CHAPTER 10
Standard Costing, Operational Performance Measures and the Balanced Scorecard

ANSWERS TO REVIEW QUESTIONS

10-1 Any control system has three basic parts: a predetermined or standard performance level, a measure of actual performance, and a comparison between standard and actual performance. The system works by making the comparison between actual and standard performance and then taking action to bring about a desired consequence.

10-2 Management by exception is a managerial technique in which only significant deviations from expected performance are investigated.

10-3 One method of setting standards is the analysis of historical data. Historical cost data provide an indicator of future costs. The methods for analyzing cost behavior described in Chapter 7 are used to predict future costs on the basis of historical costs. These predictions then form the basis for setting standards. Another method for setting standards is task analysis, which is the analysis of a production process to determine what it should cost to produce a product or service. The emphasis shifts from what the product did cost in the past to what it should cost in the future. An example of task analysis is a time-and-motion study conducted to determine how long each step performed by direct laborers should require.

10-4 A perfection (or ideal) standard is the cost expected under perfect or ideal operating conditions. A practical (or attainable) standard is the cost expected under normal operating conditions. Many behavioral scientists question the effectiveness of perfection standards. They feel that employees are more likely to perform well when they strive to achieve an attainable standard than when they strive, often unsuccessfully, to achieve a perfection standard.

10-5 A bank could use standards to specify the required amount of time to process a loan application or process a bank transaction.

10-6 Standard material prices include the purchase price of the material and any transportation costs incurred to obtain the material. The standard quantity of material is the amount required to be included in the finished product plus an allowance for normal waste expected in the production process.
10-7 An unfavorable direct-material price variance means that a higher price was paid for the material than was expected when the standard was set. A favorable variance has the opposite interpretation.

10-8 The manager in the best position to influence the direct-material price variance is the purchasing manager.

10-9 An unfavorable direct-material quantity variance means that a larger amount of material was used in the production process than should have been used in accordance with the standard. A favorable variance has the opposite interpretation.

10-10 The manager in the best position to influence the direct-material quantity variance usually is the production manager.

10-11 The direct-material price variance is based on the quantity purchased (PQ). Deviations between the actual and standard price, which are highlighted by the price variance, relate to the purchasing function in the firm. Timely action to follow up a significant price variance is facilitated by calculating this variance as soon as possible after the material is purchased.

The direct-material quantity variance is based on the amount of material used in production (AQ). The quantity variance highlights deviations between the quantity of material actually used (AQ) and the standard quantity allowed (SQ). Therefore, it makes sense to compute this variance at the time the material is used in production.

10-12 An unfavorable direct-labor rate variance means that a higher labor rate was paid than was anticipated when the standard was set. One possible cause is that labor rate raises granted were above those anticipated in setting the standards. Another possible cause is that more highly skilled workers were used to perform tasks than were required or were anticipated at the time the standards were set. A favorable variance has the opposite interpretation.

10-13 In some cases, the manager in the best position to influence the direct-labor rate variance is the production manager. In other cases, the personnel manager or union negotiator would have greater influence.

10-14 The interpretation of an unfavorable direct-labor efficiency variance is that more labor was used to accomplish a given task than was required in accordance with the standards. A favorable variance has the opposite interpretation.

10-15 The manager in the best position to influence the direct-labor efficiency variance usually is the production manager.
10-16 The issue of quantity purchased versus quantity used does not arise in the context of direct labor, because direct labor is purchased and used at the same time. Unlike direct material, direct labor cannot be purchased and inventoried for later use.

10-17 Several factors that managers often consider when determining the significance of a variance are as follows: size of variance, extent to which the variances are recurring, trends in the variances, controllability of the variances, and the perceived costs and benefits of investigating the variances.

10-18 Several ways in which standard-costing should be adapted in today's manufacturing environment are as follows:

(a) Reduced importance of labor standards and variances: As direct labor occupies a diminished role in today's manufacturing environment, the standards and variances used to control labor costs also decline in importance.

(b) Emphasis on material and overhead costs: As labor diminishes in its importance, material and overhead costs take on greater significance.

(c) Cost drivers: Identification of the factors that drive production costs takes on greater importance in the cost management system.

(d) Shifting cost structure: Advanced manufacturing systems require large outlays for production equipment, which entail a shift in the cost structure from variable costs toward fixed costs. Overhead cost control becomes especially critical.

(e) High quality and no defects: Total quality control programs that typically accompany a JIT approach strive for very high quality levels for both raw materials and finished products. One result should be very low material price and quantity variances and low costs of rework.

(f) Non-value-added costs: A key objective of a cost management system is the elimination of non-value-added costs. As these costs are reduced or eliminated, standards must be revised frequently to provide accurate benchmarks for cost control.

(g) New measures and standards: In today's manufacturing environment, new measures must be developed to control key aspects of the production process. As new measures are developed, standards should be established as benchmarks for performance. An example is the manufacturing cycle efficiency measure, which is defined as processing time divided by the sum of processing time, inspection time, waiting time, and move time.
(h) Real-time information systems: A computer-integrated manufacturing system enables the managerial accountant to collect operating data as production takes place and to report relevant performance measures to management on a real-time basis. This enables managers to eliminate the causes of unfavorable variances more quickly.

10-19 Under a standard-costing system, standard costs are used for product-costing purposes as well as for control purposes. The costs entered into Work-in-Process Inventory are standard costs. From that point forward, standard costs flow through all the manufacturing accounts. When goods are finished, the standard cost of the finished goods is removed from the Work-in-Process Inventory account and transferred to the Finished-Goods Inventory account. When goods are sold, the standard cost of the goods sold is transferred from the Finished-Goods Inventory account to Cost of Goods Sold.

10-20 Advantages of a standard-costing system include the following:

(a) Standard costs provide a basis for sensible cost comparisons. Standard costs enable the managerial accountant to compute the standard allowed cost, given actual output, which then serves as a sensible benchmark to compare with the actual cost incurred.

(b) Computation of standard costs and cost variances enables managers to employ management by exception.

(c) Variances provide a means of performance evaluation and rewards for employees.

(d) Since the variances are used in performance evaluation, they provide motivation for employees to adhere to standards.

(e) Use of standard costs in product costing results in more stable product costs than if actual production costs were used.

(f) A standard-costing system usually is less expensive than an actual- or normal-costing system.

10-21 Seven areas in which operational performance measures are being used are as follows:

(a) Raw material and scrap

(b) Inventory

(c) Machinery
(d) Product quality
(e) Production and delivery
(f) Productivity
(g) Innovation and learning

10-22 Manufacturing cycle efficiency (MCE) is defined as processing time divided by the sum of the following four items: processing time, inspection time, waiting time, and move time.

10-23 Examples of customer-acceptance measures include the number of customer complaints, the number of warranty claims, the number of products returned, and the cost of repairing returned products.

10-24 An aggregate productivity measure is defined as total output divided by total input. Such a measure is limited because it is expressed in dollars, rather than in physical attributes of the production process, and it is too highly aggregated. A preferable approach to productivity measurement is to record multiple physical measures that capture the most important determinants of a company's productivity.

10-25 Seven criticisms of standard costing in an advanced manufacturing setting are the following:

(a) Variances are too aggregate and too late to be useful.
(b) Variances are not tied to specific product lines or production batches.
(c) Standard-costing systems focus too much on direct labor.
(d) Frequent switching among products in an FMS cell makes cost standards less appropriate.
(e) Shorter product life cycles mean that individual standards are soon outmoded.
(f) Traditional standard costs are not defined broadly enough to include important costs, such as the total cost of ownership.
(g) Traditional standard-costing systems tend to focus too much on cost minimization, rather than increasing product quality or customer service.
10-26 Responses will vary widely on this question. Here are some possibilities for a bank:

- **Financial**: (a) profit; (b) cost of back-office (i.e., administrative) operations.

- **Internal operations**: (a) number of transaction errors; (b) employee retention and advancement.

- **Customer**: (a) local market share; (b) number of repeat customers.

- **Innovation and learning**: (a) new financial products; (b) employee suggestions received and implemented.

Lead measures, such as market share or new financial products, show how well the bank is doing now in areas that will affect financial performance in the future. Lag measures, such as the bank's profits, measure the bank's financial performance. Lag measures are the result of previous efforts in the bank's customer, internal operations, and learning and innovation perspectives.

10-27 An airline could measure the frequency and cost of customer complaints about lost or damaged luggage. After reducing the number of such incidents, the cost savings could be shared with the relevant employees (e.g., front-counter ticket agents and baggage-handling personnel).
SOLUTIONS TO EXERCISES

EXERCISE 10-28 (15 MINUTES)

1. Variance calculations:

   Direct-material price variance   =   \( PQ(AP - SP) \)
   =   \( 240,000(\$0.81 - \$0.80) \)
   =   \$2,400 Unfavorable

   Direct-material quantity variance =   \( SP(AQ - SQ) \)
   =   \$0.80(210,000 - 200,000*)
   =   \$8,000 Unfavorable

*\( SQ = 200,000 \text{ kilograms} = 50,000 \text{ units} \times 4 \text{ kilograms per unit} \)

   Direct-labor rate variance   =   \( AH(AR - SR) \)
   =   \$13,000(\$16.30* - \$16.00) \)
   =   \$3,900 Unfavorable

*\( AR = \$211,900 \div 13,000 \text{ hours} \)

   Direct-labor efficiency variance =   \( SR(AH - SH) \)
   =   \$16.00(13,000 - 12,500*)
   =   \$8,000 Unfavorable

*\( SH = 12,500 \text{ hours} = 50,000 \text{ units} \times .25 \text{ hours per unit} \)

2. In the electronic version of the solutions manual, press the CTRL key and click on the following link: [Build a Spreadsheet 10-28.xls](#)
## EXERCISE 10-29 (30 MINUTES)

### DIRECT-MATERIAL PRICE AND QUANTITY VARIANCES

<table>
<thead>
<tr>
<th>ACTUAL MATERIAL COST</th>
<th>STANDARD MATERIAL COST</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Actual Quantity</strong></td>
<td><strong>Actual Price</strong></td>
</tr>
<tr>
<td>240,000 kilograms purchased</td>
<td>¥$.81 per kilogram</td>
</tr>
<tr>
<td></td>
<td>¥194,400</td>
</tr>
<tr>
<td></td>
<td>$2,400 Unfavorable</td>
</tr>
</tbody>
</table>

Direct-material price variance

210,000 kilograms used × ¥$.80 per kilogram

$168,000

$8,000 Unfavorable

Direct-material quantity variance
EXERCISE 10-29 (CONTINUED)

DIRECT-LABOR RATE AND EFFICIENCY VARIANCES

<table>
<thead>
<tr>
<th>ACTUAL LABOR COST</th>
<th>STANDARD LABOR COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual Hours x Actual Rate</td>
<td>Actual Hours x Standard Rate</td>
</tr>
<tr>
<td>13,000 hours x $16.30 per hour</td>
<td>13,000 hours x $16.00 per hour</td>
</tr>
<tr>
<td>$211,900</td>
<td>$208,000</td>
</tr>
</tbody>
</table>

$3,900 Unfavorable | $8,000 Unfavorable | $11,900 Unfavorable

Direct-labor rate variance | Direct-labor efficiency variance | Direct-labor variance

EXERCISE 10-30 (30 MINUTES)

Answers will vary widely, depending on the company and the product. Typically, new products present challenges in setting standards, particularly if they involve new production processes or materials. Managerial accountants and engineers often look to other similar products or other products manufactured using similar processes to get an idea as to what the standard cost of a new product should be.

