Chapter 10
Standard Costs and the Balanced Scorecard

Solutions to Questions

10-1 A quantity standard indicates how much of an input should be used to make a unit of output. The quantity might be measured in terms of units of direct materials or hours of direct labor time. A price standard indicates how much the input should cost.

10-2 Ideal standards assume perfection and do not allow for any inefficiency. Thus, ideal standards are rarely, if ever, attained. Practical standards allow for normal inefficiency, machine breakdown time, etc., and can be attained by employees working at a reasonable, though efficient pace.

10-3 Inability to meet a standard is likely to be demoralizing to employees, and may result in decreased productivity.

10-4 A budget is usually expressed in terms of total dollars, whereas a standard is expressed on a per unit basis. A standard might be viewed as the budgeted cost for one unit.

10-5 A variance is the difference between what was planned or expected and what was actually accomplished. A standard cost system has at least two types of variances. The price variance focuses on the difference between standard and actual prices. The quantity variance is concerned with the difference between the standard quantity of input allowed for the actual output and the actual amount of the input used.

10-6 Under management by exception, managers focus their attention on operating results that deviate from expectations. It is assumed that results that meet expectations do not require investigation.

10-7 Separating an overall variance into a price variance and a quantity variance provides more information. Moreover, prices and quantities are usually the responsibilities of different managers.

10-8 The materials price variance is usually the responsibility of the purchasing manager. The materials quantity variance is usually the responsibility of the production managers and supervisors. The labor efficiency variance generally is also the responsibility of the production managers and supervisors.

10-9 The materials price variance can be computed either when materials are purchased or when they are placed into production. It is usually better to compute the variance when materials are purchased. This permits earlier recognition of the variance, since materials can lay in the warehouse for many months before being used in production. In addition, this allows the company to carry its raw materials in the inventory accounts at standard cost, which greatly simplifies bookkeeping.

10-10 This combination of variances may indicate that inferior quality materials are being purchased so as to economize on price, but that the materials create production problems due to poor quality.

10-11 If used as punitive tools, standards can breed resentment in an organization and undermine morale. Standards must never be used as an excuse to conduct witch-hunts, or as a means of finding someone to blame for problems.

10-12 Several factors other than the contractual rate paid to workers can cause a labor rate variance. For example, skilled workers with high hourly rates of pay can be given duties that require little skill and that call for low hourly rates of pay, resulting in an unfavorable rate variance. Or unskilled or untrained workers can be assigned to tasks that should be filled by more skilled workers with higher rates of pay, resulting in a favorable rate variance. Unfavorable rate variances can also arise from overtime work at premium rates.

10-13 Poor quality materials can unfavorably affect the labor efficiency variance. If the materials create production problems, a result could be excessive labor time and therefore an unfavorable labor efficiency variance. Poor quality materials would not ordinarily affect the labor rate variance.

10-14 The variable overhead efficiency variance and the direct labor efficiency variance will always be favorable or unfavorable together. Both are dependent on the number of direct labor-hours actually worked compared to the standard hours allowed. That is, in each case the formula is:

Efficiency Variance = SR(AH – SH)

Only the "SR" part of the formula differs for the two variances.

10-15 A control chart is a statistical method of isolating the variances that are truly abnormal from those that are within normal bounds. Upper and lower limits are set. Any variances falling between these limits are considered to be normal and due to chance causes. Any variances falling outside of these limits are considered exceptions and are investigated.

10-16 If labor is a fixed cost and standards are tight, then the only way to generate favorable labor efficiency variances is for every workstation to produce at capacity. However, the output of the entire system is limited by the capacity of the bottleneck. If workstations before the bottleneck in the production process produce at capacity, the bottleneck will be unable to process all of the work in process. In general, if every workstation is attempting to produce at capacity, then work in process inventory will build up in front of the workstations with the least capacity.

10-17 A company's balanced scorecard should be derived from and support its strategy. Since different companies have different strategies, their balanced scorecards should be different.

10-18 The balanced scorecard is constructed to support the company's strategy, which is a theory about what actions will further the company's goals. Assuming that the company has financial goals, measures of financial performance must be included in the balanced scorecard as a check on the reality of the theory. If the internal business processes improve, but the financial outcomes do not improve, the theory may be flawed and the strategy should be changed.

10-19 The difference between the delivery cycle time and the throughput time is the waiting period between when an order is received and when production on the order is started. The throughput time is made up of process time, inspection time, move time, and queue time. These four elements can be classified between value-added time (process time) and non-value-added time (inspection time, move time, and queue time).

10-20 If a company has an MCE of less than 1, it means the production process includes non-value-added time. An MCE of 0.40, for example, would mean that 40% of the throughput time consists of actual processing, and that the other 60% consists of moving, inspection, and other non-value-added activities.

10-21 Formal entry tends to give variances more emphasis than off-the-record computations. And, the use of standard costs in the journals simplifies the bookkeeping process through the elimination of troublesome variations in actual cost figures.

Exercise 10-1 (20 minutes)

1.

Cost per 2 kilogram container	6,000.00	Kr
Less: 2% cash discount	120.00	
Net cost	5,880.00	
Add freight cost per 2 kilogram container (1,000 Kr ÷ 10 containers)	100.00	
Total cost per 2 kilogram container (a)	5,980.00	Kr
Number of grams per container (2 kilograms × 1000 grams per kilogram) (b)	2,000	
Standard cost per gram purchased (a) ÷ (b)	2.99	Kr

2.

Alpha SR40 required per capsule as per bill of materials	6.00	grams
Add allowance for material rejected as unsuitable (6 grams ÷ 0.96 = 6.25 grams; 6.25 grams – 6.00 grams = 0.25 grams)	0.25	grams
Total	6.25	grams
Add allowance for rejected capsules (6.25 grams ÷ 25 capsules)	0.25	grams
Standard quantity of Alpha SR40 per salable capsule	6.50	grams

3.

Item	*Standard Quantity per Capsule*	*Standard Price per Gram*	*Standard Cost per Capsule*
Alpha SR40	6.50 grams	2.99 Kr	19.435 Kr

Exercise 10-2 (20 minutes)

1.

Number of chopping blocks	4,000
Number of board feet per chopping block	× 2.5
Standard board feet allowed	10,000
Standard cost per board foot	× $1.80
Total standard cost	$18,000
Actual cost incurred	$18,700
Standard cost above	18,000
Total variance—unfavorable	$ 700

2.

Actual Quantity of Inputs, at Actual Price (AQ × AP)	Actual Quantity of Inputs, at Standard Price (AQ × SP)	Standard Quantity Allowed for Output, at Standard Price (SQ × SP)
$18,700	11,000 board feet × $1.80 per board foot = $19,800	10,000 board feet × $1.80 per board foot = $18,000

Price Variance, $1,100 F	Quantity Variance, $1,800 U
Total Variance, $700 U	

Alternatively:

Materials Price Variance = AQ (AP – SP)
11,000 board feet ($1.70 per board foot* – $1.80 per board foot) = $1,100 F
*$18,700 ÷ 11,000 board feet = $1.70 per board foot.

Materials Quantity Variance = SP (AQ – SQ)
$1.80 per board foot (11,000 board feet – 10,000 board feet) = $1,800 U

Exercise 10-3 (30 minutes)

1. a. Notice in the solution below that the materials price variance is computed on the entire amount of materials purchased, whereas the materials quantity variance is computed only on the amount of materials used in production.

Actual Quantity of Inputs, at Actual Price (AQ × AP)	Actual Quantity of Inputs, at Standard Price (AQ × SP)	Standard Quantity Allowed for Output, at Standard Price (SQ × SP)
70,000 diodes × $0.28 per diode = $19,600	70,000 diodes × $0.30 per diode = $21,000	40,000 diodes* × $0.30 per diode = $12,000

Price Variance,
$1,400 F

50,000 diodes × $0.30 per diode
= $15,000

Quantity Variance,
$3,000 U

*5,000 toys × 8 diodes per toy = 40,000 diodes

Alternative Solution:

Materials Price Variance = AQ (AP – SP)
70,000 diodes ($0.28 per diode – $0.30 per diode) = $1,400 F

Materials Quantity Variance = SP (AQ – SQ)
$0.30 per diode (50,000 diodes – 40,000 diodes) = $3,000 U

Exercise 10-3 (continued)

b. Direct labor variances:

Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
\$48,000	6,400 hours × \$7 per hour = \$44,800	6,000 hours* × \$7 per hour = \$42,000

Rate Variance, \$3,200 U	Efficiency Variance, \$2,800 U
Total Variance, \$6,000 U	

*5,000 toys × 1.2 hours per toy = 6,000 hours

Alternative Solution:

Labor Rate Variance = AH (AR – SR)
6,400 hours (\$7.50* per hour – \$7.00 per hour) = \$3,200 U
*\$48,000 ÷ 6,400 hours = \$7.50 per hour

Labor Efficiency Variance = SR (AH – SH)
\$7 per hour (6,400 hours – 6,000 hours) = \$2,800 U

Exercise 10-3 (continued)

2. A variance usually has many possible explanations. In particular, we should always keep in mind that the standards themselves may be incorrect. Some of the other possible explanations for the variances observed at Topper Toys appear below:

   Materials Price Variance Since this variance is favorable, the actual price paid per unit for the material was less than the standard price. This could occur for a variety of reasons including the purchase of a lower grade material at a discount, buying in an unusually large quantity to take advantage of quantity discounts, a change in the market price of the material, and particularly sharp bargaining by the purchasing department.

   Materials Quantity Variance Since this variance is unfavorable, more materials were used to produce the actual output than were called for by the standard. This could also occur for a variety of reasons. Some of the possibilities include poorly trained or supervised workers, improperly adjusted machines, and defective materials.

   Labor Rate Variance Since this variance is unfavorable, the actual average wage rate was higher than the standard wage rate. Some of the possible explanations include an increase in wages that has not been reflected in the standards, unanticipated overtime, and a shift toward more highly paid workers.

   Labor Efficiency Variance Since this variance is unfavorable, the actual number of labor hours was greater than the standard labor hours allowed for the actual output. As with the other variances, this variance could have been caused by any of a number of factors. Some of the possible explanations include poor supervision, poorly trained workers, low quality materials requiring more labor time to process, and machine breakdowns. In addition, if the direct labor force is essentially fixed, an unfavorable labor efficiency variance could be caused by a reduction in output due to decreased demand for the company's products.

Exercise 10-4 (30 minutes)

1.

Number of units manufactured	20,000
Standard labor time per unit	× 0.4*
Total standard hours of labor time allowed	8,000
Standard direct labor rate per hour	× $6
Total standard direct labor cost	$48,000

*24 minutes ÷ 60 minutes per hour = 0.4 hour

Actual direct labor cost	$49,300
Standard direct labor cost	48,000
Total variance—unfavorable	$ 1,300

2.

Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
$49,300	8,500 hours × $6 per hour = $51,000	8,000 hours* × $6 per hour = $48,000

Rate Variance, $1,700 F

Efficiency Variance, $3,000 U

Total Variance, $1,300 U

*20,000 units × 0.4 hour per unit = 8,000 hours

Alternative Solution:

Labor Rate Variance = AH (AR – SR)
8,500 hours ($5.80 per hour* – $6.00 per hour) = $1,700 F
*$49,300 ÷ 8,500 hours = $5.80 per hour

Labor Efficiency Variance = SR (AH – SH)
$6 per hour (8,500 hours – 8,000 hours) = $3,000 U

Exercise 10-4 (continued)

3.

Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
$39,100	8,500 hours × $4 per hour = $34,000	8,000 hours × $4 per hour = $32,000

Spending Variance, $5,100 U

Efficiency Variance, $2,000 U

Total Variance, $7,100 U

Alternative Solution:

Variable Overhead Spending Variance = AH (AR – SR)
8,500 hours ($4.60 per hour* – $4.00 per hour) = $5,100 U
*$39,100 ÷ 8,500 hours = $4.60 per hour

Variable Overhead Efficiency Variance = SR (AH – SH)
$4 per hour (8,500 hours – 8,000 hours) = $2,000 U

Exercise 10-5 (20 minutes)

1.

Actual Quantity of Inputs, at Actual Price (AQ × AP)	Actual Quantity of Inputs, at Standard Price (AQ × SP)	Standard Quantity Allowed for Output, at Standard Price (SQ × SP)
20,000 ounces × $2.40 per ounce = $48,000	20,000 ounces × $2.50 per ounce = $50,000	18,000 ounces* × $2.50 per ounce = $45,000

Price Variance, $2,000 F	Quantity Variance, $5,000 U
Total Variance, $3,000 U	

*2,500 units × 7.2 ounces per unit = 18,000 ounces

Alternatively:

Materials Price Variance = AQ (AP – SP)
20,000 ounces ($2.40 per ounce – $2.50 per ounce) = $2,000 F

Materials Quantity Variance = SP (AQ – SQ)
$2.50 per ounce (20,000 ounces – 18,000 ounces) = $5,000 U

Exercise 10-5 (continued)

2.

Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
\$10,800	900 hours × \$10 per hour = \$9,000	1,000 hours* × \$10 per hour = \$10,000

Rate Variance, \$1,800 U	Efficiency Variance, \$1,000 F
Total Variance, \$800 U	

*2,500 units × 0.4 hour per unit = 1,000 hours

Alternatively:

Labor Rate Variance = AH (AR – SR)
900 hours (\$12 per hour* – \$10 per hour) = \$1,800 U
*10,800 ÷ 900 hours = \$12 per hour

Labor Efficiency Variance = SR (AH – SH)
\$10 per hour (900 hours – 1,000 hours) = 1,000 F

Exercise 10-6 (15 minutes)

Notice in the solution below that the materials price variance is computed on the entire amount of materials purchased, whereas the materials quantity variance is computed only on the amount of materials used in production.

Actual Quantity of Inputs, at Actual Price (AQ × AP)	Actual Quantity of Inputs, at Standard Price (AQ × SP)	Standard Quantity Allowed for Output, at Standard Price (SQ × SP)
20,000 ounces × $2.40 per ounce = $48,000	20,000 ounces▪ × $2.50 per ounce = $50,000	14,400 ounces* × $2.50 per ounce = $36,000

Price Variance,
$2,000 F

16,000 ounces × $2.50 per ounce
= $40,000

Quantity Variance,
$4,000 U

*2,000 bottles▪ × 7.2 ounces per bottle = 14,400 ounces

Alternatively:

Materials Price Variance = AQ (AP – SP)
20,000 ounces ($2.40 per ounce – $2.50 per ounce) = $2,000 F

Materials Quantity Variance = SP (AQ – SQ)
$2.50 per ounce (16,000 ounces – 14,400 ounces) = $4,000 U

Exercise 10-7 (20 minutes)

1. If the total variance is \$330 unfavorable, and if the rate variance is \$150 favorable, then the efficiency variance must be \$480 unfavorable, since the rate and efficiency variances taken together always equal the total variance.

   Knowing that the efficiency variance is \$480 unfavorable, one approach to the solution would be:

   Efficiency Variance = SR (AH – SH)
   \$6 per hour (AH – 420 hours*) = \$480 U
   \$6 per hour × AH – \$2,520 = \$480**
   \$6 per hour × AH = \$3,000
   AH = 500 hours

   * 168 batches × 2.5 hours per batch = 420 hours
   ** When used with the formula, unfavorable variances are positive and favorable variances are negative.

2. Knowing that 500 hours of labor time were used during the week, the actual rate of pay per hour can be computed as follows:

   Rate Variance = AH (AR – SR)
   500 hours (AR – \$6 per hour) = \$150 F
   500 hours × AR – \$3,000 = -\$150*
   500 hours × AR = \$2,850
   AR = \$5.70 per hour

   * When used with the formula, unfavorable variances are positive and favorable variances are negative.

Exercise 10-7 (continued)

An alternative approach to each solution would be to work from known to unknown data in the columnar model for variance analysis:

Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
500 hours × $5.70 per hour = $2,850	500 hours × $6 per hour* = $3,000	420 hours[§] × $6 per hour* = $2,520

Rate Variance, $150 F*

Efficiency Variance, $480 U

Total Variance, $330 U*

[§]168 batches × 2.5 hours per batch = 420 hours
*Given

Exercise 10-8 (20 minutes)

1. Throughput time = Process time + Inspection time + Move time + Queue time
   = 2.8 days + 0.5 days + 0.7 days + 4.0 days
   = 8.0 days

2. Only process time is value-added time; therefore the manufacturing cycle efficiency (MCE) is:

$$\text{MCE}=\frac{\text{Value-added time}}{\text{Throughput time}}=\frac{2.8\text{ days}}{8.0\text{ days}}=0.35$$

3. If the MCE is 35%, then the complement of this figure, or 65% of the time, was spent in non-value-added activities.

4. Delivery cycle time = Wait time + Throughput time
   = 16.0 days + 8.0 days
   = 24.0 days

5. If all queue time in production is eliminated, then the throughput time drops to only 4 days (0.5 + 2.8 + 0.7). The MCE becomes:

$$\text{MCE}=\frac{\text{Value-added time}}{\text{Throughput time}}=\frac{2.8\text{ days}}{4.0\text{ days}}=0.70$$

   Thus, the MCE increases to 70%. This exercise shows quite dramatically how the JIT approach can improve operations and reduce throughput time.

Exercise 10-9 (45 minutes)

1. a.

Actual Quantity of Inputs, at Actual Price (AQ × AP)	Actual Quantity of Inputs, at Standard Price (AQ × SP)	Standard Quantity Allowed for Output, at Standard Price (SQ × SP)
7,000 feet × $5.75 per foot = $40,250	7,000 feet × $6.00 per foot = $42,000	5,250 feet* × $6.00 per foot = $31,500

Price Variance,
$1,750 F

6,000 feet × $6.00 per foot
= $36,000

Quantity Variance,
$4,500 U

*1,500 units × 3.5 feet per unit = 5,250 feet

Alternatively:

Materials Price Variance = AQ (AP – SP)
7,000 feet ($5.75 per foot – $6.00 per foot) = $1,750 F

Materials Quantity Variance = SP (AQ – SQ)
$6.00 per foot (6,000 feet – 5,250 feet) = $4,500 U

Exercise 10-9 (continued)

b. The journal entries would be:

Raw Materials (7,000 feet × \$6 per foot)	42,000	
Materials Price Variance (7,000 feet × \$0.25 F per foot)		1,750
Accounts Payable (7,000 feet × \$5.75 per foot)		40,250
Work in Process (5,250 feet × \$6 per foot)	31,500	
Materials Quantity Variance (750 feet U × \$6 per foot)	4,500	
Raw Materials (6,000 feet × \$6 per foot)		36,000

2. a.

Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
\$8,120	725 hours × \$10 per hour = \$7,250	600 hours* × \$10 per hour = \$6,000

Rate Variance, \$870 U

Efficiency Variance, \$1,250 U

Total Variance, \$2,120 U

*1,500 units × 0.4 hour per unit = 600 hours

Alternatively:

Labor Rate Variance = AH (AR – SR)
725 hours (\$11.20 per hour* – \$10.00 per hour) = \$870 U
*\$8,120 ÷ 725 hours = \$11.20 per hour

Labor Efficiency Variance = SR (AH – SH)
\$10 per hour (725 hours – 600 hours) = \$1,250 U

Exercise 10-9 (continued)

b. The journal entry would be:

Work in Process (600 hours × \$10 per hour)	6,000	
Labor Rate Variance		
(725 hours × \$1.20 U per hour)	870	
Labor Efficiency Variance		
(125 U hours × \$10 per hour)	1,250	
Wages Payable (725 hours × \$11.20 per hour)		8,120

3. The entries are: (a) purchase of materials; (b) issue of materials to production; and (c) incurrence of direct labor cost.

Raw Materials

(a)	42,000	36,000	(b)
Bal.	6,000[1]		

Accounts Payable

		40,250	(a)

Materials Price Variance

		1,750	(a)

Wages Payable

		8,120	(c)

Materials Quantity Variance

(b)	4,500		

Labor Rate Variance

(c)	870		

Work in Process

(b)	31,500[2]		
(c)	6,000[3]		

Labor Efficiency Variance

(c)	1,250		

[1]1,000 feet of material at a standard cost of \$6.00 per foot
[2]Materials used
[3]Labor cost

Problem 10-10 (45 minutes)

1. a. In the solution below, the materials price variance is computed on the entire amount of materials purchased, whereas the materials quantity variance is computed only on the amount of materials used in production:

Actual Quantity of Inputs, at Actual Price (AQ × AP)	Actual Quantity of Inputs, at Standard Price (AQ × SP)	Standard Quantity Allowed for Output, at Standard Price (SQ × SP)
\$46,000	8,000 pounds × \$6.00 per pound = \$48,000	4,500 pounds* × \$6.00 per pound = \$27,000

Price Variance,
\$2,000 F

6,000 pounds × \$6.00 per pound
= \$36,000

Quantity Variance,
\$9,000 U

*3,000 units × 1.5 pounds per unit = 4,500 pounds

Alternatively:

Materials Price Variance = AQ (AP – SP)
8,000 pounds (\$5.75 per pound* – \$6.00 per pound) = \$2,000 F
*\$46,000 ÷ 8,000 pounds = \$5.75 per pound

Materials Quantity Variance = SP (AQ – SQ)
\$6 per pound (6,000 pounds – 4,500 pounds) = \$9,000 U

Problem 10-10 (continued)

b. No, the contract should probably not be signed. Although the new supplier is offering the materials at only $5.75 per pound, the materials do not seem to hold up well in production as shown by the large materials quantity variance. Moreover, the company still has 2,000 pounds of the material in the warehouse unused; if these materials do as poorly in production as the 6,000 pounds already used, the total quantity variance on the 8,000 pounds of materials purchased will be very large indeed.

Problem 10-10 (continued)

2. a.

Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
1,600 hours* × $12.50 per hour = $20,000	1,600 hours × $12.00 per hour = $19,200	1,800 hours** × $12.00 per hour = $21,600

Rate Variance, $800 U	Efficiency Variance, $2,400 F

Total Variance, $1,600 F

* 10 workers × 160 hours per worker = 1,600 hours
** 3,000 units × 0.6 hours per unit = 1,800 hours

Alternatively:

Labor Rate Variance = AH (AR – SR)
1,600 hours ($12.50 per hour – $12.00 per hour) = $800 U

Labor Efficiency Variance = SR (AH – SH)
$12.00 per hour (1,600 hours – 1,800 hours) = $2,400 F

b. Yes, the new labor mix should probably be continued. Although it increases the average hourly labor cost from $12.00 to $12.50, thereby causing an $800 unfavorable labor rate variance, this is more than offset by greater efficiency of labor time. Notice that the labor efficiency variance is $2,400 favorable. Thus, the new labor mix reduces overall labor costs.

Problem 10-10 (continued)

3.

Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
\$3,600	1,600 hours × \$2.50 per hour = \$4,000	1,800 hours × \$2.50 per hour = \$4,500

Spending Variance, \$400 F	Efficiency Variance, \$500 F
Total Variance, \$900 F	

Alternatively:

Variable Overhead Spending Variance = AH (AR – SR)
1,600 hours (\$2.25 per hour* – \$2.50 per hour) = \$400 F
*\$3,600 ÷ 1,600 hours = \$2.25 per hour

Variable Overhead Efficiency Variance = SR (AH – SH)
\$2.50 per hour (1,600 hours – 1,800 hours) = \$500 F

Both the labor efficiency variance and the variable overhead efficiency variance are computed by comparing actual labor-hours to standard labor-hours. Thus, if the labor efficiency variance is favorable, then the variable overhead efficiency variance will be favorable as well.

Problem 10-11 (45 minutes)

1. The standard quantity of plates allowed for tests performed during the month would be:

Smears	2,700
Blood tests	900
Total	3,600
Plates per test	× 3
Standard quantity allowed	10,800

The variance analysis for plates would be:

Actual Quantity of Inputs, at Actual Price (AQ × AP)	Actual Quantity of Inputs, at Standard Price (AQ × SP)	Standard Quantity Allowed for Output, at Standard Price (SQ × SP)
$38,400	16,000 plates × $2.50 per plate = $40,000	10,800 plates × $2.50 per plate = $27,000

Price Variance,
$1,600 F

14,000 plates × $2.50 per plate
= $35,000

Quantity Variance,
$8,000 U

Alternative Solution:

Materials Price Variance = AQ (AP – SP)
16,000 plates ($2.40 per plate* – $2.50 per plate) = $1,600 F
*$38,400 ÷ 16,000 plates = $2.40 per plate.

Materials Quantity Variance = SP (AQ – SQ)
$2.50 per plate (14,000 plates – 10,800 plates) = $8,000 U

Problem 10-11 (continued)

Note that all of the price variance is due to the hospital's 4% quantity discount. Also note that the $8,000 quantity variance for the month is equal to nearly 30% of the standard cost allowed for plates. This variance may be the result of using too many assistants in the lab.

2. a. The standard hours allowed for tests performed during the month would be:

Smears: 0.3 hour per test × 2,700 tests	810
Blood tests: 0.6 hour per test × 900 tests....	540
Total standard hours allowed.......................	1,350

The variance analysis of labor would be:

Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
$18,450	1,800 hours × $12 per hour = $21,600	1,350 hours × $12 per hour = $16,200

Rate Variance, $3,150 F

Efficiency Variance, $5,400 U

Total Variance, $2,250 U

Alternative Solution:

Labor Rate Variance = AH (AR – SR)
1,800 hours ($10.25 per hour* – $12.00 per hour) = $3,150 F
*$18,450 ÷ 1,800 hours = $10.25 per hour

Labor Efficiency Variance = SR (AH – SH)
$12 per hour (1,800 hours – 1,350 hours) = $5,400 U

Problem 10-11 (continued)

b. The policy probably should not be continued. Although the hospital is saving $1.75 per hour by employing more assistants relative to the number of senior technicians than other hospitals, this savings is more than offset by other factors. Too much time is being taken in performing lab tests, as indicated by the large unfavorable labor efficiency variance. And, it seems likely that most (or all) of the hospital's unfavorable quantity variance for plates is traceable to inadequate supervision of assistants in the lab.

3. The variable overhead variances follow:

Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
$11,700	1,800 hours × $6 per hour = $10,800	1,350 hours × $6 per hour = $8,100

Spending Variance, $900 U	Efficiency Variance, $2,700 U
Total Variance, $3,600 U	

Alternative Solution:

Variable Overhead Spending Variance = AH (AR – SR)
1,800 hours ($6.50 per hour* – $6.00 per hour) = $900 U
*$11,700 ÷ 1,800 hours = $6.50 per hour

Variable Overhead Efficiency Variance = SR (AH – SH)
$6 per hour (1,800 hours – 1,350 hours) = $2,700 U

Yes, the two variances are related. Both are computed by comparing actual labor time to the standard hours allowed for the output of the period. Thus, if there is an unfavorable labor efficiency variance, there will also be an unfavorable variable overhead efficiency variance.

Problem 10-12 (60 minutes)

1. a.

Actual Quantity of Inputs, at Actual Price (AQ × AP)	Actual Quantity of Inputs, at Standard Price (AQ × SP)	Standard Quantity Allowed for Output, at Standard Price (SQ × SP)
21,120 yards × $3.35 per yard = $70,752	21,120 yards × $3.60 per yard = $76,032	19,200 yards* × $3.60 per yard = $69,120

Price Variance, $5,280 F	Quantity Variance, $6,912 U
Total Variance, $1,632 U	

*4,800 units × 4.0 yards per unit = 19,200 yards

Alternatively:

Materials Price Variance = AQ (AP – SP)
21,120 yards ($3.35 per yard – $3.60 per yard) = $5,280 F

Materials Quantity Variance = SP (AQ – SQ)
$3.60 per yard (21,120 yards – 19,200 yards) = $6,912 U

b.

Raw Materials (21,120 yards @ $3.60 per yard)	76,032	
Materials Price Variance (21,120 yards @ $0.25 per yard F)		5,280
Accounts Payable (21,120 yards @ $3.35 per yard)		70,752

Work in Process (19,200 yards @ $3.60 per yard)	69,120	
Materials Quantity Variance (1,920 yards U @ $3.60 per yard)	6,912	
Raw Materials (21,120 yards @ $3.60 per yard) ...		76,032

Problem 10-12 (continued)

2. a.

Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
6,720 hours* × $4.85 per hour = $32,592	6,720 hours × $4.50 per hour = $30,240	7,680 hours** × $4.50 per hour = $34,560

Rate Variance, $2,352 U

Efficiency Variance, $4,320 F

Total Variance, $1,968 F

*4,800 units × 1.4 hours per unit = 6,720 hours
**4,800 units × 1.6 hours per unit = 7,680 hours

Alternatively:

Labor Rate Variance = AH (AR – SR)
6,720 hours ($4.85 per hour – $4.50 per hour) = $2,352 U

Labor Efficiency Variance = SR (AH – SH)
$4.50 per hour (6,720 hours – 7,680 hours) = $4,320 F

b.

Work in Process (7,680 hours @ $4.50 per hour).......	34,560	
Labor Rate Variance (6,720 hours @ $0.35 per hour U).........................	2,352	
Labor Efficiency Variance (960 hours F @ $4.50 per hour).......................		4,320
Wages Payable (6,720 hours @ $4.85 per hour)...		32,592

Problem 10-12 (continued)

3.

Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
6,720 hours × $2.15 per hour = $14,448	6,720 hours × $1.80 per hour = $12,096	7,680 hours × $1.80 per hour = $13,824

Spending Variance, $2,352 U

Efficiency Variance, $1,728 F

Total Variance, $624 U

Alternatively:

Variable Overhead Spending Variance = AH (AR – SR)
6,720 hours ($2.15 per hour – $1.80 per hour) = $2,352 U

Variable Overhead Efficiency Variance = SR (AH – SH)
$1.80 per hour (6,720 hours – 7,680 hours) = $1,728 F

4. No. This total variance is made up of several quite large individual variances, some of which may warrant investigation. A summary of variances is given below:

Materials:		
Price variance	$5,280 F	
Quantity variance	6,912 U	$1,632 U
Labor:		
Rate variance	2,352 U	
Efficiency variance	4,320 F	1,968 F
Variable overhead:		
Spending variance	2,352 U	
Efficiency variance	1,728 F	624 U
Net unfavorable variance		$ 288 U

Problem 10-12 (continued)

5. The variances have many possible causes. Some of the more likely causes include:

   Materials variances:

   Favorable price variance: Fortunate buy, inaccurate standards, inferior quality materials, unusual discount due to quantity purchased, drop in market price.

   Unfavorable quantity variance: Carelessness, poorly adjusted machines, unskilled workers, inferior quality materials, inaccurate standards.

   Labor variances:

   Unfavorable rate variance: Use of highly skilled workers, change in wage rates, inaccurate standards, overtime.

   Favorable efficiency variance: Use of highly skilled workers, high quality materials, new equipment, inaccurate standards.

   Variable overhead variances:

   Unfavorable spending variance: Increase in costs, inaccurate standards, waste, theft, spillage, purchases in uneconomical lots.

   Favorable efficiency variance: Same as for labor efficiency variance.

Problem 10-13 (45 minutes)

1. a.

Actual Quantity of Inputs, at Actual Price (AQ × AP)	Actual Quantity of Inputs, at Standard Price (AQ × SP)	Standard Quantity Allowed for Output, at Standard Price (SQ × SP)
25,000 pounds × $2.95 per pound = $73,750	25,000 pounds × $2.50 per pound = $62,500	20,000 pounds* × $2.50 per pound = $50,000

Price Variance, $11,250 U

19,800 pounds × $2.50 per pound = $49,500

Quantity Variance, $500 F

*5,000 ingots × 4.0 pounds per ingot = 20,000 pounds

Alternatively:

Materials Price Variance = AQ (AP – SP)
25,000 pounds ($2.95 per pound – $2.50 per pound) = $11,250 U

Materials Quantity Variance = SP (AQ – SQ)
$2.50 per pound (19,800 pounds – 20,000 pounds) = $500 F

Problem 10-13 (continued)

b.

Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
3,600 hours × $8.70 per hour = $31,320	3,600 hours × $9.00 per hour = $32,400	3,000 hours* × $9.00 per hour = $27,000

Rate Variance, $1,080 F	Efficiency Variance, $5,400 U
Total Variance, $4,320 U	

*5,000 ingots × 0.6 hour per ingot = 3,000 hours

Alternatively:

Labor Rate Variance = AH (AR – SR)
3,600 hours ($8.70 per hour – $9.00 per hour) = $1,080 F

Labor Efficiency Variance = SR (AH – SH)
$9.00 per hour (3,600 hours – 3,000 hours) = $5,400 U

Problem 10-13 (continued)

c.

Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
\$4,320	1,800 hours × \$2.00 per hour = \$3,600	1,500 hours* × \$2.00 per hour = \$3,000

Spending Variance, \$720 U | Efficiency Variance, \$600 U

Total Variance, \$1,320 U

*5,000 ingots × 0.3 hours per ingot = 1,500 hours

Alternatively:

Variable Overhead Spending Variance = AH (AR – SR)
1,800 hours (\$2.40 per hour* – \$2.00 per hour) = \$720 U
*\$4,320 ÷ 1,800 hours = \$2.40 per hour

Variable Overhead Efficiency Variance = SR (AH – SH)
\$2.00 per hour (1,800 hours – 1,500 hours) = \$600 U

Problem 10-13 (continued)

2. Summary of variances:

Material price variance	$11,250	U
Material quantity variance	500	F
Labor rate variance	1,080	F
Labor efficiency variance	5,400	U
Variable overhead spending variance	720	U
Variable overhead efficiency variance	600	U
Net variance	$16,390	U

The net unfavorable variance of $16,390 for the month caused the plant's variable cost of goods sold to increase from the budgeted level of $80,000 to $96,390:

Budgeted cost of goods sold at $16 per ingot	$80,000
Add the net unfavorable variance (as above)	16,390
Actual cost of goods sold	$96,390

This $16,390 net unfavorable variance also accounts for the difference between the budgeted net operating income and the actual net loss for the month.

Budgeted net operating income	$15,000
Deduct the net unfavorable variance added to cost of goods sold for the month	16,390
Net operating loss	$(1,390)

3. The two most significant variances are the materials price variance and the labor efficiency variance. Possible causes of the variances include:

Materials Price Variance:	Outdated standards, uneconomical quantity purchased, higher quality materials, high-cost method of transport.
Labor Efficiency Variance:	Poorly trained workers, poor quality materials, faulty equipment, work interruptions, inaccurate standards, insufficient demand.

Problem 10-14 (30 minutes)

1. a., b., and c.

	Month 1	Month 2	Month 3	Month 4
Throughput time in days:				
Process time	0.6	0.5	0.5	0.4
Inspection time	0.7	0.7	0.4	0.3
Move time	0.5	0.5	0.4	0.5
Queue time	3.6	3.6	2.6	1.7
Total throughput time	5.4	5.3	3.9	2.9
Manufacturing cycle efficiency (MCE):				
Process time ÷ Throughput time	11.1%	9.4%	12.8%	13.8%
Delivery cycle time in days:				
Wait time	9.6	8.7	5.3	4.7
Total throughput time	5.4	5.3	3.9	2.9
Total delivery cycle time	15.0	14.0	9.2	7.6

2. The general trend is favorable in all of the performance measures except for total sales. On-time delivery is up, process time is down, inspection time is down, move time is basically unchanged, queue time is down, manufacturing cycle efficiency is up, and the delivery cycle time is down. Even though the company has improved its operations, it has not yet increased its sales. This may have happened because management attention has been focused on the factory—working to improve operations. However, it may be time now to exploit these improvements to go after more sales—perhaps by increased product promotion and better marketing strategies. It will ultimately be necessary to increase sales so as to translate the operational improvements into more profits.

Problem 10-14 (continued)

3. a. and b.

	Month	
	5	*6*
Throughput time in days:		
Process time	0.4	0.4
Inspection time	0.3	
Move time	0.5	0.5
Queue time	__	__
Total throughput time	1.2	0.9
Manufacturing cycle efficiency (MCE):		
Process time ÷ Throughput time	33.3%	44.4%

As a company pares away non-value-added activities, the manufacturing cycle efficiency improves. The goal, of course, is to have an efficiency of 100%. This will be achieved when all non-value-added activities have been eliminated and process time equals throughput time.

Problem 10-15 (20 minutes)

1. Lanolin quantity standard:

Required per 100-liter batch	100 liters
Loss from rejected batches (100 liters × 1/20)	5 liters
Total quantity per good batch	105 liters

Alcohol quantity standard:

Required per 100-liter batch	8.0 liters
Loss from rejected batches (8 liters × 1/20)	0.4 liters
Total quantity per good batch	8.4 liters

Lilac powder quantity standard:

Required per 100-liter batch	200 grams
Loss from rejected batches (200 grams × 1/20)	10 grams
Total quantity per good batch	210 grams

2. Direct labor quantity standard:

Total hours per day	8 hours
Less lunch, rest breaks, and cleanup	2 hours
Productive time each day	6 hours

$$\frac{\text{Productive time each day}}{\text{Time required per batch}} = \frac{\text{6 hours per day}}{\text{2 hours per batch}} = \text{3 batches per day}$$

Time required per batch	120 minutes
Lunch, rest breaks, and cleanup (120 minutes ÷ 3 batches)	40 minutes
Total	160 minutes
Loss from rejected batches (160 minutes × 1/20)	8 minutes
Total time per good batch	168 minutes

Problem 10-15 (continued)

3. Standard cost card:

	Standard Quantity or Time per Batch	*Standard Price or Rate*	*Standard Cost per Batch*
Lanolin	105 liters	€16 per liter	€1,680.00
Alcohol	8.4 liters	€2 per liter	16.80
Lilac powder	210 grams	€1 per gram	210.00
Direct labor	168 minutes	€0.20 per minute	33.60
Total standard cost per good batch			€1,940.40

Problem 10-16 (45 minutes)

1. Actual cost of materials	$66,500
Standard cost of materials (AQ × SP):	
95,000 yards × $0.65 per yard	61,750
Price variance, unfavorable	$ 4,750

2. a. and b.

	Lot Number			
	30	*31*	*32*	*Total*
Standard yards:				
Units in lot (dozen)	1,000	1,700	1,200	3,900
Standard yards per dozen	× 24	× 24	× 24	× 24
Total standard yards	24,000	40,800	28,800	93,600
Actual yards used	24,100	40,440	28,825	93,365
Quantity variance in yards	100	(360)	25	(235)
Quantity variance in dollars @ $0.65 per yard	$65.00	$(234.00)	$16.25	$(152.75)

( ) Denotes favorable variance.

3. Actual cost of direct labor	$80,740
Standard cost of labor (AH × SR):	
11,000 hours* × $7.25 per hour	79,750
Labor rate variance, unfavorable	$ 990

*2,980 hours + 5,130 hours + 2,890 hours = 11,000 hours

Problem 10-16 (continued)

4. a. and b.

	Lot Number			
	30	*31*	*32*	*Total*
Standard hours:				
Units in lot (dozen)	1,000	1,700	1,200	3,900
Standard hours per dozen	× 3	× 3	× 3	× 3
Total	3,000	5,100	3,600	11,700
Percentage completed	× 100	× 100	× 80	—
Total standard hours	3,000	5,100	2,880	10,980
Actual hours worked	2,980	5,130	2,890	11,000
Labor efficiency variance in hours	(20)	30	10	20
Labor efficiency variance in dollars @ $7.25 per hour	$(145.00)	$217.50	$72.50	$145.00

( ) Denotes favorable variance.

5. Some supervisors and managers rarely deal with, or think in terms of, dollars in their day-to-day work. Instead they think in terms of hours, units, efficiency, and so on. For these managers, it may be better to express quantity variances in units (hours, yards, etc.) rather than in dollars. For other managers, quantity variances expressed in terms of dollars may be more useful. In some cases, managers may prefer that the variances be expressed in terms of both dollars and units.

   On the other hand, price variances expressed in units (hours, yards) would make little sense. Such variances should always be expressed in dollars to be most useful.

Problem 10-17 (30 minutes)

1. a. Materials Price Variance = AQ (AP – SP)
   6,000 pounds (\$2.75 per pound* – SP) = \$1,500 F**
   \$16,500 – 6,000 pounds × SP = \$1,500***
   6,000 pounds × SP = \$18,000
   SP = \$3 per pound

   *\$16,500 ÷ 6,000 pounds = \$2.75 per pound
   **\$1,200 U + ? = \$300 F; \$1,200 U + \$1,500 F = \$300 F.
   ***When used with the formula, unfavorable variances are positive and favorable variances are negative.

   b. Materials Quantity Variance = SP (AQ – SQ)
   \$3 per pound (6,000 pounds – SQ) = \$1,200 U
   \$18,000 – \$3 per pound × SQ = \$1,200*
   \$3 per pound × SQ = \$16,800
   SQ = 5,600 pounds

   *When used with the formula, unfavorable variances are positive and favorable variances are negative.

   Alternative approach to parts (a) and (b):

Actual Quantity of Inputs, at Actual Price (AQ × AP)	Actual Quantity of Inputs, at Standard Price (AQ × SP)	Standard Quantity Allowed for Output, at Standard Price (SQ × SP)
\$16,500*	6,000 pounds* × \$3 per pound = \$18,000	5,600 pounds × \$3 per pound = \$16,800

Price Variance, \$1,500 F

Quantity Variance, \$1,200 U*

Total Variance, \$300 F*

*Given.

   c. 5,600 pounds ÷ 1,400 units = 4 pounds per unit.

Problem 10-17 (continued)

2. a. Labor Efficiency Variance = SR (AH – SH)
$9 per hour (AH – 3,500 hours*) = $4,500 F
$9 per hour × AH – $31,500 = –$4,500**
$9 per hour × AH = $27,000
AH = 3,000 hours

*1,400 units × 2.5 hours per unit = 3,500 hours
**When used with the formula, unfavorable variances are positive and favorable variances are negative.

b. Labor Rate Variance = AH (AR – SR)
3,000 hours ($9.50 per hour* – $9.00 per hour) = $1,500 U

Alternative approach to parts (a) and (b):

Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
3,000 hours × $9.50 per hour* = $28,500*	3,000 hours × $9.00 per hour** = $27,000	3,500 hours*** × $9.00 per hour** = $31,500

Rate Variance, $1,500 U	Efficiency Variance, $4,500 F*
Total Variance, $3,000 F	

* $28,500 total labor cost ÷ 3,000 hours = $9.50 per hour
** Given
*** 1,400 units × 2.5 hours per unit = 3,500 hours

Problem 10-18 (60 minutes)

1. Total standard cost for units produced during August:

500 kits × $42 per kit	$21,000
Less standard cost of labor and overhead:	
Direct labor	(8,000)
Variable manufacturing overhead	(1,600)
Standard cost of materials used during August	$11,400

2.

Standard cost of materials used during August (a)	$11,400
Number of units produced (b)	500
Standard materials cost per kit (a) ÷ (b)	$ 22.80

$$\frac{\text{Standard materials cost per kit}}{\text{Standard materials cost per yard}} = \frac{\$22.80 \text{ per kit}}{\$6 \text{ per yard}} = 3.8 \text{ yards per kit}$$

3.

