remainder, $230,000 ($525,000 – $295,000) is therefore the fixed manufacturing costs for 2014.

3. The unit cost of ending inventory, as well as the unit cost of goods produced and sold, is $7.15 under variable costing and $8.30 under absorption costing. The difference, $1.15 ($8.30 – $7.15) is the unit fixed manufacturing cost of goods produced during the period.

In requirement 2, we calculated that the total fixed manufacturing costs are $230,000.

So, Units produced = Total manufacturing costs/Unit fixed manufacturing cost of production

 = $230,000/$1.15

 = 200,000 six-packs.

4. In 2014, Iron City incurred a total of 200,000 × $7.15 = $1,430,000 in variable manufacturing costs. This includes $880,000 in direct materials costs (given), $400,000 in direct manufacturing labor costs (given), and the rest in variable manufacturing overhead.

So, variable manufacturing overhead = $1,430,000 (–) $880,000 (–) $400,000

= $150,000.

5. Under variable costing, the proportion of variable manufacturing overhead corresponding to the units sold, relative to units produced, is expensed as variable cost of goods sold. This equals:

$150,000 × (180,000 units produced)/(200,000 units sold) = $135,000.

Moreover, the entire amount of fixed manufacturing overhead, totaling $230,000, is expensed.

So, total manufacturing overhead expensed = $135,000 (+) $230,000 = $365,000.

**9-39** (25 min.) **Cost allocation, downward demand spiral.**

**Solution Exhibit 9-39**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **2014** **Master Budget** **(1)** | **Practical****Capacity****(2)** | **2015 Master Budget** **(3)** |
| Budgeted fixed costs  | $1,517,000 | $1,517,000 | $1,517,000 |
| Denominator level | 925,000 | 1,025,000 | 820,000 |
| Budgeted fixed cost per meal Budgeted fixed costs  Denominator level($1,517,000925,000; $1,517,0001,025,000; $1,517,000820,000)  | $ 1.64 | $ 1.48 | $ 1.85 |
| Budgeted variable cost per meal |  4.60 |  4.60 |  4.60 |
| Total budgeted cost per meal | $ 6.24 | $ 6.08 | $ 6.45 |

1. The 2014 budgeted fixed costs are $1,517,000. Topman budgets for 925,000 meals in 2014, and this is used as the denominator level to calculate the fixed cost per meal. $1,517,000925,000 = $1.64 fixed cost per meal. (see column (1) in Solution Exhibit 9-39).

2. In 2015, three hospitals have dropped out of the purchasing group, and the master budget is 820,000 meals. If this is used as the denominator level, fixed cost per meal = $1,517,000 **** 820,000 = $1.85 per meal, and the total budgeted cost per meal would be $6.45 (see column (3) in Solution Exhibit 9-39). If the hospitals have already been complaining about quality and cost and are allowed to purchase from outside, they will not accept this higher price. More hospitals may begin to purchase meals from outside the system, leading to a downward demand spiral, possibly putting Topman out of business.

3. The basic problem is that Topman has excess capacity and the associated excess fixed costs. If Smith uses the practical capacity of 1,025,000 meals as the denominator level, the fixed cost per meal will be $1.48 (see column (2) in Solution Exhibit 9-39), and the total budgeted cost per meal would be $6.08, probably a more acceptable price to the customers (it may even draw back the three hospitals that have chosen to buy outside). This denominator level will also isolate the cost of unused capacity and not allocate it to the meals produced. To make the $6.08 price per meal profitable in the long run, Smith will have to find ways to either use the extra capacity or reduce Topman’s practical capacity and the related fixed costs.

**9-40** (20 min.) **Cost allocation, responsibility accounting, ethics (continuation of 9-39).**

1. (See Solution Exhibit 9-39). If Topman uses the rate based on its master budget capacity utilization to allocate fixed costs in 2014, it would allocate 740,000  $1.85 = $1,369,000. Budgeted fixed costs are $1,517,000. Therefore, the production volume variance = $1,517,000 – $1,369,000 = $148,000 U. An unfavorable production volume variance will reduce operating income by this amount. (Note: in this business, there are no inventories. All variances are written off to cost of goods sold).

2. Hospitals are charged a budgeted variable cost rate and allocated budgeted fixed costs. By overestimating budgeted meal counts, the denominator-level is larger; hence, the amount charged to individual hospitals is lower. Consider 2015 where the budgeted fixed cost rate is computed as follows:

 $1,517,000/820,000 meals = $1.85 per meal.

If in fact, the hospital administrators had better estimated and revealed their true demand (say, 740,000 meals), the allocated fixed cost per meal would have been

 $1,517,000/740,000 meals = $2.05 per meal, 10.8% higher than the $1.85 per meal.