EXERCISE 10-31 (10 MINUTES)

Standard quantity (per production lot):
- Hardwood in finished product: 8 cubic meters
- Allowance for normal scrap: 2 cubic meters
- Total standard quantity required per lot: 10 cubic meters

Standard price:
- Purchase price per cubic meter of hardwood: $1,600
- Transportation cost per cubic meter: $600
- Total standard price per cubic meter: $2,200
EXERCISE 10-31 (CONTINUED)

Standard direct-material cost of a production lot of jewelry boxes:

<table>
<thead>
<tr>
<th>Standard quantity</th>
<th>10 cubic meters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price per cubic meter</td>
<td>× $ 2,200</td>
</tr>
<tr>
<td>Standard direct-material cost</td>
<td>$22,000</td>
</tr>
</tbody>
</table>

EXERCISE 10-32 (15 MINUTES)

Direct-material price variance = \( PQ(AP - SP) \)
= 6,000($7.20 – $7.00)
= $1,200 Unfavorable

Direct-material quantity variance = \( SP(AQ - SQ) \)
= $7.00(4,200* – 4,000†)
= $1,400 Unfavorable

*AQ = 4,200 pounds = $30,240 ÷ $7.20 per pound
†SQ = 4,000 pounds = 2,000 units × 2 pounds per unit

Direct-labor rate variance = \( AH(AR - SR) \)
= 6,450*($18.20 – $18.00)
= $1,290 Unfavorable

*AH = 6,450 hours = $117,390 ÷ $18.20 per hour

Direct-labor efficiency variance = \( SR(AH - SH) \)
= $18(6,450 – 6,000*)
= $8,100 Unfavorable

*SH = 6,000 hours = 2,000 units × 3 hours per unit
EXERCISE 10-33 (30 MINUTES)

DIRECT-MATERIAL PRICE AND QUANTITY VARIANCES

<table>
<thead>
<tr>
<th>ACTUAL MATERIAL COST</th>
<th>STANDARD MATERIAL COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual Quantity</td>
<td>Actual Price</td>
</tr>
<tr>
<td>6,000 pounds</td>
<td>$7.20 per pound</td>
</tr>
<tr>
<td>purchased</td>
<td></td>
</tr>
</tbody>
</table>

$43,200

$1,200 Unfavorable

Direct-material price variance

4,200 pounds used $7.00 per pound

$29,400

$1,400 Unfavorable

Direct-material quantity variance
EXERCISE 10-33 (CONTINUED)

DIRECT-LABOR RATE AND EFFICIENCY VARIANCES

<table>
<thead>
<tr>
<th>ACTUAL LABOR COST</th>
<th>STANDARD LABOR COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual Hours</td>
<td>Standard Hours</td>
</tr>
<tr>
<td>Actual Rate</td>
<td>Standard Rate</td>
</tr>
<tr>
<td>Actual Hours used</td>
<td>Standard Hours allowed</td>
</tr>
<tr>
<td>×</td>
<td>×</td>
</tr>
<tr>
<td>$18.20 per hour</td>
<td>$18.00 per hour</td>
</tr>
<tr>
<td>6,450 hours</td>
<td>6,000 hours</td>
</tr>
<tr>
<td>$117,390</td>
<td>$108,000</td>
</tr>
</tbody>
</table>

$1,290 Unfavorable Direct-labor rate variance

$8,100 Unfavorable Direct-labor efficiency variance

$9,390 Unfavorable Direct-labor variance
EXERCISE 10-34 (25 MINUTES)

1. (a) Statistical control chart with variance data plotted:

(b) Only the variances in May and June would be investigated, since they are the only ones that exceed 1 standard deviation, $950.
EXERCISE 10-34 (CONTINUED)

2. Rule of thumb:

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard cost</td>
<td>$19,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cutoff percentage</td>
<td>× 6%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cutoff value for investigation</td>
<td>$ 1,140</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Only the June variance, $1,200 U, is equal to or greater than the cutoff value. Thus, only June's variance would be investigated. (U denotes unfavorable.)

3. This is a judgment call, and there is no right or wrong answer. It would be reasonable to conclude that the consistent stream of relatively large unfavorable variances should be investigated before May. The three variances for February, March, and April would be cause for concern.

EXERCISE 10-35 (5 MINUTES)

Good output = (7/8) \times input = .875 \times input

\[
\frac{\text{Good output}}{.875} = \begin{array}{c}
3,500 \text{ kilograms} \\
.875
\end{array}
\]

\[
\frac{\text{3,500 kilograms}}{.875} = 4,000 \text{ kilograms of input}
\]

The standard allowed input quantity in May was 4,000 kilograms.
EXERCISE 10-36 (30 MINUTES)

<table>
<thead>
<tr>
<th></th>
<th>Direct Labor</th>
<th>Direct Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard price or rate per unit of input</td>
<td>$20 per hr&lt;sup&gt;e&lt;/sup&gt;</td>
<td>$8 per kg</td>
</tr>
<tr>
<td>Standard quantity per unit of output</td>
<td>4 hrs per unit&lt;sup&gt;f&lt;/sup&gt;</td>
<td>2.75 lbs per unit&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Actual quantity used per unit of output</td>
<td>3.5 hrs</td>
<td>3 lbs per unit&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Actual price or rate per unit of output</td>
<td>$21 per hr</td>
<td>$7 per kg</td>
</tr>
<tr>
<td>Actual output</td>
<td>10,000 units</td>
<td>10,000 units</td>
</tr>
<tr>
<td>Direct-material price variance</td>
<td>—</td>
<td>$30,000 F</td>
</tr>
<tr>
<td>Direct-material quantity variance</td>
<td>—</td>
<td>$20,000 U&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Total of direct-material variances</td>
<td>—</td>
<td>$10,000 F</td>
</tr>
<tr>
<td>Direct-labor rate variance</td>
<td>$35,000 U&lt;sup&gt;d&lt;/sup&gt;</td>
<td>—</td>
</tr>
<tr>
<td>Direct-labor efficiency variance</td>
<td>$100,000 F</td>
<td>—</td>
</tr>
<tr>
<td>Total of direct-labor variances</td>
<td>$65,000 F</td>
<td>—</td>
</tr>
</tbody>
</table>

Explanatory notes:

a. Direct-material price variance  =  \( PQ(AP - SP) \)

\[ \$30,000 \text{ F} = PQ(\$7 - \$8) \]

\[ PQ = 30,000 \text{ kgs} \]

\[ \text{Actual quantity used} = \text{quantity purchased} \]

\[ AQ = PQ = 30,000 \text{ kgs} \]

\[ \text{Actual quantity per unit of output} = \frac{30,000 \text{ kgs}}{10,000 \text{ units}} = 3 \text{ kgs per unit} \]

b. Total direct-material variance  =  price variance + quantity variance

\[ \$10,000 \text{ F} = \$30,000 \text{ F} + \text{quantity variance} \]

\[ \text{Quantity variance} = \$20,000 \text{ U} \]

c. Direct-material quantity variance  =  \( SP(AQ - SQ) \)

\[ \$20,000 \text{ U} = \$8(30,000 - SQ) \]

\[ SQ = 27,500 \text{ kgs} \]

\[ \text{Standard quantity per unit} = \frac{27,500 \text{ kgs}}{10,000 \text{ units}} = 2.75 \text{ kgs per unit} \]
EXERCISE 10-36 (CONTINUED)

d. Total direct-labor variance = rate variance + efficiency variance
   \$65,000 \text{ F} = \text{rate variance} + \$100,000 \text{ F}
   \text{Rate variance} = \$35,000 \text{ U}

e. \text{AH} = 10,000 \text{ units} \times 3.5 \text{ hrs per unit} = 35,000 \text{ hrs}
   \text{Direct-labor rate variance} = \text{AH}(\text{AR} – \text{SR})
   \$35,000 \text{ U} = 35,000(\$21 – \text{SR})
   \text{SR} = \$20

f. Direct-labor efficiency variance = \text{SR}(\text{AH} – \text{SH})
   \$100,000 \text{ F} = \$20 (35,000 – \text{SH})
   \text{SH} = 40,000 \text{ hrs}
   \text{Standard hrs per unit} = 40,000 \text{ hrs}/10,000 \text{ units}
   = 4 \text{ hrs per unit}
EXERCISE 10-37 (10 MINUTES)

1. Manufacturing cycle efficiency = \[
\frac{\text{processing time}}{\text{processing time} + \text{inspection time} + \text{waiting time} + \text{move time}}
\]
   = \frac{8.5 \text{ hours}}{8.5 \text{ hours} + 0.5 \text{ hour} + 0.5 \text{ hour} + 0.5 \text{ hour}}
   = 85%

2. Manufacturing cycle time = \[
\frac{\text{total production time per batch}}{\text{units per batch}}
\]
   = \frac{10 \text{ hours}}{30 \text{ units per batch}}
   = 0.3 \text{ hours (or 18 minutes)} \text{ per unit}

3. Velocity = \[
\frac{\text{units per batch}}{\text{total production time per batch}}
\]
   = \frac{30 \text{ units}}{10 \text{ hours}}
   = 3 \text{ units per hour}

EXERCISE 10-38 (10 MINUTES)

1. Manufacturing cycle efficiency (MCE):

   MCE = \frac{\text{processing time}}{\text{processing time} + \text{inspection time} + \text{waiting time} + \text{move time}}

   = \frac{3 \text{ days}}{3 \text{ days} + 1.5 \text{ days} + 15 \text{ days} + 2.5 \text{ days}}
   = 3/22 \quad 13.6\% \text{ (rounded)}

2. Delivery cycle time is the average time between receipt of the customer's order until delivery of the goods. In this case the delivery cycle time is 22 days.
EXERCISE 10-39 (15 MINUTES)

1. Aggregate (or total) productivity = \frac{\text{total output}}{\text{total input}}

   = \frac{\$10,000,000}{\$8,000,000} = 1.25

2. This summary financial measure does not convey much information to management or other users of the data. A preferable approach would be to record multiple physical measures that capture the most important determinants of the bank's productivity. Examples include the following:
   
   a. Clerk time per bank window customer
   b. Errors per 1,000 transactions handled
   c. Checks miscoded per 1,000 checks processed
   d. Customers per day
   e. Customers per employee
   f. Square feet of space in bank per 1,000 customers
   g. Average time to process a loan application
EXERCISE 10-40 (15 MINUTES)