Actual cost of material used	$10,000
Standard cost of material used	11,400
Total variance	$ 1,400 F

The price and quantity variances together equal the total variance. If the quantity variance is $600 U, then the price variance must be $2,000F:

Price variance	$ 2,000 F
Quantity variance	600 U
Total variance	$ 1,400 F

Problem 10-18 (continued)

Alternative Solution:

Actual Quantity of Inputs, at Actual Price (AQ × AP)	Actual Quantity of Inputs, at Standard Price (AQ × SP)	Standard Quantity Allowed for Output, at Standard Price (SQ × SP)
2,000 yards × $5 per yard = $10,000*	2,000 yards × $6 per yard* = $12,000	1,900 yards** × $6 per yard* = $11,400

Price Variance, $2,000 F	Quantity Variance, $600 U*
Total Variance, $1,400 F	

*Given.
**500 kits × 3.8 yards per kit = 1,900 yards

4. The first step in computing the standard direct labor rate is to determine the standard direct labor-hours allowed for the month's production. The standard direct labor-hours can be computed by working with the variable manufacturing overhead cost figures, since they are based on direct labor-hours worked:

Standard manufacturing variable overhead cost for August (a)	$1,600
Standard manufacturing variable overhead rate per direct labor-hour (b)	$2
Standard direct labor-hours for the month (a) ÷ (b)	800

$$\frac{\text{Total standard labor cost for the month}}{\text{Total standard direct labor-hours for the month}} = \frac{\$8,000}{800 \text{ DLHs}}$$

$$= \$10 \text{ per DLH}$$

Problem 10-18 (continued)

5. Before the labor variances can be computed, it is necessary to compute the actual direct labor cost for the month:

Actual cost per kit produced ($42.00 + $0.14)		$ 42.14
Number of kits produced		× 500
Total actual cost of production		$21,070
Less: Actual cost of materials	$10,000	
Actual cost of manufacturing variable overhead	1,620	11,620
Actual cost of direct labor		$ 9,450

With this information, the variances can be computed:

Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
$9,450	900 hours* × $10 per hour = $9,000	$8,000*

Rate Variance, $450 U

Efficiency Variance, $1,000 U

Total Variance, $1,450 U

*Given.

Problem 10-18 (continued)

6.

Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
$1,620*	900 hours* × $2 per hour* = $1,800	$1,600*

Spending Variance, $180 F

Efficiency Variance, $200 U

Total Variance, $20 U

*Given.

7.

	Standard Quantity or Hours per Kit	*Standard Price or Rate*	*Standard Cost per Kit*
Direct materials....................	3.8 yards[1]	$ 6 per yard	$22.80
Direct labor..........................	1.6 hours[2]	$10 per hour[3]	16.00
Variable manufacturing overhead..........................	1.6 hours	$ 2 per hour	3.20
Total standard cost per kit.....			$42.00

[1]From part 2.
[2]800 hours (from part 4) ÷ 500 kits = 1.6 hours per kit.
[3]From part 4.

Problem 10-19 (60 minutes)

1. a.

Actual Quantity of Inputs, at Actual Price (AQ × AP)	Actual Quantity of Inputs, at Standard Price (AQ × SP)	Standard Quantity Allowed for Output, at Standard Price (SQ × SP)
60,000 feet × $0.95 per foot = $57,000	60,000 feet × $1.00 per foot = $60,000	36,000 feet* × $1.00 per foot = $36,000

Price Variance, $3,000 F

38,000 feet × $1.00 per foot = $38,000

Quantity Variance, $2,000 U

*6,000 units × 6.0 feet per unit = 36,000 feet

Alternative approach:

Materials Price Variance = AQ (AP – SP)
60,000 feet ($0.95 per foot – $1.00 per foot) = $3,000 F

Materials Quantity Variance = SP (AQ – SQ)
$1.00 per foot (38,000 feet – 36,000 feet) = $2,000 U

b.

Raw Materials (60,000 feet @ $1.00 per foot).........	60,000	
Materials Price Variance (60,000 feet @ $0.05 per foot F)....................		3,000
Accounts Payable (60,000 feet @ $0.95 per foot).......................		57,000
Work in Process (36,000 feet @ $1.00 per foot)......	36,000	
Materials Quantity Variance (2,000 feet U @ $1.00 per foot)	2,000	
Raw Materials (38,000 feet @ $1.00 per foot)....		38,000

Problem 10-19 (continued)

2. a.

Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
$27,950	6,500 hours* × $4.50 per hour = $29,250	6,000 hours** × $4.50 per hour = $27,000

Rate Variance, $1,300 F

Efficiency Variance, $2,250 U

Total Variance, $950 U

*The actual hours worked during the period can be computed through the variable overhead efficiency variance, as follows:

SR (AH – SH) = Efficiency Variance
$3 per hour (AH – 6,000 hours**) = $1,500 U
$3 per hour × AH – $18,000 = $1,500***
$3 per hour × AH = $19,500
AH = 6,500 hours

**6,000 units × 1.0 hour per unit = 6,000 hours
***When used with the formula, unfavorable variances are positive and favorable variances are negative.

Alternative approach:

Labor Rate Variance = AH × (AR – SR)
6,500 hours ($4.30 per hour* – $4.50 per hour) = $1,300 F

*$27,950 ÷ 6,500 hours = $4.30 per hour

Labor Efficiency Variance = SR (AH – SH)
$4.50 per hour (6,500 hours – 6,000 hours) = $2,250 U

Problem 10-19 (continued)

b.

Work in Process		
(6,000 hours @ $4.50 per hour)	27,000	
Labor Efficiency Variance		
(500 hours U @ $4.50 per hour).......................	2,250	
Labor Rate Variance		
(6,500 hours @ $0.20 per hour F)		1,300
Wages Payable		
(6,500 hours @ $4.30 per hour)..................		27,950

3. a.

Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
$20,475	6,500 hours × $3.00 per hour = $19,500	6,000 hours × $3.00 per hour = $18,000

Spending Variance, $975 U

Efficiency Variance, $1,500 U

Total Variance, $2,475 U

Alternative approach:

Variable Overhead Spending Variance = AH × (AR – SR)
6,500 hours ($3.15 per hour* – $3.00 per hour) = $975 U

*$20,475 ÷ 6,500 hours = $3.15 per hour

Variable Overhead Efficiency Variance = SR (AH – SH)
$3.00 per hour (6,500 hours – 6,000 hours) = $1,500 U

Problem 10-19 (continued)

b. No. When variable manufacturing overhead is applied on the basis of direct labor-hours, it is impossible to have an unfavorable variable manufacturing overhead efficiency variance when the direct labor efficiency variance is favorable. The variable manufacturing overhead efficiency variance is the same as the direct labor efficiency variance except that the difference between actual hours and the standard hours allowed for the output is multiplied by a different rate. If the direct labor efficiency variance is favorable, the variable manufacturing overhead efficiency variance must also be favorable.

4. *For materials:*

Favorable price variance: Decrease in outside purchase prices, fortunate buy, inferior quality materials, unusual discounts due to quantity purchased, inaccurate standards.

Unfavorable quantity variance: Inferior quality materials, carelessness, poorly adjusted machines, unskilled workers, inaccurate standards.

For labor:

Favorable rate variance: Unskilled workers (paid lower rates), piecework, inaccurate standards.

Unfavorable efficiency variance: Poorly trained workers, poor quality materials, faulty equipment, work interruptions, fixed labor with insufficient demand to keep them all busy, inaccurate standards.

For variable overhead:

Unfavorable spending variance: Increase in supplier prices, inaccurate standards, waste, theft of supplies.

Unfavorable efficiency variance: See comments under direct labor efficiency variance.

Problem 10-20 (75 minutes)

1.

Actual Quantity of Inputs, at Actual Price (AQ × AP)	Actual Quantity of Inputs, at Standard Price (AQ × SP)	Standard Quantity Allowed for Output, at Standard Price (SQ × SP)
290,000 feet × $2.10 per foot = $609,000	290,000 feet × $2.00 per foot = $580,000	300,000 feet* × $2.00 per foot = $600,000

Price Variance, $29,000 U	Quantity Variance, $20,000 F
Total Variance, $9,000 U	

*20,000 units × 15 feet per unit = 300,000 feet

Alternative Solution:

Materials Price Variance = AQ (AP – SP)
290,000 feet ($2.10 per foot – $2.00 per foot) = $29,000 U

Materials Quantity Variance = SP (AQ – SQ)
$2 per foot (290,000 feet – 300,000 feet) = $20,000 F

Yes, the decrease in waste is apparent because of the $20,000 favorable quantity variance.

If the company wants to continue to compute the material price variance, then the standard price per board foot should be changed to reflect current JIT purchase costs. The old standard price of $2 per board foot is no longer relevant.

Problem 10-20 (continued)

2.

Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
35,000 hours × $9.80 per hour = $343,000	35,000 hours × $10.00 per hour = $350,000	30,000 hours* × $10.00 per hour = $300,000

Rate Variance, $7,000 F	Efficiency Variance, $50,000 U
Total Variance, $43,000 U	

*20,000 units × 1.5 hours per unit = 30,000 hours

Alternative Solution:

Labor Rate Variance = AH (AR – SR)
35,000 hours ($9.80 per hour – $10.00 per hour) = $7,000 F

Labor Efficiency Variance = SR (AH – SH)
$10 per hour (35,000 hours – 30,000 hours) = $50,000 U

Problem 10-20 (continued)

No, the labor efficiency variance is not appropriate as a measure of performance in this situation. The reasons are:

- Labor is largely a fixed cost rather than a variable cost since the company maintains a stable work force to operate its flow line. Thus, the variance is not a valid measure of efficiency.
- In a JIT environment the goal is not to have high efficiency in the use of labor if such efficiency results in the production of unneeded goods. The goal is to produce only as needed to meet demand. Tom Hanson is tied to the past in that he is focusing solely on the utilization of labor time and is overlooking the impact of unneeded goods on the organization. Unfortunately, the situation posed in the problem is a common one as companies switch from a traditional system to JIT, and sometimes JIT doesn't work because of misplaced emphasis on efficiency variances. In a JIT setting, it is an interesting paradox that one of the "costs" of greater efficiency on the production line is greater "inefficiency" on the part of labor as it is occasionally idle or as it spends time at various tasks other than producing goods.

Problem 10-20 (continued)

3\.

Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
$118,000	35,000 hours × $4.00 per hour = $140,000	30,000 hours* × $4.00 per hour = $120,000

Spending Variance, $22,000 F	Efficiency Variance, $20,000 U
Total Variance, $2,000 F	

*20,000 units × 1.5 hours per unit = 30,000 hours

Alternative Solution:

Actual variable overhead cost	$118,000
Actual hours × standard rate:	
(35,000 hours × $4.00 per hour)	140,000
Spending variance	$ 22,000 F

Variable Overhead Efficiency Variance = SR (AH – SH)
$4.00 per hour (35,000 hours – 30,000 hours) = $20,000 U

It is doubtful that direct labor and variable manufacturing overhead costs are still correlated. Direct labor time is now largely a fixed cost. Variable manufacturing overhead, however, will tend to rise and fall with actual changes in production. If variable manufacturing overhead cost were indeed correlated with direct labor, then the actual variable manufacturing overhead cost for June should have been about $140,000 (35,000 hours × $4.00 per hour). But actual variable manufacturing overhead cost was far below this figure, as shown by the large favorable spending variance for the month. Indeed, the actual variable overhead cost figure—$118,000—is very near the $120,000 standard cost allowed for the month's output. Thus, it appears that as production has been cut back, variable manufacturing overhead cost has also decreased, but direct labor has remained stable.

Problem 10-20 (continued)

4. a. and b.

