

**Exercise 13-13** (15 minutes)

1. Time rate to be used:

Plumbers' wages and fringe benefits (\$340,000 ÷ 20,000 hours) .....	\$17
Other repair costs (\$160,000 ÷ 20,000 hours).....	8
Desired profit per hour of plumber time .....	<u>5</u>
Total charging rate per hour for service.....	<u>\$30</u>

Material loading charge:

Ordering, handling, and storage cost .....	15% of invoice cost
Desired profit on parts .....	<u>30%</u> of invoice cost
Material loading charge .....	<u>45%</u> of invoice cost

2. Time charge: 3 hours × \$30 per hour .....	\$ 90
Material charge:	
Invoice cost of parts .....	\$40
Material loading charge (45% × \$40).....	<u>18</u> <u>58</u>
Billed cost of the job.....	<u>\$148</u>

**Problem 13-21** (60 minutes)

1. The \$2.00 per unit general overhead cost is not relevant to the decision, because the total general company overhead cost will be the same regardless of whether the company decides to make or buy the subassemblies. Also, the depreciation on the old equipment is not a relevant cost since it represents a sunk cost and the old equipment is worn out and must be replaced. The cost of supervision is relevant because this cost can be avoided by buying the subassemblies.

	<i>Differential Costs Per Unit</i>		<i>Total Differential Costs for 40,000 Units</i>	
	<i>Make</i>	<i>Buy</i>	<i>Make</i>	<i>Buy</i>
Outside supplier's price .....		\$8.00		\$320,000
Direct materials .....	\$2.75		\$110,000	
Direct labour (\$4.00 × 0.75) .....	3.00		120,000	
Variable overhead (\$0.60 × 0.75) .....	0.45		18,000	
Supervision .....	0.75		30,000	
Equipment rental* .....	<u>1.50</u>		<u>60,000</u>	
Total .....	<u>\$8.45</u>	<u>\$8.00</u>	<u>\$338,000</u>	<u>\$320,000</u>
Difference in favour of buying ...		<u>\$0.45</u>		<u>\$18,000</u>

\* \$60,000 per year ÷ 40,000 units per year = \$1.50 per unit

**Problem 13-21** (continued)

2. a. Notice that unit costs for both supervision and equipment rental will change if the company needs 50,000 subassemblies each year. These fixed costs will be spread over a larger number of units, thereby decreasing the cost per unit.

	<i>Differential Costs Per Unit</i>		<i>Total Differential Costs—50,000 Units</i>	
	<i>Make</i>	<i>Buy</i>	<i>Make</i>	<i>Buy</i>
Outside supplier's price .....		\$8.00		\$400,000
Direct materials .....	\$2.75		\$137,500	
Direct labour .....	3.00		150,000	
Variable overhead.....	0.45		22,500	
Supervision (\$30,000 ÷ 50,000 units) .....	0.60		30,000	
Equipment rental (\$60,000 ÷ 50,000 units) .....	<u>1.20</u>		<u>60,000</u>	
Total .....	<u>\$8.00</u>	<u>\$8.00</u>	<u>\$400,000</u>	<u>\$400,000</u>
Difference .....		<u>\$0</u>		<u>\$0</u>

The company would be indifferent between the two alternatives if 50,000 subassemblies were needed each year.

**Problem 13-21** (continued)

- b. Again, notice that the unit costs for both supervision and equipment rental decrease with the greater volume of units.

	<i>Differential Costs Per Unit</i>		<i>Total Differential Costs—60,000 Units</i>	
	<i>Make</i>	<i>Buy</i>	<i>Make</i>	<i>Buy</i>
Outside supplier's price.....		\$8.00		\$480,000
Direct materials.....	\$2.75		\$165,000	
Direct labour.....	3.00		180,000	
Variable overhead .....	0.45		27,000	
Supervision (\$30,000 ÷ 60,000 units).....	0.50		30,000	
Equipment rental (\$60,000 ÷ 60,000 units).....	<u>1.00</u>		<u>60,000</u>	
Total.....	<u>\$7.70</u>	<u>\$8.00</u>	<u>\$462,000</u>	<u>\$480,000</u>
Difference in favour of making ..		<u>\$0.30</u>		<u>\$18,000</u>

The company should purchase the new equipment and make the subassemblies if 60,000 units per year are needed.