1. Raw-Material Inventory ........................................... 192,000
   Direct-Material Price Variance ................................... 2,400
   Accounts Payable .................................................. 194,400

2. & 3. Work-in-Process Inventory ................................... 160,000
   Direct-Material Quantity Variance .............................. 8,000
   Raw-Material Inventory ........................................... 168,000
   Work-in-Process Inventory ........................................ 200,000
   Direct-Labor Rate Variance ....................................... 3,900
   Direct-Labor Efficiency Variance ............................... 8,000
   Wages Payable ..................................................... 211,900

4. Cost of Goods Sold .................................................. 22,300
   Direct-Material Price Variance .................................... 2,400
   Direct-Material Quantity Variance ................................ 8,000
   Direct-Labor Rate Variance ....................................... 3,900
   Direct-Labor Efficiency Variance ............................... 8,000

EXERCISE 10-41 (15 MINUTES)

<table>
<thead>
<tr>
<th>Raw-Material Inventory</th>
<th>Direct-Material Price Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>192,000</td>
<td>168,000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Work-in-Process Inventory</th>
<th>Direct-Material Quantity Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>160,000</td>
<td>8,000</td>
</tr>
<tr>
<td>200,000</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Accounts Payable</th>
<th>Direct-Labor Rate Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>194,400</td>
<td>3,900</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Wages Payable</th>
<th>Direct-Labor Efficiency Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>211,900</td>
<td>8,000</td>
</tr>
</tbody>
</table>

| Cost of Goods Sold | 22,300 |
SOLUTIONS TO PROBLEMS

PROBLEM 10-42 (35 MINUTES)

1. Schedule of standard production costs:

<table>
<thead>
<tr>
<th></th>
<th>Standard Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct material</td>
<td>$58,500</td>
</tr>
<tr>
<td>Direct labor</td>
<td>$585,000</td>
</tr>
<tr>
<td>Total standard production costs</td>
<td>$643,500</td>
</tr>
</tbody>
</table>

2. Variances:

   a. Direct-material price variance
      \[ (PQ \times AP) - (PQ \times SP) \]
      \[ = (12,500 \times 5.20) - (12,500 \times 5.00) \]
      \[ = 2,500 \text{ Unfavorable} \]

   b. Direct-material quantity variance
      \[ (AQ \times SP) - (SQ \times SP) \]
      \[ = (11,550 \times 5.00) - (11,700* \times 5.00) \]
      \[ = 750 \text{ Favorable} \]

      *7,800 units \times 1.5 \text{ kgs. per unit} = 11,700 \text{ lb.}

   c. Direct-labor rate variance
      \[ (AH \times AR) - (AH \times SR) \]
      \[ = (40,100 \times 14.60) - (40,100 \times 15.00) \]
      \[ = 16,040 \text{ Favorable} \]

   d. Direct-labor efficiency variance
      \[ (AH \times SR) - (SH \times SR) \]
      \[ = (40,100 \times 15.00) - (39,000* \times 15.00) \]
      \[ = 16,500 \text{ Unfavorable} \]

      *7,800 units \times 5 \text{ hours per unit} = 39,000 \text{ hr.}
PROBLEM 10-42 (CONTINUED)

3. In the electronic version of the solutions manual, press the CTRL key and click on the following link: Build a Spreadsheet 10-42.xls

PROBLEM 10-43 (15 MINUTES)

<table>
<thead>
<tr>
<th>Direct Material</th>
<th>Initial Mix</th>
<th>Unit Cost</th>
<th>Standard Material Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nyclyn</td>
<td>12 kg</td>
<td>$1.45</td>
<td>$17.40</td>
</tr>
<tr>
<td>Salex</td>
<td>9.6 ltr</td>
<td>$1.80</td>
<td>$17.28</td>
</tr>
<tr>
<td>Protet</td>
<td>5 kg</td>
<td>$2.40</td>
<td>$12.00</td>
</tr>
</tbody>
</table>

Standard material cost for each 10-liter container $46.68

PROBLEM 10-44 (25 MINUTES)

1. Direct-material price variance = \((PQ \times AP) - (PQ \times SP)\)
   = \((18,000 \times $1.38) - (18,000 \times $1.35)\)
   = $24,840 – $24,300
   = $540 Unfavorable

2. Direct-material quantity variance = \((AQ \times SP) - (SQ \times SP)\)
   = \((9,500 \times $1.35) - (10,000* \times $1.35)\)
   = $12,825 – $13,500
   = $675 Favorable

   *500 units \times 20 meters per unit = 10,000 meters

3. Direct-labor rate variance = \((AH \times AR) - (AH \times SR)\)
   = \((2,100 \times $9.15) - (2,100 \times $8.90)\)
   = $19,215 – $18,690
   = $525 Unfavorable
PROBLEM 10-44 (CONTINUED)

4. Direct-labor efficiency variance = 
   \((AH \times SR) - (SH \times SR)\)
   
   \[= (2,100 \times 8.90) - (2,000 \times 8.90)\]
   
   \[= 18,690 - 17,800\]
   
   \[= 890 \text{ Unfavorable}\]

*500 units \(\times\) 4 hours per unit = 2,000 hours

PROBLEM 10-45 (35 MINUTES)

1. Type I fertilizer:
   
   Price variance:
   
   Actual quantity purchased \(\times\) actual price
   
   \[2,500 \text{ kilograms} \times \$1.08\]........................................\$2,700

   Actual quantity purchased \(\times\) standard price
   
   \[2,500 \text{ kilograms} \times \$1.00\]........................................\$2,500

   Direct-material price variance........................................\$200 \text{ Unfavorable}

   Quantity variance:
   
   Actual quantity used \(\times\) standard price
   
   \[1,850 \text{ kilograms} \times \$1.00\]........................................\$1,850

   Standard quantity allowed \(\times\) standard price
   
   \[2,200 \text{ kilograms} \times \$1.00\]........................................\$2,200

   Direct-material quantity variance..................................\$350 \text{ Favorable}

* 20 pounds \(\times\) 55 clients \(\times\) 2 applications

Type II fertilizer:

Price variance:

Actual quantity purchased \(\times\) actual price

\[5,000 \text{ kilograms} \times \$0.80\].................................\$4,000

Actual quantity purchased \(\times\) standard price

\[5,000 \text{ kilograms} \times \$0.84\].................................\$4,200

Direct-material price variance.........................................\$200 \text{ Favorable}
PROBLEM 10-45 (CONTINUED)

Quantity variance:
Actual quantity used x standard price
3,900 kilograms x $ .84.......................... $3,276
Standard quantity allowed x standard price
4,400 kilograms* x $ .84.......................... 3,696
Direct-material quantity variance.................. $ 420 Favorable

* 20 kilograms x 55 clients x 4 applications

2. Direct-labor variances:
Rate variance:
Actual hours used x actual rate
165 hours x $11.50.............................. $1,897.50
Actual hours used x standard rate
165 hours x $9.00.............................. 1,485.00
Direct-labor rate variance...................... $ 412.50 Unfavorable

Efficiency variance:
Actual hours used x standard rate
165 hours x $9.00.............................. $1,485.00
Standard hours allowed x standard rate
220 hours* x $9.00.............................. 1,980.00
Direct-labor efficiency variance............... $ 495.00 Favorable

* 2/3 hours x 55 clients x 6 applications

3. Actual cost of applications:
Type I fertilizer:
Actual quantity used x actual price (1,850 kg. x $ 1.08)..... $1,998.00
Type II fertilizer:
Actual quantity used x actual price (3,900 kgs x $ .80)..... 3,120.00
Direct labor:
Actual hours used x actual rate (165 hours x $11.50)......... 1,897.50
Total actual cost.............................................. $7,015.50

Yes, the service was a financial success. Amato charged clients $40 per application, generating revenue of $13,200 (55 clients x 6 applications x $40). With costs of $7,015.50, the fertilization service produced a profit of $6,184.50.
PROBLEM 10-45 (CONTINUED)

4. (a) Yes, the service was a success. Overall costs were controlled as indicated by a total favorable variance of $852.50. In addition, each of the three cost components (Type I fertilizer, Type II fertilizer, and direct labor) produced a net favorable variance. Amato did have a sizable unfavorable labor-rate variance as a result of his having to pay $11.50 per hour when a more typical wage rate would have been $9.00 per hour. This inflated rate is attributable to the tight labor market, which is beyond his control. Note: Part of the variance may have been caused by a standard rate that was set too low, especially given the fact that this is a new service.

<table>
<thead>
<tr>
<th>Fertilizer</th>
<th>Price Variance</th>
<th>Quantity Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type I</td>
<td>$200.00 Unfavorable</td>
<td>350.00 Favorable</td>
</tr>
<tr>
<td>Type II</td>
<td>200.00 Favorable</td>
<td>420.00 Favorable</td>
</tr>
<tr>
<td>Direct Labor</td>
<td>412.50 Unfavorable</td>
<td>495.00 Favorable</td>
</tr>
</tbody>
</table>

Total material and labor variances $852.50 Favorable

(b) In this case, several of the favorable variances may have come back to haunt Amato. The favorable labor efficiency variance means that less time is being spent on the job than originally anticipated. This may indicate that the part-time employee is rushing and doing sloppy work. Also, less fertilizer used than budgeted (i.e., favorable quantity variances for both Type I and Type II) would likely give rise to an increased occurrence of weeds as well as a lack of greening in the lawn.

5. This is a management judgment for Amato to make. If the service is continued, Amato should consider hiring a full-time employee and insisting on the standard amount of fertilizer being applied to each lawn.

PROBLEM 10-46 (30 MINUTES)

1. No. The variances are favorable and small, less than 2% and 4% of budgeted materials and labor cost amounts ($350,000), respectively. However, the report is incomplete: by simply reporting total variances for material and labor, one cannot get a totally clear picture of performance. Price, quantity, rate, and efficiency variances should be calculated for further insight.
PROBLEM 10-46 (CONTINUED)

2. Direct-material variances:
   Price variance:
   Actual quantity purchased x actual price
   22,500 kilograms x $15.40……………………… $346,500
   Actual quantity purchased x standard price
   22,500 kilograms x $17.60……………………… 396,000
   Direct-material price variance……………………... $ 49,500 Favorable

   Quantity variance:
   Actual quantity used x standard price
   22,500 kilograms x $17.60……………………... $396,000
   Standard quantity allowed x standard price
   19,950 kilograms* x $17.60……………………... 351,120
   Direct-material quantity variance……………………... $ 44,880 Unfavorable

   * 9,500 units x 2.1 kilograms

   Total direct-material variance:
   $49,500F + $44,880U = $4,620F

Direct-labor variances:
   Rate variance:
   Actual hours used x actual rate
   20,900 hours x $16.00………………………… $334,400
   Actual hours used x standard rate
   20,900 hours x $14.00………………………… 292,600
   Direct-labor rate variance……………………… $ 41,800 Unfavorable

   Efficiency variance:
   Actual hours used x standard rate
   20,900 hours x $14.00………………………… $292,600
   Standard hours allowed x standard rate
   24,700 hours* x $14.00………………………… 345,800
   Direct-labor efficiency variance………………… $ 53,200 Favorable

   * 9,500 units x 2.6 hours

   Total direct-labor variance:
   $41,800U + $53,200F = $11,400F
PROBLEM 10-46 (CONTINUED)

3. Yes. Although the combined variances are small, a more detailed analysis reveals the presence of sizable, offsetting variances (all well above 10% of budgeted cost amounts). A variance investigation should be undertaken if the likely benefits of the investigation appear to exceed the costs.