	Month		
	April	*May*	*June*
Throughput time—hours:			
Processing time (x)	1.6	1.5	1.3
Inspection time	0.3	0.2	0.1
Move time	3.2	2.7	1.2
Queue time	14.9	10.6	3.9
Total throughput time (y)	20.0	15.0	6.5
Manufacturing cycle efficiency (MCE):			
Processing time (x) ÷ Throughput time (y)	8%	10%	20%

Note that the manufacturing cycle efficiency has improved dramatically over the last three months. This means that non-value-added time is being pared out of the production process.

5. Under JIT the goal of the company is to produce to meet demand rather than to just fill labor time. Thus, the traditional labor variances are often unfavorable. Throughput time and MCE focus on *all* elements of manufacturing—not just labor time. These other elements, which are independent of labor time, are showing greater efficiency each month as the company pares out non-value-added activities in the plant.

   Throughput time and MCE are more appropriate in this situation since they focus on those elements that are of greatest importance in a JIT environment such as now being developed by PC Deco. The labor efficiency variance has little or no significance in such an environment.

Problem 10-21 (45 minutes)

The answers below are not the only possible answers. Ingenious people can figure out many different ways of making performance look better even though it really isn't. This is one of the reasons for a *balanced scorecard*. By having a number of different measures that ultimately are linked to overall financial goals, there will be less opportunity to "game" the system.

1. Speed-to-market can be improved by taking on less ambitious projects. Instead of working on major product innovations that require a great deal of time and effort, R&D may choose to work on small, incremental improvements in existing products. There is also a danger that in the rush to push products out the door, the products will be inadequately tested and developed.

2. Performance measures that are ratios or percentages present special dangers. A ratio can be increased either by increasing the numerator or by decreasing the denominator. Usually, the intention is to increase the numerator in the ratio, but a manager may react by decreasing the denominator instead. In this case (which actually happened), the managers pulled telephones out of the high-crime areas. This eliminated the problem for the managers, but was not what the CEO or the city officials had intended. They wanted the phones fixed, not eliminated.

3. In real life, the production manager simply added several weeks to the delivery cycle time. In other words, instead of promising to deliver an order in four weeks, the manager promised to deliver in six weeks. This increase in delivery cycle time did not, of course, please customers and drove some business away, but it dramatically improved the percentage of orders delivered on time.

Problem 10-21 (continued)

4. As stated above, ratios can be improved by changing either the numerator or the denominator. Managers who are under pressure to increase the revenue per employee may find it easier to eliminate employees than to increase revenues. Of course, eliminating employees may reduce total revenues and total profits, but the revenue per employee will increase as long as the percentage decline in revenues is less than the percentage cut in number of employees. Suppose, for example, that a manager is responsible for business units with a total of 1,000 employees, $120 million in revenues, and profits of $2 million. Further suppose that a manager can eliminate one of these business units that has 200 employees, revenues of $10 million, and profits of $1.2 million.

	Before eliminating the business unit	*After eliminating the business unit*
Total revenue.................	$120,000,000	$110,000,000
Total employees.............	1,000	800
Revenue per employee...	$120,000	$137,500
Total profits...................	$2,000,000	$800,000

As these examples illustrate, performance measures should be selected with a great deal of care and managers should avoid placing too much emphasis on any one performance measure.

Problem 10-22 (30 minutes)

1. a., b., and c.

	Month			
	1	*2*	*3*	*4*
Throughput time in days:				
Process time	0.6	0.6	0.6	0.6
Inspection time	0.1	0.3	0.6	0.8
Move time	1.4	1.3	1.3	1.4
Queue time	5.6	5.7	5.6	5.7
Total throughput time	7.7	7.9	8.1	8.5
Manufacturing cycle efficiency (MCE):				
Process time ÷ Throughput time	7.8%	7.6%	7.4%	7.1%
Delivery cycle time in days:				
Wait time	16.7	15.2	12.3	9.6
Total throughput time	7.7	7.9	8.1	8.5
Total delivery cycle time	24.4	23.1	20.4	18.1

2. a. The company seems to be improving mainly in the areas of quality control, material control, on-time delivery, and total delivery cycle time. Customer complaints, warranty claims, defects, and scrap are all down somewhat, which suggests that the company has been paying attention to quality in its improvement campaign. The fact that on-time delivery and delivery cycle time have both improved also suggests that the company is seeking to please the customer with improved service.

   b. Inspection time has increased dramatically. Use as percentage of availability has deteriorated, and throughput time as well as MCE show negative trends.

Problem 10-22 (continued)

c. While it is difficult to draw any definitive conclusions, it appears that the company has concentrated first on those areas of performance that are of most immediate concern to the customer—quality and delivery performance. The lower scrap and defect statistics suggest that the company has been able to improve its processes to reduce the rate of defects; although, some of the improvement in quality apparently was due simply to increased inspections of the products before they were shipped to customers.

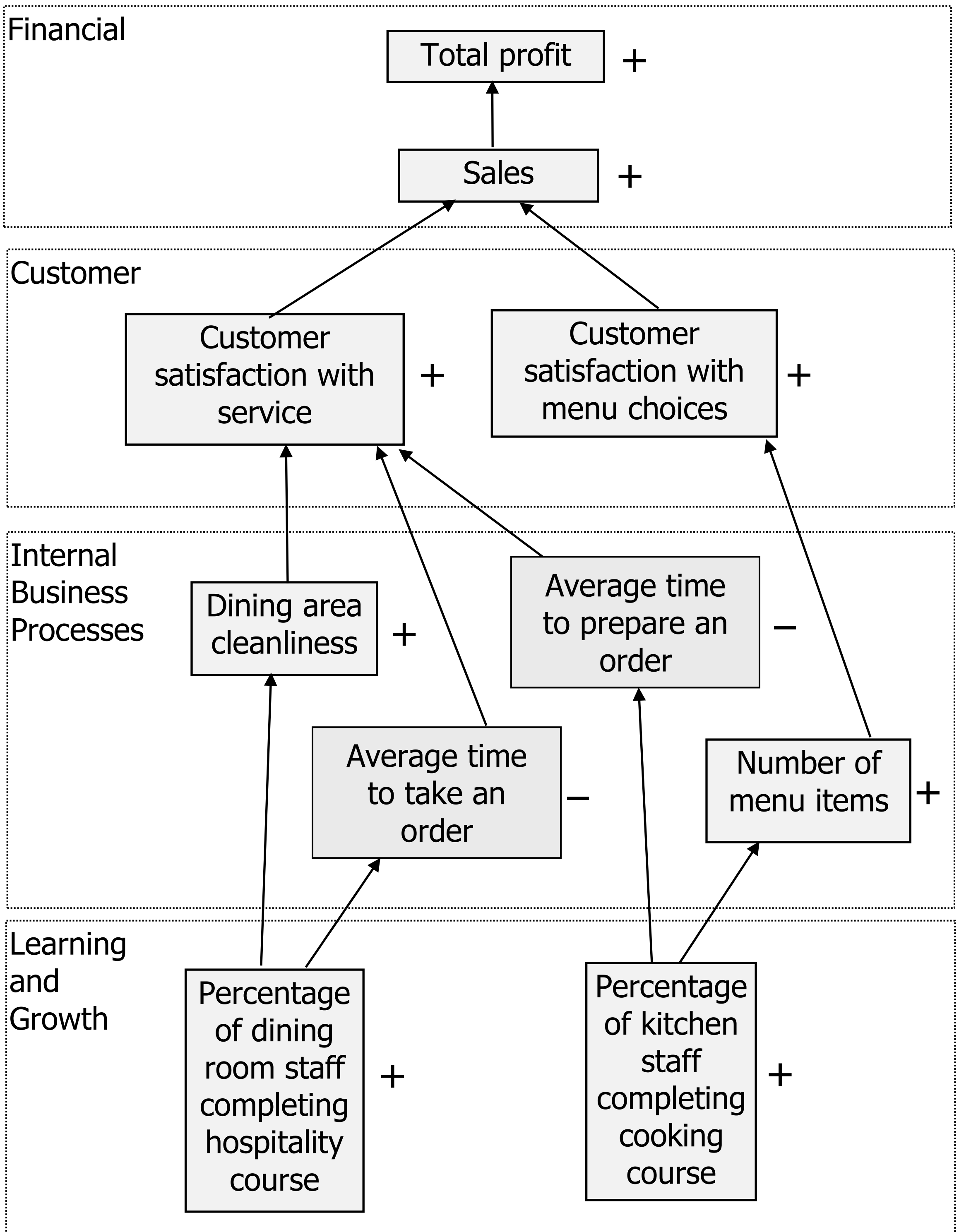
3. a. and b.

	Month	
	5	*6*
Throughput time in days:		
Process time	0.6	0.6
Inspection time	0.8	—
Move time	1.4	1.4
Queue time	—	—
Total throughput time	2.8	2.0
Manufacturing cycle efficiency (MCE):		
Process time ÷ Throughput time	21.4%	30.0%

As non-value-added activities are eliminated, the manufacturing cycle efficiency improves. The goal, of course, is to have an efficiency of 100%. This is achieved when all non-value-added activities have been eliminated and process time equals throughput time.

Problem 10-23 (45 minutes)

1. Students' answers may differ in some details from this solution.



2. The hypotheses underlying the balanced scorecard are indicated by the arrows in the diagram. Reading from the bottom of the balanced scorecard, the hypotheses are:
   - If the percentage of dining room staff who complete the hospitality course increases, then the average time to take an order will decrease.
   - If the percentage of dining room staff who complete the hospitality course increases, then dining room cleanliness will improve.
   - If the percentage of kitchen staff who complete the cooking course increases, then the average time to prepare an order will decrease.
   - If the percentage of kitchen staff who complete the cooking course increases, then the number of menu items will increase.
   - If the dining room cleanliness improves, then customer satisfaction with service will increase.
   - If the average time to take an order decreases, then customer satisfaction with service will increase.
   - If the average time to prepare an order decreases, then customer satisfaction with service will increase.
   - If the number of menu items increases, then customer satisfaction with menu choices will increase.
   - If customer satisfaction with service increases, sales will increase.
   - If customer satisfaction with menu choices increases, sales will increase.
   - If sales increase, total profits for the Lodge will increase.

   Each of these hypotheses is questionable to some degree. For example, even if the number of menu items increases, customer satisfaction with the menu choices may not increase. The items added to the menu may not appeal to customers. The fact that each of the hypotheses can be questioned does not, however, invalidate the balanced scorecard. If the scorecard is used correctly, management will be able to identify which, if any, of the hypotheses is incorrect. [See below.]

3. Management will be able to tell if a hypothesis is false if an improvement in a performance measure at the bottom of an arrow does not, in fact, lead to improvement in the performance measure at the tip of the arrow. For example, if the number of menu items is increased, but customer satisfaction with the menu choices does not increase, management will immediately know that something was wrong with their assumptions.

Problem 10-24 (45 minutes)

1. Each kilogram of fresh mushrooms yields 150 grams of dried mushrooms suitable for packing:

One kilogram of fresh mushrooms	1,000 grams
Less: unacceptable mushrooms (¼ of total)	250
Acceptable mushrooms	750
Less 80% shrinkage during drying	600
Acceptable dried mushrooms	150 grams

Since 1,000 grams of fresh mushrooms yield 150 grams of dried mushrooms, 100 grams (or, 0.1 kilogram) of fresh mushrooms should yield the 15 grams of acceptable dried mushrooms that are packed in each jar.