**Problem 13-21** (continued)

3. Other factors that the company should consider include:
- a. Will volume in future years be increasing, or will it remain constant at 40,000 units per year? (If volume increases, then buying the new equipment becomes more desirable, as shown in the computations above.)
  - b. Can quality control be maintained if the subassemblies are purchased from the outside supplier?
  - c. Does the company have some other profitable use for the space now being used to produce the subassemblies? Does production of the subassemblies require use of a constrained resource?
  - d. Will the outside supplier be dependable in meeting shipping schedules?
  - e. Can the company begin making the subassemblies again if the supplier proves to be undependable, or are there alternative suppliers?
  - f. If the outside supplier's offer is accepted and the need for subassemblies increases in future years, will the supplier have the capacity to provide more than 40,000 subassemblies per year?

**Problem 13-22** (45 minutes)

1. Selling price per unit.....	\$40
Less variable expenses per unit* .....	<u>24</u>
Contribution margin per unit .....	<u>\$16</u>

\*\$9.50 + \$10.00 + \$2.80 + \$1.70 = \$24.00

Increased unit sales (80,000 × 25%).....	20,000
Contribution margin per unit .....	× <u>\$16</u>
Incremental contribution margin.....	\$320,000
Less added fixed selling expense .....	<u>150,000</u>
Incremental net operating income .....	<u>\$170,000</u>

Yes, the increase in fixed selling expense would be justified.

2. Variable production cost per unit (\$24.00 – \$1.70) ...	\$22.30
Import duties, etc. (\$14,000 ÷ 20,000 units) .....	0.70
Shipping cost per unit.....	<u>1.50</u>
Break-even price per unit.....	<u>\$24.50</u>

3. If the plant operates at 25% of normal levels, then only 5,000 units will be produced and sold during the three-month period:

80,000 units per year × 3/12 = 20,000 units.

20,000 units × 25% = 5,000 units produced and sold.

Given this information, the simplest approach to the solution is:

Contribution margin lost if the plant is closed (5,000 units × \$16 per unit*) .....	\$ (80,000)
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Fixed costs that can be avoided if the plant is closed:

Fixed manufacturing overhead cost (\$400,000 × 3/12 = \$100,000; \$100,000 × 40%) .....	\$40,000
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Fixed selling cost (\$360,000 × 3/12 = \$90,000; \$90,000 × 1/3).....	<u>30,000</u>	<u>70,000</u>
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Net disadvantage of closing the plant.....	<u>\$ (10,000)</u>
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\*\$40.00 – (\$9.50 + \$10.00 + \$2.80 + \$1.70) = \$16.00

**Problem 13-22** (continued)

Alternative approach:

	<i>Keep the Plant Open</i>	<i>Close the Plant</i>
Sales (5,000 units × \$40 per unit) .....	\$ 200,000	\$ 0
Less variable expenses		
(5,000 units × \$24 per unit) .....	<u>120,000</u>	<u>0</u>
Contribution margin .....	<u>80,000</u>	<u>0</u>
Less fixed expenses:		
Fixed manufacturing overhead cost:		
\$400,000 × 3/12 .....	100,000	
\$400,000 × 3/12 × 60%.....		60,000
Fixed selling expense:		
\$360,000 × 3/12 .....	90,000	
\$360,000 × 3/12 × 2/3.....		<u>60,000</u>
Total fixed expenses .....	<u>190,000</u>	<u>120,000</u>
Net operating income (loss) .....	<u><u>\$(110,000)</u></u>	<u><u>\$(120,000)</u></u>

4. The relevant cost is \$1.70 per unit, which is the variable selling expense per Zet. Since the blemished units have already been produced, all production costs (including the variable production costs) are sunk. The fixed selling expenses are not relevant since they will remain the same regardless of whether or not the blemished units are sold. The variable selling expense may or may not be relevant—depending on how the blemished units are sold. For example, the units may be sold through a liquidator without incurring the normal variable selling expense.