4. No, things are not going as smoothly as the vice president believes. With regard to the new supplier, Santa Rosa is paying less than expected for direct materials. However, the quality may be poor, as indicated by the unfavorable quantity variance and increased usage.

Turning to direct labor, the favorable efficiency variance means that the company is producing units by consuming fewer hours than expected. This may be the result of the team-building/morale-boosting exercises, as a contented, well-trained work force tends to be more efficient. However, another plausible explanation could be that Santa Rosa is paying premium wages (as indicated by the unfavorable rate variance) to hire laborers with above-average skill levels.

As a side note, the favorable direct-labor efficiency variance may partially explain the unfavorable material quantity variance. That is, laborers may be rushing through their jobs and using more material than the standards allow.

5. Yes. Schmidt is the production supervisor. The prices paid for materials and the quality of material acquired are normally the responsibility of the purchasing manager. The change to the new supplier may introduce problems of dealing with the unknown—the supplier's reliability, ability to deliver quality goods, etc. Finally, direct-labor wage rates are often a function of market conditions, which would likely be uncontrollable from Schmidt's perspective.
PROBLEM 10-47 (35 MINUTES)

1. a. Machine hours \( \times 4 = \) standard direct-labor hours
   \[165.5 \times 4 = 662\]

   b. Direct-labor efficiency variance = \((AH - SH)SR\)
   \[= (374 - 662) \times 15.08\]
   \[= -4,343 \text{ F} \]

2. |                | a. Standard Direct-Labor Cost* | b. 20% of the Standard Direct-Labor Cost* |
<table>
<thead>
<tr>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>January</td>
<td>$ 9,983</td>
<td>$1,997</td>
</tr>
<tr>
<td>February</td>
<td>6,050</td>
<td>1,210</td>
</tr>
<tr>
<td>March</td>
<td>33,297</td>
<td>6,659</td>
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<tr>
<td>April</td>
<td>43,056</td>
<td>8,611</td>
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<tr>
<td>May</td>
<td>9,651</td>
<td>1,930</td>
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<tr>
<td>June</td>
<td>13,994</td>
<td>2,799</td>
</tr>
<tr>
<td>July</td>
<td>6,273</td>
<td>1,255</td>
</tr>
<tr>
<td>August</td>
<td>5,791</td>
<td>1,158</td>
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<tr>
<td>September</td>
<td>5,791</td>
<td>1,158</td>
</tr>
<tr>
<td>October</td>
<td>4,343</td>
<td>869</td>
</tr>
</tbody>
</table>

*Rounded.

3. The variances for all of the months except August and September exceed 20% of the standard direct-labor cost and would therefore be investigated.
PROBLEM 10-47 (CONTINUED)

4. Statistical control chart for direct-labor efficiency variances:

Favorable variances (in thousands)

<table>
<thead>
<tr>
<th>Month</th>
<th>$0</th>
<th>$5</th>
<th>$10</th>
<th>$15</th>
<th>$20</th>
<th>$25</th>
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</table>

Unfavorable variances (in thousands)

<table>
<thead>
<tr>
<th>Month</th>
<th>$0</th>
<th>$5</th>
<th>$10</th>
<th>$15</th>
<th>$20</th>
<th>$25</th>
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<td>Oct</td>
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</tr>
</tbody>
</table>
PROBLEM 10-47 (CONTINUED)

5. The variances for March, April, and June will be investigated, since they exceed one standard deviation.

6. The production volume was much greater in March, April, and June.

PROBLEM 10-48 (25 MINUTES)

1. Direct-material price variance = \( PQ \times AP \) – \( PQ \times SP \)
   
   = $304,000 – (160,000 \times $1.75)
   
   = $304,000 – $280,000
   
   = $24,000 Unfavorable

2. Direct-material quantity variance = \( SP(AQ – SQ) \)
   
   = $1.75(142,500 – 152,000*)
   
   = $16,625 Favorable

   *Standard quantity allowed = 19,000 units \times 8 \text{ lbs. per unit} = 152,000 \text{ lbs.}

3. Direct-labor rate variance = \( AH \times AR \) – \( AH \times SR \)
   
   = $37,800* – (5,000 \times $8.00)
   
   = $2,200 Favorable

   *90\% \times $42,000 = $37,800

4. Direct-labor efficiency variance = \( SR(AH – SH) \)
   
   = $8.00(5,000 – 4,750*)
   
   = $2,000 Unfavorable

   *19,000 units \times .25 \text{ hour per unit} = 4,750 \text{ hours}
PROBLEM 10-49 (30 MINUTES)

1. a. Responsibility for setting standards:

   **Materials:**

   The development of standard prices for material is primarily the responsibility of the materials manager.

   Operating departmental managers and engineers should be involved in setting standards for material quantities.

   **Labor:**

   The personnel manager or payroll manager would be involved in setting standard labor rates.

   Operating department managers with input from production supervisors and engineers would be involved in setting standards for labor usage.

b. The factors that should be considered in establishing material standards include the following:

   - Price studies, including expected general economic conditions, industry prospects, demand for the materials, and market conditions.
   - Product specifications from descriptions, drawings, and blueprints.
   - Past records on raw-material cost, usage, waste, and scrap.

Factors in establishing labor standards:

   - Engineering studies of the time required to complete various tasks.
   - Learning.
   - Expected wage rates.
   - Expected labor mix (e.g., skilled versus unskilled).
PROBLEM 10-49 (CONTINUED)

2. The basis for assignment of responsibility under a standard-costing system is controllability. Judgments about whether departments or department managers are performing efficiently should not be affected by items over which they have no control.

The responsibility for a variance should be assigned to the department or individual that has the greatest responsibility for deciding whether a specific cost should be incurred. Some variances, however, are interdependent and responsibility must be shared.

PROBLEM 10-50 (30 MINUTES)

1. Variances (U denotes unfavorable; F denotes favorable):

   a. Direct-labor rate variance for each labor class:

<table>
<thead>
<tr>
<th>Labor Class</th>
<th>Actual Rate</th>
<th>Standard Rate</th>
<th>Difference in Rates</th>
<th>Actual Hours</th>
<th>Rate Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>III</td>
<td>$17.20</td>
<td>$16.00</td>
<td>$1.20</td>
<td>550</td>
<td>$660 U</td>
</tr>
<tr>
<td>II</td>
<td>15.00</td>
<td>14.00</td>
<td>1.00</td>
<td>650</td>
<td>650 U</td>
</tr>
<tr>
<td>I</td>
<td>10.80</td>
<td>10.00</td>
<td>.80</td>
<td>375</td>
<td>300 U</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$1,610 U</td>
</tr>
</tbody>
</table>

   b. Direct-labor efficiency variance for each labor class:

<table>
<thead>
<tr>
<th>Labor Class</th>
<th>Actual Hours</th>
<th>Standard Hours*</th>
<th>Difference in Hours</th>
<th>Standard Rate</th>
<th>Efficiency Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>III</td>
<td>550</td>
<td>500</td>
<td>50</td>
<td>$16.00</td>
<td>$800 U</td>
</tr>
<tr>
<td>II</td>
<td>650</td>
<td>500</td>
<td>150</td>
<td>14.00</td>
<td>2,100 U</td>
</tr>
<tr>
<td>I</td>
<td>375</td>
<td>500</td>
<td>(125)</td>
<td>10.00</td>
<td>(1,250) F</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$1,650 U</td>
</tr>
</tbody>
</table>

   *Given April's output of production.
PROBLEM 10-50 (CONTINUED)

2. The advantages of not changing the labor rate would include (1) comparison of actual operating results to a fixed base which was previously approved by management, and (2) the clerical or computer cost savings of not implementing the change. If labor standards are not changed during the year to incorporate significant changes in labor costs, a noncontrollable variance is created. This variance may mask actual operating variances. In addition, when reporting operating variances that contain a significant noncontrollable variance, a credibility gap may be created.

3. In the electronic version of the solutions manual, press the CTRL key and click on the following link:  Build a Spreadsheet  10-50.xls

PROBLEM 10-51 (35 MINUTES)

1. Standard cost per cooling rack:

   Direct material:
   - Wire (1.5 meters* × $3.00 per meter)............................ $4.50
   - Footpads (4 pads × $.05 per pad) ............................. .20  $4.70

   Direct labor:
   - Prepare and cut (14.4†/60 hr. × $8.00 per hr.)......... $1.92
   - Assemble and finish (6/60 hr. × $8.00 per hr.) ............. .80  2.72

   Total standard unit cost........................................ $7.42

   *1.25 meters × (5+1)
   5 1.5 meters

   † 12 min. per rack × (5+1)
   5 14.4 min.
PROBLEM 10-51 (CONTINUED)

2.  
   a. The role of the purchasing manager in the development of standards includes establishing the standard cost for material required by the bill of materials, determining if the company should take advantage of price reductions available through economic order size, and obtaining data regarding the availability of materials.

   b. The role of the industrial engineer in the development of standards includes preparing the bill of materials that specifies the types and quantities of material required; establishing, in conjunction with the production supervisor, any allowances for scrap, shrinkage, and waste; and participating in time studies and test runs to facilitate the establishment of time standards.

   c. The role of the managerial accountant in the development of standards includes reviewing all information regarding material and labor standards received from other departments, establishing the labor rate standards based on the type of labor required, determining application rates for indirect costs such as material handling and manufacturing overhead, and converting physical standards such as hours and quantities to monetary equivalents.

3.  
   a. Standard costing allows for management by exception. Timely reporting of variances allows management to take corrective action before costs get out of hand. The breakdown of variances into various components helps management trace the source of potential cost problems. Standard costing may also motivate employees to operate more efficiently if they are allowed to participate in setting the standards.

   b. The standard costing system can have a negative impact on the motivation of employees if the standards are too easily attainable or too difficult to reach. If the standards are too easy, employees may tend to reduce productivity. If they are too difficult, production workers may become frustrated and ignore the standards. Also, standards that are set without production employee input may not be accepted as realistic by those employees.
PROBLEM 10-52 (40 MINUTES)

1. The standard cost per 10-gallon batch of strawberry jam is determined as follows:

   Strawberries (7.5 qts. × $0.80) ............................................ $ 6.00
   Other ingredients (10 gal. × $0.45) ........................................ 4.50
   Sorting labor (3/60 hr. × 6 qt. × $9.00) .................................. 2.70
   Blending labor (12/60 hr. × $9.00) ....................................... 1.80
   Packaging (40 qt.† × $0.38) .................................................. 15.20
   Total standard cost per 10-gallon batch................................. $30.20

   *6 quarts × 5/4 = 7.5 qt., needed to produce 6 good quarts.
   †4 qt. per gal. × 10 gal. = 40 qt.