The direct labor standards are determined as follows:

	Sorting and Inspecting
Direct labor time per kilogram of fresh mushrooms	15 minutes
Grams of dried mushrooms per kilogram of fresh mushrooms	÷ 150 grams
Direct labor time per gram of dried mushrooms	0.10 minute per gram
Grams of dried mushrooms per jar	× 15 grams
Direct labor time per jar	1.5 minutes

	Drying
Direct labor time per kilogram of acceptable sorted fresh mushrooms	10 minutes
Grams of dried mushrooms per kilogram of acceptable sorted fresh mushrooms	÷ 200 grams
Direct labor time per gram of dried mushrooms	0.05 minute per gram
Grams of dried mushrooms per jar	× 15 grams
Direct labor time per jar	0.75 minute

Problem 10-24 (continued)

Standard cost per jar of dried chanterelle mushrooms:

Direct material:		
Fresh mushrooms		
(0.1 kilogram per jar × €60.00 per kilogram)	€6.00	
Jars, lids, and labels (€10.00 ÷ 100 jars).....................	0.10	€6.10
Direct labor:		
Sorting and inspecting		
(1.5 minutes per jar × €0.20 per minute*)	0.30	
Drying (0.75 minute per jar × €0.20 per minute*)	0.15	
Packing		
(0.10 minute per jar** × €0.20 per minute*)	0.02	0.47
Standard cost per jar		€6.57

*€12.00 per hour is €0.20 per minute.
**10 minutes per 100 jars is 0.10 minute per jar.

Problem 10-24 (continued)

2. a. Ordinarily, the purchasing manager has more influence over the prices of purchased materials than anyone else in the organization. Therefore, the purchasing manager is usually held responsible for material price variances.

   b. The production manager is usually held responsible for materials quantity variances. However, this situation is a bit unusual. The quantity variance will be heavily influenced by the quality of the mushrooms acquired from gatherers by the purchasing manager. If the mushrooms have an unusually large proportion of unacceptable mushrooms, the quantity variance will be unfavorable. The production process itself is likely to have less effect on the amount of wastage and spoilage. On the other hand, if the production manager is not held responsible for the quantity variance, the production workers may not take sufficient care in their handling of the mushrooms. A partial solution to this problem would be to make the sorting and inspection process part of the purchasing manager's responsibility. The purchasing manager would then be held responsible for any wastage in excess of the 100 grams expected for each 300 grams of acceptable fresh mushrooms. The production manager would be held responsible for any wastage after that point. This is only a partial solution, however, because the purchasing manager may pass on at least 300 grams of every 400 grams of fresh mushrooms, whether they are acceptable or not.

Problem 10-25 (45 minutes)

This is a very difficult problem that is harder than it looks. Be sure your students have been thoroughly “checked out” in the variance formulas before assigning it.

1.

Actual Quantity of Inputs, at Actual Price (AQ × AP)	Actual Quantity of Inputs, at Standard Price (AQ × SP)	Standard Quantity Allowed for Output, at Standard Price (SQ × SP)
$36,000	6,000 yards × $6.50 per yard* = $39,000	5,600 yards** × $6.50 per yard* = $36,400

Price Variance, $3,000 F | Quantity Variance, $2,600 U

Total Variance, $400 F

*$18.20 ÷ 2.8 yards = $6.50 per yard.
**2,000 units × 2.8 yards per unit = 5,600 yards

Alternative Solution:

Materials Price Variance = AQ (AP – SP)
6,000 yards ($6.00 per yard* – $6.50 per yard) = $3,000 F
*$36,000 ÷ 6,000 yards = $6.00 per yard

Materials Quantity Variance = SP (AQ – SQ)
$6.50 per yard (6,000 yards – 5,600 yards) = $2,600 U

Problem 10-25 (continued)

2. Many students will miss parts 2 and 3 because they will try to use *product* costs as if they were *hourly* costs. Pay particular attention to the computation of the standard direct labor time per unit and the standard direct labor rate per hour.

Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
\$7,600	760 hours × \$9 per hour* = \$6,840	800 hours** × \$9 per hour* = \$7,200

Rate Variance, \$760 U | Efficiency Variance, \$360 F

Total Variance, \$400 U

* 780 standard hours ÷ 1,950 robes = 0.4 standard hour per robe.
\$3.60 standard cost per robe ÷ 0.4 standard hours = \$9 standard rate per hour.

** 2,000 robes × 0.4 standard hour per robe = 800 standard hours.

Alternative Solution:

Labor Rate Variance = AH (AR – SR)
760 hours (\$10 per hour* – \$9 per hour) = \$760 U
*\$7,600 ÷ 760 hours = \$10 per hour

Labor Efficiency Variance = SR (AH – SH)
\$9 per hour (760 hours – 800 hours) = \$360 F

Problem 10-25 (continued)

3.

Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
$3,800	760 hours × $3 per hour* = $2,280	800 hours × $3 per hour* = $2,400

Spending Variance, $1,520 U	Efficiency Variance, $120 F
Total Variance, $1,400 U	

*$1.20 standard cost per robe ÷ 0.4 standard hours = $3 standard rate per hour.

Alternative Solution:

Variable Overhead Spending Variance = AH (AR – SR)
760 hours ($5 per hour* – $3 per hour) = $1,520 U
*$3,800 ÷ 760 hours = $5 per hour

Variable Overhead Efficiency Variance = SR (AH – SH)
$3 per hour (760 hours – 800 hours) = $120 F

Case 10-26 (30 minutes)

Purchasing Department

The Purchasing Department's incentive is to obtain raw materials at the lowest possible prices. In an effort to reduce costs and increase bonuses in the department, managers may have selected vendors of raw materials based on price alone—neglecting to take fully into account other factors such as reliability, quality, and delivery time. The department may also have ordered inferior materials at a lower price. While purchase costs may be reduced by such actions, total manufacturing and other costs may increase as a consequence of longer delivery times, lower reliability, greater inspection costs, higher rework costs, expediting costs, and material wastage.

Poor quality material affects other departments. More material and labor would be required to make products, reducing efficiency, and ultimately raising costs. Poor quality material can also create more maintenance problems, such as excessive wear and machinery breakdowns. These effects in turn can easily lead to interdepartmental conflicts, lowering morale and undercutting attempts at team-building.

Manufacturing Department

The new incentive plan rewards managers in the manufacturing department for reducing direct labor costs. Managers in the department may have attempted to reduce direct labor costs by hiring new, less experienced workers at a lower wage than existing workers. If more experienced workers are replaced by less experienced workers, more defects may have resulted—which would increase the amount of rework. However, since rework is not included in direct labor cost, it has no negative impact on the bonus plan. In addition, managers may have attempted to reduce labor costs by pushing workers to work faster. Unless this is done very carefully, more defects are likely to result—again increasing the amount of rework—and morale is likely to plummet.

Case 10-26 (continued)

Maintenance Department
The new incentive plan rewards managers in the maintenance department for reducing the department's total cost. The managers may have accomplished this cost-reduction goal by cutting back on necessary maintenance. This could lead to increased breakdowns, more downtime, poorly adjusted equipment generating more defective products, and diversion of production personnel into maintenance tasks.

(CMA, adapted)

Case 10-27 (30 minutes)

This case, which is based on an actual situation, may be difficult for some students to grasp since it requires looking at standard costs from an entirely different perspective. In this case, standard costs have been inappropriately used as a means to manipulate reported earnings rather than as a way to control costs.

1. Lansing has evidently set very loose standards in which the standard prices and standard quantities are far too high. This will guarantee that favorable variances will ordinarily result from operations. If the standard costs are set artificially high, the standard cost of goods sold will be artificially high and thus the division's net operating income will be depressed until the favorable variances are recognized. If Lansing saves the favorable variances, he can release just enough in the second and third quarters to show some improvement and then he can release all of the rest in the last quarter, creating the annual "Christmas present."

2. Lansing should not be permitted to continue this practice for several reasons. First, it distorts the quarterly earnings for both the division and the company. The distortions of the division's quarterly earnings are troubling because the manipulations may mask real signs of trouble. The distortions of the company's quarterly earnings are troubling because they may mislead external users of the financial statements. Second, Lansing should not be rewarded for manipulating earnings. This sets a moral tone in the company that is likely to lead to even deeper trouble. Indeed, the permissive attitude of top management toward manipulation of earnings may indicate the existence of other, even more serious, ethical problems in the company. Third, a clear message should be sent to division managers like Lansing that their job is to manage their operations, not their earnings. If they keep on top of operations and manage well, the earnings should take care of themselves.

Case 10-27 (continued)

3. Stacy Cummins does not have any easy alternatives available. She has already taken the problem to the President, who was not interested. If she goes around the President to the Board of Directors, she will be putting herself in a politically difficult position with little likelihood that it will do much good if, in fact, the Board of Directors already knows what is going on.

   On the other hand, if she simply goes along, she will be violating the "Objectivity" standard of ethical conduct for management accountants. The Home Security Division's manipulation of quarterly earnings does distort the entire company's quarterly reports. And the Objectivity standard clearly stipulates that "management accountants have a responsibility to disclose fully all relevant information that could reasonably be expected to influence an intended user's understanding of the reports, comments, and recommendations presented." Apart from the ethical issue, there is also a very practical consideration. If Merced Home Products becomes embroiled in controversy concerning questionable accounting practices, Stacy Cummins will be viewed as a responsible party by outsiders and her career is likely to suffer dramatically.

   We would suggest that Ms. Cummins quietly bring the problem to the attention of the audit committee of the Board of Directors, carefully laying out in a non-confrontational manner the problems created by Lansing's practice of manipulating earnings. If the President and the Board of Directors are still not interested in dealing with the problem, she may reasonably conclude that the best alternative is to start looking for another job.

Case 10-28 (90 minutes)

Note: This is a very rigorous case; it should be assigned only after students have been fully "checked out" in variance computations and journal entries.

1\.

Standard cost of Material A used in production (a)	$2,400
Standard cost of Material A per batch (5 gallons × $6 per gallon) (b)	$30
Number of batches produced (a) ÷ (b)	80

2\. a. The number of gallons of Material A used in production can be computed through analysis of the raw materials inventory account:

Balance, Material A, 6/1	$ 720
Add purchases (550 gallons @ $6 per gallon)	3,300
Total Material A available	4,020
Less balance, Material A, 6/7	1,500
Total Material A used	$2,520

$2,520 ÷ $6 per gallon = 420 gallons

b. Quantity Variance = SP (AQ – SQ)
$6 per gallon (420 gallons – 400 gallons*) = $120 U
*80 batches × 5 gallons per batch = 400 gallons

c.

Standard cost of purchases (550 gallons × $6 per gallon)	$3,300
Add unfavorable price variance	220
Actual cost of purchases	$3,520

Alternatively:
Price Variance = (AQ × AP) – (AQ × SP)
(550 gallons × AP) – (550 gallons × $6 per gallon) = $220 U
(550 gallons × AP) – ($3,300) = $220*
(550 gallons × AP) = $3,520

*When used with the formula, unfavorable variances are positive and favorable variances are negative.