Hence, by deliberately overstating budgeted meal count, hospitals are able to reduce the price charged by Topman for each meal. In this scheme, Topman bears the downside risk of demand overestimates.

3. Evidence that could be collected include:

(a) Budgeted meal-count estimates and actual meal-count figures each year for each hospital controller. Over an extended time period, there should be a sizable number of both underestimates and overestimates. Controllers could be ranked on both their percentage of overestimation and the frequency of their overestimation.

(b) Look at the underlying demand estimates by patients at individual hospitals. Each hospital controller has other factors (such as hiring of nurses) that give insight into their expectations of future meal-count demands. If these factors are inconsistent with the meal-count demand figures provided to the central food-catering facility, explanations should be sought.

4. (a) Highlight the importance of a corporate culture of honesty and openness. Cayzer could institute a Code of Ethics that highlights the upside of individual hospitals providing honest estimates of demand (and the penalties for those who do not).

 (b) Have individual hospitals contract in advance for their budgeted meal count. Unused amounts would be charged to each hospital at the end of the accounting period. This approach puts a penalty on hospital administrators who overestimate demand.

 (c) Use an incentive scheme that has an explicit component for meal-count forecasting accuracy. Each meal-count “forecasting error” would reduce the bonus by some amount, say $0.05. Thus, if a hospital bids for 292,000 meals and actually uses 200,000 meals, its bonus would be reduced by $0.05 × (292,000 – 200,000) = $4,600.

**9-41** (60 min.) **Absorption, variable, and throughput costing.**

1.

(a)  = 

 = 

 = $750 per standard assembly hour or $15,000
per vehicle

(b) Direct materials per unit $ 36,000

 Direct manufacturing labor per unit 10,800

 Variable manufacturing overhead per unit 12,000

 Fixed manufacturing overhead per unit 15,000

 Total manufacturing cost per unit $73,800

2. Amounts in thousands.

|  |  |
| --- | --- |
|  | **Absorption Costing** |
|  | **January** | **February** | **March** |
| Revenues ($96,000 × 2,000; 2,900; 3,200)Cost of goods soldBeginning inventoryVariable manufacturing costs ($58.80 × 3,200; 2,400; 3,800)Allocated fixed manufacturing costs ($15 × 3,200; 2,400; 3,800)Cost of goods available for saleDeduct ending inventory ($73.80 × 1,200; 700; 1,300) Adjustment for production-volume variancea Cost of goods soldGross marginMarketing costsOperating incomeInventory Details (Units)Beginning inventoryProductionGoods available for saleSalesEnding inventoryInventory Details ($73.80 per unit)Beginning inventoryEnding inventory | $192,000$ 0188,160 48,000236,160 (88,560) (3,000) F 144,60047,400 0$47,4000 3,2003,200 2,000 1,200$ 0$88,560 | $278,400$ 88,560141,120 36,000265,680 (51,660) 9,000 U 223,02055,380 0$ 55,3801,200 2,4003,600 2,900 700$88,560$51,660 | $307,200$ 51,660223,440 57,000332,100 (95,940) (12,000) F 224,16083,040 0$83,040700 3,8004,500 3,200 1,300$51,660$95,940 |
| **Computation of Bonus** | **January** | **February** | **March** |
| Operating income× 0.25% | $47,400,000$ 118,500 | $55,380,000$ 138,450 | $83,040,000$ 207,600 |
| aProduction–volume variance = (Denominator level – Production) × Budgeted rate January: (3,000 – 3,200) × $15,000 per vehicle = $ 3,000,000 F February: (3,000 – 2,400) × $15,000 per vehicle = $ 9,000,000 U March: (3,000 – 3,800) × $15,000 per vehicle = $12,000,000 F |

3. Amounts in thousands.

|  |  |
| --- | --- |
|  | **Variable Costing** |
|  | **January** |  **February** |  **March** |
| RevenuesVariable cost of goods soldBeginning inventoryVariable manuf. costs ($58.80 × 3,200; 2,400; 3,800)Cost of goods available for saleDeduct ending inventory ($58.80 ×1,200; 700, 1,300) Variable cost of goods soldVariable marketing costsTotal variable costsContribution marginFixed costsFixed manuf. overhead costsFixed marketing costs Total fixed costsOperating incomeInventory details ($58.80 per unit)Beginning inventory (units)Ending inventory (units)Beginning inventoryEnding inventory | $192,000 0 188,160188,160 (70,560) 117,600 0 117,600 74,40045,000 0 45,000$ 29,40001,200$0$70,560 | $278,400 70,560 141,120211,680 (41,160) 170,520 0 170,520 107,88045,000 0 45,000$ 62,8801,200700$70,560$41,160 | $307,200 41,160 223,440264,600 (76,440) 188,160 0 188,160 119,04045,000 0 45,000$ 74,0407001,300$41,160$76,440 |
| **Computation of Bonus** | **January** | **February** | **March** |
| Operating incomeBonus (Operating income × 0.25%) | $29,400,000$ 73,500 |  $62,880,000 $ 157,200 | $74,040,000$ 185,100 |