2. Joe Adams' behavior regarding the cost information is unethical because it violates the following ethical standards:

   **Competence:** Provide decision support information and recommendations that are accurate, clear, concise, and timely.

   **Integrity:** Mitigate conflicts of interest.

   **Credibility:** Communicate information fairly and objectively.

3. a. In general, the purchasing manager is held responsible for unfavorable material price variances. Causes of these variances include the following:

   • Failure to forecast price increases correctly.
   • Purchasing nonstandard or uneconomical lots.
   • Purchasing from suppliers other than those offering the most favorable terms.
PROBLEM 10-52 (CONTINUED)

b. In general, the production manager is held responsible for unfavorable labor efficiency variances. Causes of these variances include the following: poorly trained labor, substandard or inefficient equipment, or substandard material.

PROBLEM 10-53 (40 MINUTES)

1. Variances to be investigated using rule of thumb:

<table>
<thead>
<tr>
<th>Variance Type</th>
<th>Month</th>
<th>Amount</th>
<th>Percentage of Standard Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Efficiency</td>
<td>August</td>
<td>38,000 U</td>
<td>7.60%</td>
</tr>
<tr>
<td>Efficiency</td>
<td>September</td>
<td>37,000 U</td>
<td>7.40%</td>
</tr>
<tr>
<td>Efficiency</td>
<td>October</td>
<td>42,000 U</td>
<td>8.40%</td>
</tr>
<tr>
<td>Efficiency</td>
<td>November</td>
<td>60,000 U</td>
<td>12.00%</td>
</tr>
<tr>
<td>Efficiency</td>
<td>December</td>
<td>52,000 U</td>
<td>10.40%</td>
</tr>
</tbody>
</table>

2. The company's direct-labor efficiency variances exhibit a consistent unfavorable trend throughout the year. Beginning in January with an unfavorable variance of $5,000, the variances gradually increase to unfavorable variances of $60,000 and $52,000 in November and December, respectively.

When to investigate the trend in the variances is a judgment call. A reasonable investigation point would be July, when the unfavorable trend has persisted for six months and the variance is just under the $30,000 threshold value.

It would also be reasonable to investigate the direct-labor rate variance. Although the variances are relatively small, they remain consistently favorable over the eight-month period from May through December. Once again, this is a judgment call.

3. It is important to follow up on favorable variances. A consistent pattern of favorable variances, a favorable trend, or a large favorable variance may indicate that employees have discovered a more efficient production method. Management should learn about such a development and may wish to implement the method elsewhere in the company.
PROBLEM 10-53 (CONTINUED)

4. Statistical control chart: investigate August and October variances.
PROBLEM 10-54 (40 MINUTES)

Memorandum

Date: Today

To: President, Yonsei Plastics Ltd.

From: Controller

Subject: Performance of Seoul Plant

1. The Seoul Plant's performance for the period January through June is summarized as follows:

   a. Production processing and productivity:

      The plant's cycle time (or throughput time) has improved over the period from 20 hours to 17 hours (average of 18.8 hours). This indicates that the efficiency of the actual processing of products has improved. Consistent with this observation is the reduction in setup time from 70 to 62 hours (average of 65.5). However, the plant's manufacturing cycle efficiency has declined through the period, indicating that too much time is being spent on inspection time, waiting time, and move time, relative to actual processing time. Overtime hours have increased, possibly, due to higher demand late in the period. Power consumption has remained stable.

   b. Product quality and customer acceptance:

      The plant's quality control program appears to be paying off. The number of defective units in finished goods declined dramatically, and no products were returned. This is the result of the plant's inspectors more effectively identifying defective units while still in process. Effort should be devoted in the future to the reduction of the in-process defective rate.

   c. Delivery performance:

      Delivery performance is good, but could be improved. All orders were filled, but only an average of 95 percent of the orders were filled on time in May and June. This might reflect increased demand, as evidenced by the increase in overtime hours.
d. Raw material, scrap and inventory:

The rate of defective raw materials has declined to zero. The purchasing team is doing a good job by ensuring delivery of high-quality raw materials. Inventory value has been steady through the period with an average of 4.8 percent of sales. This is probably as low as can reasonably be expected in this industry.

e. Machine maintenance:

Machine downtime improved during the period from 30 hours to 10 hours (average of 21.7 hours), but bottleneck machine downtime was too high, particularly in May. Also, unscheduled machine maintenance calls were up in May and June.

2. Recommended actions:

a. Investigate the reasons behind the decline in manufacturing-cycle efficiency. Concentrate on the elimination of non-value-added activities, such as move time and wait time.

b. Maintain inspections in process. Try to reduce the in-process defective rate by emphasizing the importance of quality to the work force.

c. Investigate causes of bottleneck machine downtime and correct the situation.
PROBLEM 10-55 (45 MINUTES)

1. Categories of measures:

<table>
<thead>
<tr>
<th>Measure</th>
<th>Area of Manufacturing Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cycle time (days)</td>
<td>a</td>
</tr>
<tr>
<td>Number of defective finished products</td>
<td>b</td>
</tr>
<tr>
<td>Manufacturing-cycle efficiency</td>
<td>a</td>
</tr>
<tr>
<td>Customer complaints</td>
<td>b,c</td>
</tr>
<tr>
<td>Unresolved complaints</td>
<td>c</td>
</tr>
<tr>
<td>Products returned</td>
<td>b,c</td>
</tr>
<tr>
<td>Warranty claims</td>
<td>b,c</td>
</tr>
<tr>
<td>In-process products rejected</td>
<td>d</td>
</tr>
<tr>
<td>Aggregate productivity</td>
<td>a,e</td>
</tr>
<tr>
<td>Number of units produced per day per employee</td>
<td>a,e</td>
</tr>
<tr>
<td>Percentage of on-time deliveries</td>
<td>f</td>
</tr>
<tr>
<td>Percentage of orders filled</td>
<td>f</td>
</tr>
<tr>
<td>Inventory value/sales revenue</td>
<td>g,h</td>
</tr>
<tr>
<td>Machine downtime (minutes)</td>
<td>i</td>
</tr>
<tr>
<td>Bottleneck machine downtime (minutes)</td>
<td>i</td>
</tr>
<tr>
<td>Overtime (minutes) per employee</td>
<td>a,e</td>
</tr>
<tr>
<td>Average setup time (minutes)</td>
<td>a</td>
</tr>
</tbody>
</table>
PROBLEM 10-55 (CONTINUED)

2. Memorandum

Date: Today

To: Management, MedTech, Inc.

From: Controller

Subject: Performance of Singapore plant during 1st quarter

The performance of the Singapore plant is evaluated in nine key areas:

a. Production processing:

   Cycle time, manufacturing-cycle efficiency, and productivity measures all point to consistency and high-level performance throughout the measurement period. Both cycle time and manufacturing-cycle efficiency exhibit slight, favorable trends.

b. Product quality:

   The number of defective finished products, number of products returned, and warranty claims all show improvement over the period. All three measures suggest excellent performance in quality control.

c. Customer acceptance:

   Customer complaints are steady with an average of 6.5 complaints during a two-week period. The number of unresolved complaints improved during the period from 2 to 0. Performance in this area is very high, but there is a little room for improvement.

d. In-process quality control:

   The number of products rejected in process has increased. This speaks well for the in-process inspection effort. The cause of these defective in-process units should be investigated and corrected.
e. Productivity:

Both the aggregate productivity measure and the number of units produced per day per employee remained relatively steady throughout the period. The latter of these two measures exhibited a slight, favorable trend.

f. Delivery performance:

Both performance measures (percentages of on-time deliveries and orders filled) were very high through the period, finishing at 100 percent in period 6.

g. & h. Raw material and scrap; inventory:

Inventory value/sales revenue remained consistently low through the period (average of 1.83 percent).

i. Machine maintenance:

Machine downtime was low through the period (average of 84 minutes each two-week period). Bottleneck machine downtime was low except in period 5. The cause of that incident should be investigated.

Overall evaluation:

The Singapore plant has performed at a very high level of efficiency in virtually every phase of its operations during the 1st quarter.
PROBLEM 10-56 (45 MINUTES)

1. a. The semiannual installments and total bonus for the Charter Division are calculated as follows:

**CHARTER DIVISION**
*GAIN-SHARING BONUS CALCULATION*
*FOR THE YEAR ENDED DECEMBER 31, 20X1*

First installment, January–June:

- Profitability \((.02 \times \$462,000)\) \(\$9,240\)
- Rework \([.02 \times \$462,000] – \$11,500\) \((2,260)\)
- On-time delivery (no bonus—under 96%) \(-0-\)
- Sales returns \([[(.015 \times \$4,200,000) – \$84,000] \times 50\%]\) \((10,500)\)
- Semiannual installment \(\$3,520\)

First semiannual bonus awarded \(\$0\)

Second installment, July–December:

- Profitability \((.02 \times \$440,000)\) \(\$8,800\)
- Rework \([.02 \times \$440,000] – \$11,000\) \((2,200)\)
- On-time delivery (96%–98%) \(2,000\)
- Sales returns \([[(.015 \times \$4,400,000) – \$70,000] \times 50\%]\) \((2,000)\)
- Semiannual installment \(\$6,600\)

Second semiannual bonus awarded \(6,600\)

Total bonus awarded for the year \(\$6,600\)

b. The employees of the Charter Division are likely to be frustrated by the new plan, since the division bonus is more than \$20,000 less than that of the previous year, when sales and operating income were similar. However, both on-time deliveries and sales returns improved in the second half of the year, while rework costs were relatively even. If the division continues to improve at the same rate, the Charter Division bonus will approximate or exceed what it was under the old plan. The only open question is whether the employees have sufficient motivation to effect improvement.
PROBLEM 10-56 (CONTINUED)

2. a. The semiannual installments and total bonus for the Mesa Division are calculated as follows:

**MESA DIVISION**

**GAIN-SHARING BONUS CALCULATION**

**FOR THE YEAR ENDED DECEMBER 31, 20X1**

First installment, January–June:

- Profitability (.02 × $342,000) .................................................. $6,840
- Rework [(0.02 × $342,000) – $6,000] .............................................. -0
- On-time delivery (over 98%) .................................................. 5,000
- Sales returns
  - [{[(0.015 × $2,850,000) – $44,750] × 50%} ........ (1,000)
  - Semiannual installment.................................................. $10,840
- First semiannual bonus awarded ........................................ $10,840

Second installment, July–December:

- Profitability (.02 × $406,000) .................................................. $8,120
- Rework [(0.02 × $406,000) – $8,000] .............................................. -0
- On-time delivery (no bonus—under 96%) .............................. -0
- Sales returns
  - [{[(0.015 × $2,900,000) – $42,500] × 50%} ........ 3,000†
  - Semiannual installment.................................................. $11,120
- Second semiannual bonus awarded ................................. 11,120
- Total bonus awarded for the year .................................... $21,960

* Rework costs not in excess of 2 percent of operating income.
† $3,000, since sales returns are less than 1.5 percent of sales.

b. The employees of the Mesa Division should be as satisfied with the new plan as with the old plan, because the bonus was almost equivalent. However, there is no sign of improvements in this division; in fact, on-time deliveries declined considerably in the second half of the year. Therefore, the bonus situation may not be as favorable in the future. Decreased bonuses could motivate the employees to improve, or they could frustrate employees and undermine their motivation.
PROBLEM 10-56 (CONTINUED)

3. Harrington's revised bonus plan for the Charter Division fostered improvements including the following:

- Increase of 1.9 percent in on-time deliveries
- $500 reduction in rework costs
- $14,000 reduction in sales returns

However, operating income as a percentage of sales has decreased from 11 to 10 percent.