Case 10-28 (continued)

d. Raw Materials—A (550 gallons @ $6 per gallon)... 3,300
Materials Price Variance
(550 gallons @ $0.40 per gallon)...................... 220
Accounts Payable
(550 gallons @ $6.40 per gallon*)............... 3,520

*$3,520 ÷ 550 gallons = $6.40 per gallons

Work in Process (400 gallons @ $6 per gallon).....	2,400	
Materials Quantity Variance (20 gallons @ $6 per gallon)	120	
Raw Materials (420 gallons @ $6 per gallon)...		2,520

3. a. The standard cost per pound of Material B can be computed by analyzing the raw materials inventory account:

Total Material B used in production	$600
Add balance, Material B, 6/7.....................	200
Total Material B available..........................	800
Deduct balance, Material B, 6/1	0
Purchases of Material B...........................	$800

$800 ÷ 200 pounds = $4 per pound

b.

Material B drawn from inventory	$600	÷ $4 = 150 pounds used
Add favorable quantity variance................................	40	
Standard cost of material used...	$640	÷ $4 = 160 pounds allowed

Alternatively:

Quantity Variance = (AQ × SP) – (SQ × SP)
$600 – (SQ × $4 per pound) = $40 F
$600 – $4 per pound × SQ = -$40*
$4 per pound × SQ =$640
SQ = 160 pounds

*When used with the formula, favorable variances are negative.

Case 10-28 (continued)

c. 160 pounds ÷ 80 batches = 2 pounds per batch

d.

Total cost of materials purchased	$4,240
Less cost of Material A (Part 2)..........	3,520
Cost of Material B............................	$ 720

Price Variance = (AQ × AP) – (AQ × SP)
=$720 – (200 pounds × $4 per pound)
=$720 – $800 = $80 F

e.

Raw Materials—B (200 pounds @ $4.00 per pound) ...	800	
Materials Price Variance (200 pounds @ $0.40 per pound)......................		80
Accounts Payable (200 pounds @ $3.60 per pound*)....................		720

*$720 ÷ 200 pounds = $3.60 per pound

Work in Process (160 pounds @ $4.00 per pound) ...	640	
Materials Quantity Variance (10 pounds @ $4.00 per pound)......................		40
Raw Materials—B (150 pounds @$4.00 per pound).....................		600

4. a. Efficiency Variance = SR (AH – SH)
$8 per hour (230 hours – SH) = $240 U
$1,840 – $8 per hour × SH = $240*
$8 per hour × SH = $1,600
SH = 200 hours

*When used with the formula, unfavorable variances are positive.

b. 200 hours ÷ 80 batches = 2.5 hours per batch.

c. Rate Variance = (AH × AR) – (AH × SR)
=$1,725 – (230 hours × $8 per hour)
=$1,725 – $1,840 = $115 F

Case 10-28 (continued)

d. Work in Process (200 hours @ $8 per hour)....... 1,600

d. Work in Process (200 hours @ $8 per hour).......	1,600	
Labor Efficiency Variance (30 hours @ $8 per hour)	240	
Labor Rate Variance (230 hours @ $0.50 per hour)..................		115
Wages Payable (230 hours @ $7.50 per hour*)		1,725

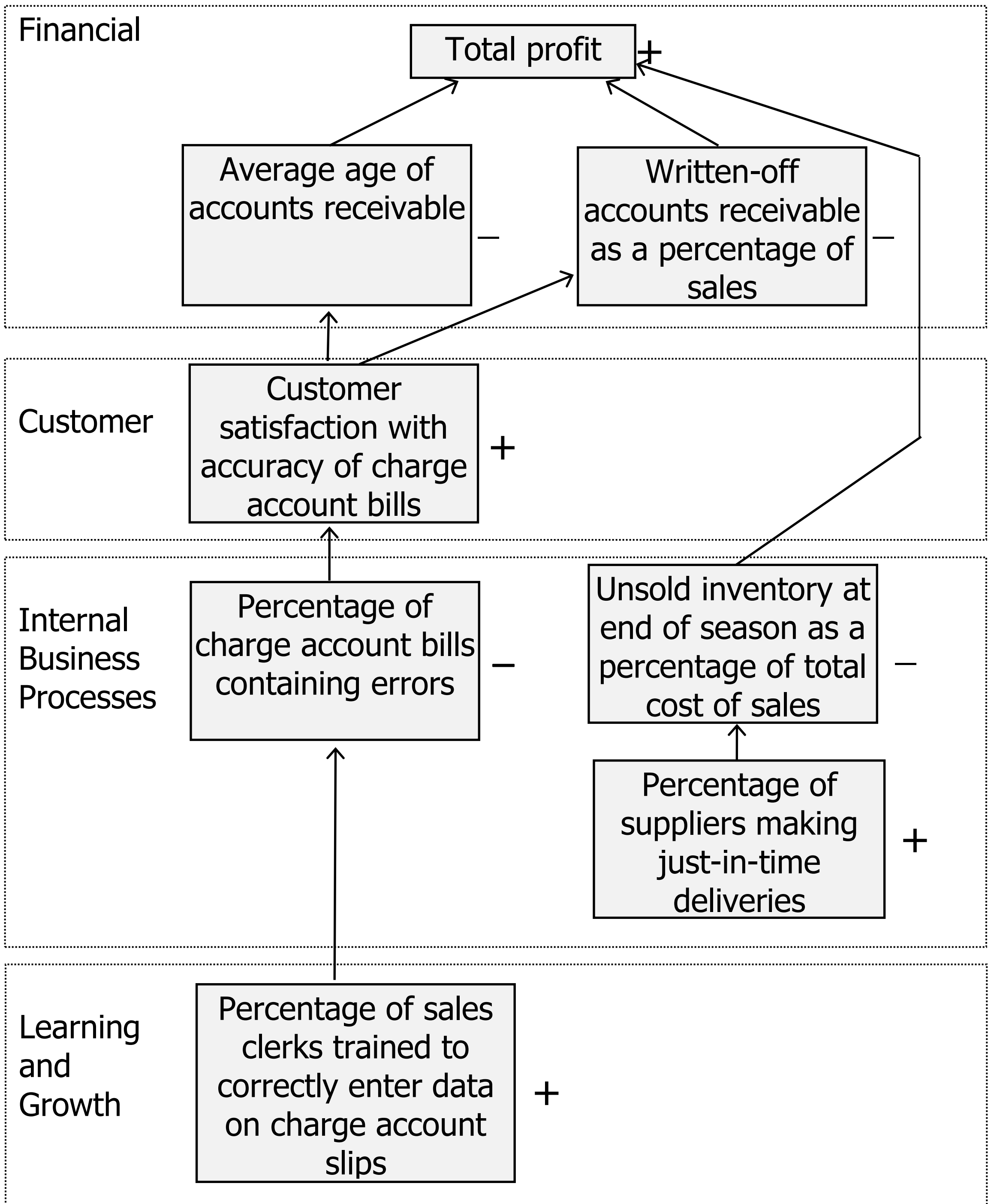
*$1,725 ÷ 230 hours = $7.50 per hour

5.

	Standard Quantity per Batch	*Price or Rate*	*Standard Cost per Batch*
Material A.......	5 gallons	$6 per gallon	$30
Material B.......	2 pounds	$4 per pound	8
Direct labor	2.5 hours	$8 per hour	20
Total			$58

Case 10-29 (60 minutes)

1. Answers may differ concerning which category—learning and growth, internal business processes, customers, or financial—a particular performance measure belongs to.



Case 10-29 (continued)

The performance measures that are not included above may have an impact on total profit, but they are not linked in any obvious way with the two key problems that have been identified by management—accounts receivables and unsold inventory. If every performance measure that potentially impacts profit is included in a company's balanced scorecard, it would become unwieldy and focus would be lost.

2. The results can be exploited for information about the company's strategy. Each link in the balanced scorecard should be regarded as a hypothesis of the form "If ..., then ...". For example, the balanced scorecard on the previous page contains the hypothesis "If customers express greater satisfaction with the accuracy of their charge account bills, then there will be improvement in the average age of accounts receivable." If customers in fact do express greater satisfaction with the accuracy of their charge account bills, but there is not an improvement in the average age of accounts receivable, this would have to be considered evidence that is inconsistent with the hypothesis. Management should try to figure out why there has been no improvement in the average age of receivables. (See the answer below for possible explanations.) The answer may suggest a shift in strategy.

   In general, the most important results are those in which there has been an improvement in something that is supposed to lead to an improvement in something else, but none has occurred. This evidence contradicts a hypothesis underlying the company's strategy and provides invaluable feedback that can lead to modification of the strategy.

Case 10-29 (continued)

3. a. This evidence is inconsistent with two of the hypotheses underlying the balanced scorecard. The first of these hypotheses is "If customers express greater satisfaction with the accuracy of their charge account bills, then there will be improvement in the average age of accounts receivable." The second of these hypotheses is "If customers express greater satisfaction with the accuracy of their charge account bills, then there will be improvement in bad debts." There are a number of possible explanations. Two possibilities are that the company's collection efforts are ineffective and that the company's credit reviews are not working properly. In other words, the problem may not be incorrect charge account bills at all. The problem may be that the procedures for collecting overdue accounts are not working properly. Or, the problem may be that the procedures for reviewing credit card applications let through too many poor credit risks. If so, this would suggest that efforts should be shifted from reducing charge account billing errors to improving the internal business processes dealing with collections and credit screening. And in that case, the balanced scorecard should be modified.

   b. This evidence is inconsistent with three hypotheses. The first of these is "If the average age of receivables declines, then profits will increase." The second hypothesis is "If the written-off accounts receivable decrease as a percentage of sales, then profits will increase." The third hypothesis is "If unsold inventory at the end of the season as a percentage of cost of sales declines, then profits will increase."

   Again, there are a number of possible explanations for the lack of results consistent with the hypotheses. Managers may have decreased the average age of receivables by simply writing off old accounts earlier than was done previously. This would actually decrease reported profits in the short term. Bad debts as a percentage of sales could be decreased by drastically cutting back on extensions of credit to customers—perhaps even canceling some charge accounts. (There would be no bad debts at all if there were no credit sales.) This would have the effect of reducing bad debts, but might irritate otherwise loyal credit customers and reduce sales and profits.

Case 10-29 (continued)

The reduction in unsold inventories at the end of the season as a percentage of cost of sales could have occurred for a number of reasons that are not necessarily good for profits. For example, managers may have been too cautious about ordering goods to restock low inventories—creating stockouts and lost sales. Or, managers may have cut prices drastically on excess inventories in order to eliminate them before the end of the season. This may have reduced the willingness of customers to pay the store's normal prices. Or, managers may have gotten rid of excess inventories by selling them to discounters *before* the end of the season.

Group Exercise 10-30

The answers to the questions in this group exercise will depend on the particular company that is investigated.

Group Exercise 10-31

The answers to the questions in this group exercise will depend on the particular company that is investigated.