5. The costs that can be avoided by purchasing from the outside supplier are relevant. These costs are:

Variable production costs .....	\$22.30
Fixed manufacturing overhead cost (\$400,000 × 70% = \$280,000; \$280,000 ÷ 80,000 units).....	3.50
Variable selling expense (\$1.70 × 60%).....	<u>1.02</u>
Total avoidable cost .....	<u><u>\$26.82</u></u>

To be acceptable, the outside manufacturer's quotation must be *less* than \$26.82 per unit.

**Problem 13-29** (60 minutes)

1. Supporting computations:

Number of pads produced per year:

$$100,000 \text{ labour-hours} \div 2 \text{ labour-hours per pad} = 50,000 \text{ pads}$$

Standard cost per pad:

$$\$4,000,000 \text{ cost of goods sold} \div 50,000 \text{ pads} = \$80 \text{ cost per pad}$$

Fixed manufacturing overhead cost per pad:

$$\$1,750,000 \div 50,000 \text{ pads} = \$35 \text{ per pad}$$

Manufacturing overhead cost per pad:

$$\$7 \text{ variable cost per pad} + \$35 \text{ fixed cost per pad} = \$42 \text{ per pad}$$

Direct labour cost per pad:

$$\$80 - (\$30 + \$42) = \$8$$

Given the computations above, the completed standard cost card follows:

	<i>Standard Quantity or Hours</i>	<i>Standard Price or Rate</i>	<i>Standard Cost</i>
Direct materials .....	5 metres	\$ 6 per metre	\$30
Direct labour .....	2 hours	4 per hour *	8
Manufacturing overhead.....	2 hours	21 per hour **	<u>42</u>
Total standard cost per pad .....			<u>\$80</u>

\*  $\$8 \div 2 \text{ hours} = \$4 \text{ per hour.}$

\*\*  $\$42 \div 2 \text{ hours} = \$21 \text{ per hour.}$

**Problem 13-29** (continued)

2. a.

$$\begin{aligned}
 \text{Markup percentage on absorption cost} &= \frac{(\text{Required ROI} \times \text{Investment}) + \text{SG\&A expenses}}{\text{Unit sales} \times \text{Unit product cost}} \\
 &= \frac{(24\% \times \$3,500,000) + \$2,160,000}{50,000 \text{ pads} \times \$80 \text{ per pad}} \\
 &= \frac{\$3,000,000}{\$4,000,000} \\
 &= 75\%
 \end{aligned}$$

b. Direct materials .....	\$30
Direct labour .....	8
Manufacturing overhead .....	<u>42</u>
Unit product cost.....	80
Add markup: 75% .....	<u>60</u>
Target selling price .....	<u>\$140</u>

c. Sales (50,000 pads × \$140 per pad) .....	\$7,000,000
Less cost of goods sold (50,000 pads × \$80 per pad) ....	<u>4,000,000</u>
Gross margin .....	3,000,000
Less selling, general, and administrative expense.....	<u>2,160,000</u>
Net operating income.....	<u>\$ 840,000</u>

$$\begin{aligned}
 \text{ROI} &= \frac{\text{Net operating income}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Average operating assets}} \\
 &= \frac{\$840,000}{\$7,000,000} \times \frac{\$7,000,000}{\$3,500,000} = 12\% \times 2 = 24\%
 \end{aligned}$$

**Problem 13-29** (continued)

3. Total fixed cost:

Manufacturing overhead.....	\$1,750,000
Selling, general, and administrative [\$2,160,000 – (50,000 pads × \$5 variable per pad)] .	<u>1,910,000</u>
Total fixed cost.....	\$3,660,000

Variable cost per pad:

Direct materials .....	\$30
Direct labour .....	8
Variable manufacturing overhead.....	7
Variable selling .....	<u>5</u>
Total variable cost.....	<u>\$50</u>

To achieve the 24% ROI, the company would have to sell at least the 50,000 units assumed in part (2) above. The break-even volume can be computed as follows:

$$\begin{aligned} \text{Break-even point} &= \frac{\text{Fixed expenses}}{\text{Unit contribution margin}} \\ \text{in units sold} &= \frac{\$3,660,000}{\$140 \text{ per pad} - \$50 \text{ per pad}} \\ &= 40,667 \text{ pads} \end{aligned}$$