The Mesa Division's bonus has remained at the status quo. The effects of the revised plan at MedLine Equipment Corporation have been offset by the following:

- Increase of 2 percent in operating income as a percentage of sales (from 12 to 14 percent)
- Decrease of 3.6 percent in on-time deliveries
- $2,000 increase in rework costs
- $2,250 decrease in sales returns

These results suggest that the gain-sharing bonus plan needs revisions. Suggestions include the following:

- Creating a reward structure for rework costs that are below 2 percent of operating income that would encourage employees to drive costs lower.
- Reviewing the whole year in total. The bonus plan should carry forward the negative amounts for one six-month period into the next six-month period, incorporating the entire year when calculating a bonus.
- Developing benchmarks, and then giving rewards for improvements over prior periods and encouraging continuous improvement.
PROBLEM 10-57 (50 MINUTES)

1. a. Direct-labor rate variance  
   \[ (AH \times AR) - (AH \times SR) \]
   \[ = (36,500 \times 8.24) - (36,500 \times 8.20) \]
   \[ = 1,460 \text{ Unfavorable} \]

   "300,760 ÷ 36,500 hours"

   b. Direct-labor efficiency variance  
   \[ (AH \times SR) - (SH \times SR) \]
   \[ = (36,500 \times 8.20) - (37,200 \times 8.20) \]
   \[ = 5,740 \text{ Favorable} \]

   *Standard allowed direct-labor hours:

   Completed units ................ 5,600 units \times 6 hours per unit  33,600 hours
   Partially completed units .......... 800 units \times 75\% \times 6 hours per unit  3,600 hours
   Total standard hours allowed ........ 37,200 hours

   c. Actual quantity of material used:

   Direct-material quantity variance  
   \[ (AQ \times SP) - (SQ \times SP) \]
   \[ = (AQ \times 5.00) - (51,200 \times 5.00) \]
   \[ = 1,500 \text{ Unfavorable} \]

   Therefore: $5(AQ - 51,200) = 1,500$
   \[ AQ - 51,200 = 300 \]
   \[ AQ = 51,500 \text{ kilograms} \]

   *Standard quantity of material allowed:

   Completed units .................... 5,600 units \times 8 kilograms  44,800 kilograms
   Partially completed units ............. 800 units \times 8 kilograms  6,400 kilograms
   Total standard quantity allowed ....... 51,200 kilograms
d. Actual price paid per kilogram of direct material:

\[
\text{Actual price} = \frac{249,250}{50,000} = \$4.985 \text{ per kilogram}
\]

e. Direct-material and direct-labor cost transferred to finished goods:

<table>
<thead>
<tr>
<th>Component</th>
<th>Quantity</th>
<th>Unit Cost</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct-material cost transferred</td>
<td>5,600</td>
<td>$40</td>
<td>$224,000</td>
</tr>
<tr>
<td>Direct-labor cost transferred</td>
<td>5,600</td>
<td>$49.20</td>
<td>$275,520</td>
</tr>
<tr>
<td><strong>Total cost transferred</strong></td>
<td></td>
<td></td>
<td><strong>$499,520</strong></td>
</tr>
</tbody>
</table>

f. Direct-material and direct-labor cost in November 30 balance of Work-in-Process Inventory:

<table>
<thead>
<tr>
<th>Component</th>
<th>Quantity</th>
<th>Unit Cost</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct material</td>
<td>800</td>
<td>$40 per unit</td>
<td>$32,000</td>
</tr>
<tr>
<td>Direct labor</td>
<td>800</td>
<td>75% × $49.20</td>
<td>$29,520</td>
</tr>
<tr>
<td><strong>Total cost in ending</strong></td>
<td></td>
<td></td>
<td><strong>$61,520</strong></td>
</tr>
<tr>
<td>Work-in-Process Inventory</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
PROBLEM 10-57 (CONTINUED)

2. Raw-Material Inventory ................................................. 250,000
   Direct-Material Price Variance ................................. 750*
   Accounts Payable ............................................. 249,250

*Direct-material price variance = PQ(AP – SP)
= 50,000($4.985 – $5.00) = $750 Favorable

To record the purchase of raw material and the direct-material price variance.

Work-in-Process Inventory ........................................ 256,000*
   Direct-Material Quantity Variance ........................... 1,500
   Raw-Material Inventory ......................................... 257,500†

*51,200 × $5.00 = $256,000
†51,500 × $5.00 = $257,500

To add the direct-material cost to work in process and record the direct-material quantity variance.

Work-in-Process Inventory ........................................ 305,040*
   Direct-Labor Rate Variance ......................................... 1,460
   Direct-Labor Efficiency Variance ............................. 5,740
   Wages Payable ................................................. 300,760

*37,200 × $8.20 = $305,040

To add the direct-labor cost to work-in-process, record the direct-labor rate and efficiency variances, and recognize the actual direct-labor cost.
PROBLEM 10-58 (25 MINUTES)

1. (a) Direct-material price variance = \(PQ(AP - SP)\)

<table>
<thead>
<tr>
<th>Product</th>
<th>Calculation</th>
<th>Price Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard tent</td>
<td>(1,050 ($12.80* - $12))</td>
<td>$840 U</td>
</tr>
<tr>
<td>Deluxe tent</td>
<td>(400 ($15.80\dagger - $16))</td>
<td>$80 F</td>
</tr>
<tr>
<td>Direct-material</td>
<td>Price variance</td>
<td>$760 U</td>
</tr>
</tbody>
</table>

\*\$12.80 = \$13,440 ÷ 1,050
\dagger\$15.80 = \$6,320 ÷ 400

(b) Direct-material quantity variance = \(SP(AQ - SQ)\)

<table>
<thead>
<tr>
<th>Product</th>
<th>Calculation</th>
<th>Quantity Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard tent</td>
<td>$12 (625 - 600**)</td>
<td>$300 U</td>
</tr>
<tr>
<td>Deluxe tent</td>
<td>$16 (360 - 360\dagger)</td>
<td>-0-</td>
</tr>
<tr>
<td>Direct-material</td>
<td>quantity variance</td>
<td>$300 U</td>
</tr>
</tbody>
</table>

\*600 = 100 tents × 6 meters per tent
\dagger360 = 120 tents × 3 meters per tent
PROBLEM 10-58 (CONTINUED)

2. Raw-Material Inventory ............................................ 19,000*
   Direct-Material Price Variance .................................. 760
   Accounts Payable ............................................. 19,760

To record purchase of tent fabrics.

*$19,000 = (1,050 meters × $12 per meter) + (400 meters × $16 per meter)

Work-in-Process Inventory ........................................... 12,960*
   Direct-Material Quantity Variance ............................. 300
   Raw-Material Inventory .......................................... 13,260†

To record use of direct material.

*$12,960 = (600 meters × $12 per meter) + (360 meters × $16 per meter)
†$13,260 = (625 meters × $12 per meter) + (360 meters × $16 per meter)
PROBLEM 10-59 (60 MINUTES)

1. Standard cost schedule:

### DIRECT MATERIAL

<table>
<thead>
<tr>
<th></th>
<th>Construction Department</th>
<th>Finishing Department</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Standard quantity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Direct material and parts in finished product:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Veneered wood</td>
<td>3.5 kgs</td>
<td>—</td>
</tr>
<tr>
<td>Bridge and strings</td>
<td>—</td>
<td>1 set</td>
</tr>
<tr>
<td>Allowance for normal waste</td>
<td>.5 kg</td>
<td>—</td>
</tr>
<tr>
<td><strong>Total standard quantity per guitar</strong></td>
<td><strong>4 kgs</strong></td>
<td><strong>1 set</strong></td>
</tr>
<tr>
<td><strong>Standard price:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Direct material and parts:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Veneered wood</td>
<td>$24 per kg</td>
<td>—</td>
</tr>
<tr>
<td>Bridge and strings</td>
<td>—</td>
<td>$20 per set</td>
</tr>
<tr>
<td><strong>Standard direct-material cost:</strong></td>
<td><strong>4 kgs</strong></td>
<td><strong>1 set</strong></td>
</tr>
<tr>
<td>Standard quantity</td>
<td>× $24 per kg</td>
<td>× $20 per set</td>
</tr>
<tr>
<td>Standard cost per guitar</td>
<td>$96 per guitar</td>
<td>$20 per guitar</td>
</tr>
<tr>
<td>Actual output in July</td>
<td>× 500 guitars</td>
<td>× 500 guitars</td>
</tr>
<tr>
<td><strong>Total standard cost of direct material in July</strong></td>
<td><strong>$48,000</strong></td>
<td><strong>$10,000</strong></td>
</tr>
</tbody>
</table>

### DIRECT LABOR

<table>
<thead>
<tr>
<th></th>
<th>Construction Department</th>
<th>Finishing Department</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Standard direct-labor cost:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standard quantity</td>
<td>6 hrs</td>
<td>3 hrs</td>
</tr>
<tr>
<td>Standard rate</td>
<td>× $20</td>
<td>× $15</td>
</tr>
<tr>
<td>Standard cost per guitar</td>
<td>$120</td>
<td>$45</td>
</tr>
<tr>
<td>Actual output in July</td>
<td>× 500 guitars</td>
<td>× 500 guitars</td>
</tr>
<tr>
<td><strong>Total standard cost of direct labor in July</strong></td>
<td><strong>$60,000</strong></td>
<td><strong>$22,500</strong></td>
</tr>
</tbody>
</table>
PROBLEM 10-59 (CONTINUED)

2. (a) Construction Department:

**DIRECT-MATERIAL PRICE AND QUANTITY VARIANCES**

<table>
<thead>
<tr>
<th>ACTUAL MATERIAL COST</th>
<th>STANDARD MATERIAL COST</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Actual Quantity</strong></td>
<td><strong>Actual Price</strong></td>
</tr>
<tr>
<td>3,000 kilograms purchased</td>
<td>$25 per kilogram</td>
</tr>
<tr>
<td>$75,000</td>
<td>$72,000</td>
</tr>
</tbody>
</table>

$3,000 Unfavorable Direct-material price variance

$54,000 Unfavorable Direct-material quantity variance
### DIRECT-LABOR RATE AND EFFICIENCY VARIANCES