4.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **January** | **February** | **March** | **Total** |
| Absorption-Costing BonusVariable-Costing BonusDifference | $118,500 73,500$45,000 | $138,450 157,200$(18,750) | $207,600 185,100$ 22,500 | $464,550 415,800$48,750 |

 The difference between absorption and variable costing arises because of differences in production and sales:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **January** | **February** | **March** | **Total** |
| ProductionSalesIncrease (decrease) in inventory | 3,2002,0001,200 | 2,4002,900 (500) | 3,8003,200 600 | 9,4008,1001,300 |

With absorption costing, by building for inventory, Holzhausen can capitalize $15,000 of fixed manufacturing overhead cost per unit. This will provide a bonus payment of $37.50 (0.25% × $15,000) per unit. Operating income under absorption costing will exceed that under variable costing when production is greater than sales. During the three-month period, the inventory buildup is 1,300 units, giving a difference of $48,750 ($37.50 × 1,300) in bonus payments.

5. Amounts in thousands

|  |  |
| --- | --- |
|  | Throughput Costing |
|  | **January** | **February** | **March** |
| RevenuesDirect material cost of goods soldBeginning inventory ($36 × 0; 1,200; 700)Direct materials ($36 × 3,200; 2,400; 3,800)Cost of goods available for saleDeduct ending inventory ($36 × 1,200; 700; 1,300) Total direct material cost of goods soldThroughput contributionOther costsManufacturinga | $192,0000 115,200115,200 (43,200) 72,000 120,000117,960 | $278,40043,200 86,400129,600 (25,200) 104,400 174,00099,720 | $307,20025,200 136,800162,000 (46,800) 115,200 192,000131,640 |
| Marketing Total other costsOperating income |  0117,960$ 2,040 |  0 99,720$ 74,280 |  0 131,640$ 60,360 |

a($22.8 × 3,200) + $45,000

 ($22.8 × 2,400) + $45,000

 ($22.8 × 3,800) + $45,000

|  |  |  |  |
| --- | --- | --- | --- |
| **Computation of Bonus** | **January** | **February** | **March** |
| Operating income Bonus (Operating income × 0.25%) | $2,040,000$ 5,100 | $74,280,000$ 185,700 | $60,360,000$ 150,900 |

A summary of the bonuses paid is:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **January** | **February** | **March** | **Total** |
| Absorption CostingVariable CostingThroughput Costing | $118,50073,5005,100 | $138,450157,200185,700 | $207,600185,100150,900 | $464,550415,800341,700 |

6. Alternative approaches include:

(a) Carefully plan budget and inventory.

(b) Use an alternative income computation approach to absorption costing (such as variable costing or throughput costing).

1. Use a financial charge to reduce the incentives for inventory buildup.
2. Change the compensation package to have a longer-term focus using either an external variable (e.g., stock options) or an internal variable (e.g., five-year average income).

(e) Adopt nonfinancial performance targets, e.g., attaining but not exceeding present inventory levels.

**9-42** (30 min.) **Costing methods and variances, comprehensive.**

1. Actual Absorption costing C

 Normal Absorption costing D

 Standard Absorption costing A

 Standard Variable costing B

Statement C, with no variances, is clearly actual costing. Statement D, which contains variances for overhead but not for direct materials and direct labor, must be normal costing. Finally, A has a higher figure for Cost of Goods Sold and so must represent standard absorption costing (where fixed manufacturing overhead is also treated as a product cost), while B is standard variable costing.

2. The net income under standard variable costing (B; $155,000) exceeds that under standard absorption costing (A; $130,000). Because there are no work-in-process inventories, this reflects a higher level of fixed overhead expensed from opening inventory under absorption costing than the amount trapped in ending inventory. With stable standard costs, this implies that the level of finished goods inventory has decreased in 2013.

3. From statement B, the aggregate variance for variable overhead is zero. So, the $25,000 variance for total overhead in A must all be for fixed overhead. We are told that there is no flexible budget variance for fixed overhead. The $25,000 variance in statement A (standard absorption costing) must therefore be the production volume variance. As it is added to cost of goods sold, the variance is unfavorable. This implies that fixed manufacturing overhead costs were underapplied, or that fewer units were produced than the denominator (expected) level.

4. The aggregate variable overhead variance of zero is the sum of the spending and efficiency variances. Note that variable overhead is applied using direct labor hours as the driver. We are told that there is no direct labor efficiency variance (because the direct labor variance is a price variance), which implies that the variable overhead efficiency variance is also zero. Therefore, the variable overhead spending variance must also be zero, i.e., it is neither favorable nor unfavorable.