#### PROBLEM 10-59 (CONTINUED)

<table>
<thead>
<tr>
<th>ACTUAL LABOR COST</th>
<th>STANDARD LABOR COST</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Actual</strong></td>
<td><strong>Standard</strong></td>
</tr>
<tr>
<td>Hours used × Rate</td>
<td>Hours × Rate</td>
</tr>
<tr>
<td>2,850 hours × $19</td>
<td>2,850 hours × $20</td>
</tr>
<tr>
<td>Actual hours used</td>
<td>Standard hours used</td>
</tr>
<tr>
<td>$54,150</td>
<td>$57,000</td>
</tr>
</tbody>
</table>

$2,850 Favorable Direct-labor rate variance

$5,850 Favorable Direct-labor efficiency variance

$5,850 Favorable Direct-labor variance

> (b) Finishing Department:

<table>
<thead>
<tr>
<th>ACTUAL LABOR COST</th>
<th>STANDARD LABOR COST</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Actual</strong></td>
<td><strong>Standard</strong></td>
</tr>
<tr>
<td>Hours used × Rate</td>
<td>Hours × Rate</td>
</tr>
<tr>
<td>1,570 hours × $16</td>
<td>1,570 hours × $15</td>
</tr>
<tr>
<td>Actual hours used</td>
<td>Standard hours used</td>
</tr>
<tr>
<td>$25,120</td>
<td>$23,550</td>
</tr>
</tbody>
</table>

$1,570 Unfavorable Direct-labor rate variance

$1,050 Unfavorable Direct-labor efficiency variance

$2,620 Unfavorable Direct-labor variance
PROBLEM 10-59 (CONTINUED)

3. Cost variance report:

<table>
<thead>
<tr>
<th></th>
<th>Construction Department</th>
<th></th>
<th>Finishing Department</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Amount</td>
<td>Percentage of Standard Cost</td>
<td>Amount</td>
<td>Percentage of Standard Cost</td>
</tr>
<tr>
<td>Direct material:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standard cost, given actual output...............</td>
<td>$48,000</td>
<td>—</td>
<td>$ 10,000</td>
<td>—</td>
</tr>
<tr>
<td>Direct-material price variance.......................</td>
<td>3,000 U</td>
<td>6.25%</td>
<td>0-</td>
<td>0-</td>
</tr>
<tr>
<td>Direct-material quantity variance.......................</td>
<td>6,000 U</td>
<td>12.50%</td>
<td>0-</td>
<td>0-</td>
</tr>
<tr>
<td>Direct labor:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standard cost, given actual output...............</td>
<td>$60,000</td>
<td>—</td>
<td>$22,500</td>
<td>—</td>
</tr>
<tr>
<td>Direct-labor rate variance</td>
<td>2,850 F</td>
<td>4.75%</td>
<td>1,570 U</td>
<td>6.98%</td>
</tr>
<tr>
<td>Direct-labor efficiency variance</td>
<td>3,000 F</td>
<td>5.00%</td>
<td>1,050 U</td>
<td>4.67%</td>
</tr>
</tbody>
</table>
PROBLEM 10-60 (45 MINUTES)

1. Journal entries:

   Raw-Material Inventory .................................................. 72,000
   Direct-Material Price Variance ........................................ 3,000
   Accounts Payable ..................................................... 75,000

   To record purchase of veneered wood.

   Raw-Material Inventory .................................................. 9,000
   Accounts Payable ..................................................... 9,000

   To record purchase of bridges and strings.

   Work-in-Process Inventory ............................................. 48,000
   Direct-Material Quantity Variance .................................. 6,000
   Raw-material Inventory ................................................ 54,000

   To record usage of veneered wood.

   Work-in-Process Inventory ............................................. 10,000
   Raw-Material Inventory ................................................ 10,000

   To record usage of bridges and strings.

   Work-in-Process Inventory ............................................. 60,000
   Direct-Labor Rate Variance ........................................... 2,850
   Direct-Labor Efficiency Variance .................................... 3,000
   Wages Payable ......................................................... 54,150

   To record Construction Department direct-labor costs and variances.

   Work-in-Process Inventory ............................................. 22,500
   Direct-Labor Rate Variance ........................................... 1,570
   Direct-Labor Efficiency Variance .................................... 1,050
   Wages Payable ......................................................... 25,120

   To record Finishing Department direct-labor costs and variances.
PROBLEM 10-60 (CONTINUED)

Finished-Goods Inventory ................................................... 140,500
Work-in-Process Inventory ................................................... 140,500

To record completion of 500 guitars at a standard cost of $281 each
($281 = $96 + $20 + $120 + $45).

Accounts Receivable .......................................................... 120,000
Sales Revenue ........................................................................ 120,000

Cost of Goods Sold ............................................................... 84,300
Finished-Goods Inventory .................................................... 84,300

To record sale of 300 guitars at a price of $400 each and a standard cost of $281 each.

Cost of Goods Sold ............................................................... 5,770
Direct-Labor Rate Variance ..................................................... 1,280*
Direct-Labor Efficiency Variance ............................................ 1,950†
  Direct-Material Price Variance ............................................. 3,000
  Direct-Material Quantity Variance ................................. 6,000

To close variances into Cost of Goods Sold.

*Sum of direct-labor rate variances: $1,280 F = $2,850 F + $1,570 U
†Sum of direct-labor efficiency variances: $1,950 F = $3,000 F + $1,050 U
PROBLEM 10-60 (CONTINUED)

2. Posting of journal entries:

<table>
<thead>
<tr>
<th>Raw-Material Inventory</th>
<th>Accounts Receivable</th>
</tr>
</thead>
<tbody>
<tr>
<td>72,000 54,000</td>
<td></td>
</tr>
<tr>
<td>9,000 10,000</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Work-in-Process Inventory</th>
<th>Accounts Payable</th>
</tr>
</thead>
<tbody>
<tr>
<td>48,000 140,500</td>
<td>75,000 9,000</td>
</tr>
<tr>
<td>10,000</td>
<td></td>
</tr>
<tr>
<td>60,000</td>
<td></td>
</tr>
<tr>
<td>22,500</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Finished-Goods Inventory</th>
<th>Wages Payable</th>
</tr>
</thead>
<tbody>
<tr>
<td>140,500 84,300</td>
<td>54,150 25,120</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cost of Goods Sold</th>
<th>Sales Revenue</th>
</tr>
</thead>
<tbody>
<tr>
<td>84,300</td>
<td>120,000</td>
</tr>
<tr>
<td>5,770</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Direct-Material Price Variance</th>
<th>Direct-Labor Rate Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>3,000 3,000</td>
<td>1,570 2,850</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Direct-Material Quantity Variance</th>
<th>Direct-Labor Efficiency Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>6,000 6,000</td>
<td>1,050 3,000</td>
</tr>
</tbody>
</table>

PROBLEM 10-61 (60 MINUTES)

Answers will vary widely, depending on the bank chosen, its stated goals, and students’ choices of lead and lag measures.
SOLUTIONS TO CASES

CASE 10-62 (60 MINUTES)

1. Standard cost of lots 22, 23, and 24:

<table>
<thead>
<tr>
<th>Lot</th>
<th>Quantity (boxes)</th>
<th>Standard Cost per Box</th>
<th>Total Standard Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>22</td>
<td>1,000</td>
<td>$106.50</td>
<td>$106,500</td>
</tr>
<tr>
<td>23</td>
<td>1,700</td>
<td>106.50</td>
<td>181,050</td>
</tr>
<tr>
<td>24</td>
<td>1,200</td>
<td>90.48*</td>
<td>108,576</td>
</tr>
<tr>
<td>Standard cost of production</td>
<td></td>
<td></td>
<td>$396,126</td>
</tr>
</tbody>
</table>

*Standard material cost plus 80 percent of standard cost of labor and overhead:
$26.40 + (80%)($44.10 + $36.00).

2. Variances (U denotes unfavorable; F denotes favorable):

<table>
<thead>
<tr>
<th>European Styles, Inc.</th>
<th>Direct-Material Price Variance For November</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual cost of materials purchased</td>
<td>$106,400</td>
</tr>
<tr>
<td>Standard cost of materials purchased (95,000 × $1.10)</td>
<td>104,500</td>
</tr>
<tr>
<td>Direct-material price variance</td>
<td>$1,900 U</td>
</tr>
</tbody>
</table>
CASE 10-62 (CONTINUED)

EUROPEAN STYLES, INC.
DIRECT-MATERIAL AND DIRECT-LABOR VARIANCES
FOR NOVEMBER

<table>
<thead>
<tr>
<th>Lot no.</th>
<th>22</th>
<th>23</th>
<th>24</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct-material quantity variance:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standard yards:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boxes in lot</td>
<td>1,000</td>
<td>1,700</td>
<td>1,200</td>
<td>3,900</td>
</tr>
<tr>
<td>Standard yards per box</td>
<td>× 24</td>
<td>× 24</td>
<td>× 24</td>
<td>× 24</td>
</tr>
<tr>
<td>Total standard quantity</td>
<td>24,000</td>
<td>40,800</td>
<td>28,800</td>
<td>93,600</td>
</tr>
<tr>
<td>Actual yards used</td>
<td>24,100</td>
<td>40,440</td>
<td>28,825</td>
<td>93,365</td>
</tr>
<tr>
<td>Variance in yards*</td>
<td>100</td>
<td>(360)</td>
<td>25</td>
<td>(235)</td>
</tr>
<tr>
<td>Standard price</td>
<td>× $1.10</td>
<td>× $1.10</td>
<td>× $1.10</td>
<td>× $1.10</td>
</tr>
<tr>
<td>Direct-material quantity variance</td>
<td>$ 110 U</td>
<td>$ (396) F</td>
<td>$27.50 U</td>
<td>$ (258.50) F</td>
</tr>
</tbody>
</table>

*Parentheses denote favorable variance.

<table>
<thead>
<tr>
<th>Lot no.</th>
<th>22</th>
<th>23</th>
<th>24</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct-labor efficiency variance:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standard hours:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boxes in lot</td>
<td>1,000</td>
<td>1,700</td>
<td>1,200</td>
<td></td>
</tr>
<tr>
<td>Standard hours per box</td>
<td>× 3</td>
<td>× 3</td>
<td>× 3</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>3,000</td>
<td>5,100</td>
<td>3,600</td>
<td></td>
</tr>
<tr>
<td>Percentage of completion</td>
<td>× 100%</td>
<td>× 100%</td>
<td>× 80%</td>
<td></td>
</tr>
<tr>
<td>Total standard hours</td>
<td>3,000</td>
<td>5,100</td>
<td>2,880</td>
<td>10,980</td>
</tr>
<tr>
<td>Actual hours worked</td>
<td>2,980</td>
<td>5,130</td>
<td>2,890</td>
<td>11,000</td>
</tr>
<tr>
<td>Variance in hours*</td>
<td>(20)</td>
<td>30</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>Standard rate</td>
<td>× $14.70</td>
<td>× $14.70</td>
<td>× $14.70</td>
<td>× $14.70</td>
</tr>
<tr>
<td>Direct-labor efficiency variance</td>
<td>$ (294) F</td>
<td>$441 U</td>
<td>$147 U</td>
<td>$294 U</td>
</tr>
</tbody>
</table>

*Parentheses denote favorable variance.
CASE 10-62 (CONTINUED)

<table>
<thead>
<tr>
<th>Lot no.</th>
<th>22</th>
<th>23</th>
<th>24</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct-labor rate variance:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actual hours worked ............</td>
<td>2,980</td>
<td>5,130</td>
<td>2,890</td>
<td>11,000</td>
</tr>
<tr>
<td>Rate paid in excess of standard ($15.00 – $14.70) ............</td>
<td>×$ .30</td>
<td>×$ .30</td>
<td>×$ .30</td>
<td>×$ .30</td>
</tr>
<tr>
<td>Variance ..........................</td>
<td>$ 894</td>
<td>$1,539</td>
<td>$ 867</td>
<td>$ 3,300</td>
</tr>
</tbody>
</table>

3. **Journal entries:**

- Raw-material Inventory ........................................ 104,500*
- Direct-Material Price Variance ................................. 1,900
  - Accounts Payable ............................................. 106,400

*95,000 × $1.10 = $104,500

To record the purchase of raw material.

- Work-in-Process Inventory ...................................... 102,960*
  - Direct-Material Quantity Variance ............................ 258.50
  - Raw-Material Inventory ........................................ 102,701.50

*93,600 × $1.10 = $102,960

To add direct-material cost to work-in-process inventory and record the direct-material quantity variance.

- Work-in-Process Inventory ...................................... 161,406*
  - Direct-Labor Rate Variance .................................. 3,300
  - Direct-Labor Efficiency Variance ............................ 294
  - Wages Payable .................................................. 165,000

*10,980 × $14.70 = $161,406

To add direct-labor cost to work-in-process inventory, record the direct-labor variances, and record the incurrence of direct-labor cost.
CASE 10-63 (75 MINUTES)

The completed list is shown below. Begin by filling in the facts you know. The reasoning used to reduce the remaining data is explained after the list of answers.

1. Actual output (in drums)

\[
= \frac{\text{standard quantity of direct material A allowed, given actual output}}{\text{standard quantity of direct material A per drum}}
\]

\[
= \frac{10,000 \text{ lb.}}{10 \text{ lb. per drum}} \times 1,000 \text{ drums}
\]

2.

<table>
<thead>
<tr>
<th>Direct material</th>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Standard quantity per drum</td>
<td>10 lb.</td>
<td>5 gal.</td>
</tr>
<tr>
<td>b. Standard price</td>
<td>$5.00/lb.</td>
<td>$3.00/gal.</td>
</tr>
<tr>
<td>c. Standard cost per drum</td>
<td>$50.00</td>
<td>$15.00</td>
</tr>
<tr>
<td>d. Standard quantity allowed, given actual output</td>
<td>10,000 lb.</td>
<td>5,000 gal.</td>
</tr>
<tr>
<td>e. Actual quantity purchased</td>
<td>12,000 lb.</td>
<td>6,000 gal.</td>
</tr>
<tr>
<td>f. Actual price</td>
<td>$4.50/lb.</td>
<td>$3.20/gal.</td>
</tr>
<tr>
<td>g. Actual quantity used</td>
<td>10,500 lb.</td>
<td>4,800 gal.</td>
</tr>
<tr>
<td>h. Price variance</td>
<td>$6,000 F</td>
<td>$1,200 U</td>
</tr>
<tr>
<td>i. Quantity variance</td>
<td>$2,500 U</td>
<td>$600 F</td>
</tr>
</tbody>
</table>

\text{Standard quantity of direct material B per drum}

\[
= \frac{\text{standard quantity of direct material B allowed, given actual output}}{\text{actual output}}
\]

\[
= \frac{5,000 \text{ gal.}}{1,000 \text{ drums}} \times 5 \text{ gal.}
\]

\text{Standard price of direct material B}

\[
= \frac{\text{standard cost of material B per drum}}{\text{standard quantity allowed per drum}}
\]

\[
= \frac{\$15.00 \text{ per drum}}{5 \text{ gal. per drum}} \times \$3.00 \text{ per gal.}
\]
CASE 10-63 (CONTINUED)

c) Standard cost of direct material A per drum = 10 lbs. × $5.00 per lb. = $50.00.

d) The reasoning for the actual price of direct material B is as follows, where the subscripts denote materials A and B:

\[
\text{Increase in accounts payable} = \text{actual cost of material purchases} = (PQ_A \times AP_A) + (PQ_B \times AP_B)
\]

\[
\$73,200 = (12,000 \times $4.50) + (6,000 \times AP_B)
\]

\[
AP_B = \$3.20 \text{ per gallon}
\]

e) This conclusion comes from the following formula for the quantity variance:

\[
\text{Quantity variance (A)} = SP(AQ - SQ)
\]

\[
\$2,500 \text{ U} = (AQ - 10,000) \times $5.00
\]

\[
AQ = 10,500 \text{ lb.}
\]

f) Direct material A price variance = \(PQ \times (AP - SP)\)

\[
= 12,000 \times ($4.50 - $5.00)
\]

\[
= $6,000 \text{ F}
\]

g) Direct material B quantity variance = \(SP \times (AQ - SQ)\)

\[
= $3.00 \times (4,800 - 5,000)
\]

\[
= $600 \text{ F}
\]
CASE 10-63 (CONTINUED)

3.

<table>
<thead>
<tr>
<th>Direct labor:</th>
<th>I (mixers)</th>
<th>II (packers)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Standard hours per drum</td>
<td>2 hr.&lt;sup&gt;a&lt;/sup&gt;</td>
<td>4 hr.</td>
</tr>
<tr>
<td>b. Standard rate per hour</td>
<td>$15.00</td>
<td>$12.00&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>c. Standard cost per drum</td>
<td>$30.00</td>
<td>$48.00</td>
</tr>
<tr>
<td>d. Standard quantity allowed, given actual output</td>
<td>2,000 hr.&lt;sup&gt;c&lt;/sup&gt;</td>
<td>4,000 hr.&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td>e. Actual rate per hour</td>
<td>$15.30&lt;sup&gt;e&lt;/sup&gt;</td>
<td>$11.90</td>
</tr>
<tr>
<td>f. Actual hours</td>
<td>2,000 hr&lt;sup&gt;f&lt;/sup&gt;</td>
<td>4,100 hr.&lt;sup&gt;g&lt;/sup&gt;</td>
</tr>
<tr>
<td>g. Rate variance</td>
<td>$600 U</td>
<td>$410 F&lt;sup&gt;h&lt;/sup&gt;</td>
</tr>
<tr>
<td>h. Efficiency variance</td>
<td>-0.&lt;sup&gt;i&lt;/sup&gt;</td>
<td>$1,200 U</td>
</tr>
</tbody>
</table>

<sup>a</sup>Standard hours of direct labor type I per drum

\[
\text{Standard hours of direct labor type I per drum} = \frac{\text{standard cost of direct labor type I per drum}}{\text{standard rate per hour}}
\]

\[
= \frac{\$30.00 \text{ per drum}}{\$15.00 \text{ per hr.}} = 2 \text{ hr.}
\]

<sup>b</sup>Direct labor type II, standard rate per hour

\[
\text{Standard rate per hour for direct labor type II} = \frac{\text{standard cost of direct labor type II per drum}}{\text{standard hours per drum}}
\]

\[
= \frac{\$48.00 \text{ per drum}}{4 \text{ hr. per drum}} = $12.00
\]

<sup>c</sup>Direct labor type I, standard quantity allowed, given actual output

\[
= 1,000 \text{ drums} \times 2 \text{ hr. per drum}
\]

\[= 2,000 \text{ hr.}
\]

<sup>d</sup>Direct labor type II, standard quantity allowed given actual output

\[
= 1,000 \text{ drums} \times 4 \text{ hr. per drum}
\]

\[= 4,000 \text{ hr.}
\]
CASE 10-63 (CONTINUED)

e Direct labor type I, actual rate per hour = $15.30. Use the formula for the direct-labor rate variance as follows:

Direct-labor rate variance = $600 U = 2,000 (AR – $15.00)

AR = $15.30

f Direct labor type I, actual hours = 2,000 hr. Since there was no labor type I efficiency variance, actual hours and standard hours are equal.

g Direct labor type II, actual hours = 4,100 hr. Use the formula for the direct-labor efficiency variance, as follows:

Direct-labor (II) efficiency variance = $1,200 U = $12.00 (AH – 4,000)

AH = 4,100 hr.

h Direct-labor type II, rate variance = 4,100 ($11.90 – $12.00) = $410 F
CASE 10-63 (CONTINUED)

Direct labor type I, efficiency variance = zero.

Now fill in the remaining variance in the following tabulation:

Direct-material variances:
A: Price variance .......................................................... $6,000 F
A: Quantity variance .................................................. 2,500 U
B: Price variance .......................................................... 1,200 U
B: Quantity variance .................................................. 600 F

Direct-labor variances:
I: Rate variance ............................................................ 600 U
I: Efficiency variance .................................................. ?
II: Rate variance .......................................................... 410 F
II: Efficiency variance .................................................. 1,200 U

Total (favorable variance because of credit to cost of Goods Sold)....... $1,510 F

Therefore, the direct-labor type I efficiency variance = $1,510 – $6,000 + $2,500
+ $1,200 – $600 + $600 – $410 + $1,200 = 0

4. Total of all variances for the month: $1,510 F (favorable because of credit to Cost of Goods Sold).
FOCUS ON ETHICS  (See page 434 in the text.)

Was sacrificing quality to cut standards ethical in this situation?

Smith did not act ethically when he ordered wood of an inferior quality as he knew that his actions would harm customers (through provision of inferior products) and the company (both through product replacement costs and through damage to its reputation). Rigas, as controller, was acting both ethically and within the scope of his job when he questioned Smith about the requisition. It is part of Rigas’s job to ensure that the new standard-costing system was not manipulated by employees to produce specific personal gains through the compensation process. Further, if he hadn't realized that this price variance was probably a one-time event, it might have led to inaccurate standard costs being set for future periods. Hence it was important that he understood what had really happened in the wood transaction. Rigas was also acting ethically when he went to the production controller to voice his concerns, since he was seeking to halt the potential for harm to customers and to the company, as described above.

Rigas, if convinced that the ordered raw material is inferior, should work with the production manager to stop further shipments of the wood. If there is concrete evidence that Smith was acting against the best interests of the firm, then it could be grounds for disciplinary action or even dismissal. Barring such evidence, then Rigas should keep a closer eye on Smith's actions to ensure that short-term motives for personal gain are not driving his decision making process.

It is possible that a balanced scorecard would help avoid this type of situation in the future. Under this approach, raw material quality measures could be included in the internal processes section of the scorecard, thus drawing attention to this key issue for the company's success.