Answers to Problems

1. a. **Orlando**

TC = VC(X) + FC + initial investment
= ($14.7/unit)(800,000 units/year)(10 years)
+ ($12,000,000/year)(10 year) + $166,000,000
= $ 403,600,000

Olympia

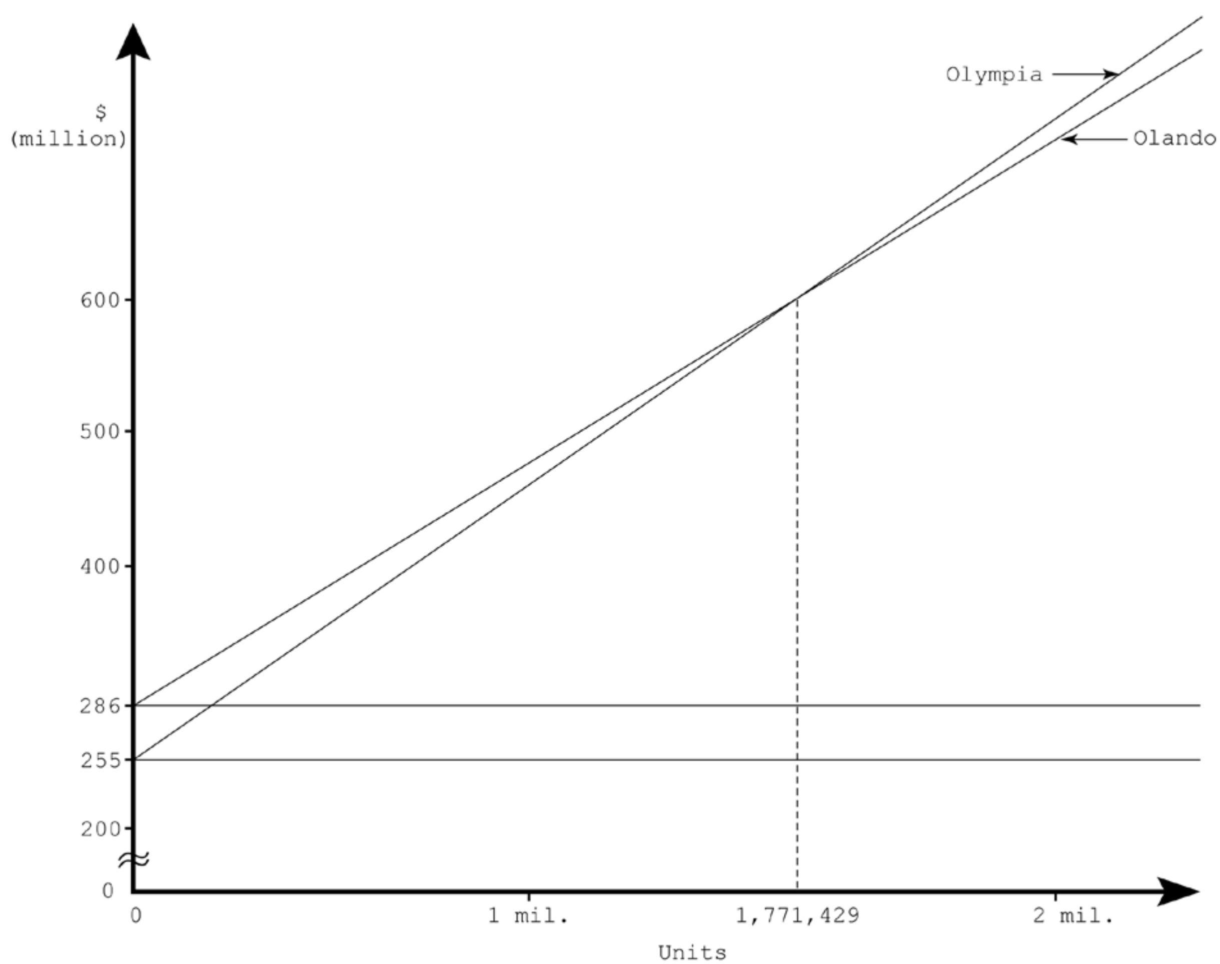
TC = ($16.45/unit)(800,000 units/year)(10 years)
+ ($11,000,000/year)(10 years) + $145,000,000
= $ 386,600,000

At 800,000 units per year for a ten year period, Olympia has the lower cost.

b. ($14.70)(10)(X) + $12,000,000(10) + $166,000,000
= ($16.45)(10)(X) + $11,000,000(10) + $145,000,000
147(X) + 286,000,000 = 164.5(X) + 255,000,000
17.5X = 31,000,000
X = 1,771,429 units

At an annual volume of 1,771,429 units, these facilities have equal costs.

c.



3. a.

	Weights	Oakland Raw Score	Oakland Weighted Score	Portland Raw Score	Portland Weighted Score	Seattle Raw Score	Seattle Weighted Score
Univ. Res.	50	4	200	2	100	2	100
Pool of Engineers	50	4	200	3	150	2	100
Management Education	40	2	80	3	120	3	120
Culture	20	1	20	2	40	3	60
Recreation	20	2	40	4	80	3	60
			540		490		440

b. The scale on this problem is different from the problem solved in the book. In the book, ten is considered the best score. In this problem, one is considered the best score. Seattle has the best score. Seattle's strengths are in the available pool of engineers and university research in aerospace. The difference between Seattle and Portland are probably not significant.

c. Given that the qualitative factors are about the same, Seattle could be recommended. At this point, it would be appropriate to determine if some important factor has been overlooked.

5. a. Unit cost for 1,000,000 transactions per year:

Total annual cost = Fixed costs + (Variable costs/unit)(Number of units)

$$= \$12{,}000{,}000 + \frac{(\$120/\text{hr.})}{(5{,}000 \text{ trans./hr.})} (1{,}000{,}000 \text{ trans.})$$

$$= \$12{,}024{,}000$$

Unit cost = Total annual cost/number of units produced
= (\$12,024,000/yr.)/(1,000,000 trans./yr.)
= \$12.02/trans.

b. Unit cost for 10,000,000 transactions per year:

$$\text{Total annual cost} = \$12{,}000{,}000 + \frac{(\$120/\text{hr.})}{(5{,}000 \text{ trans./hr.})} (10{,}000{,}000 \text{ trans.})$$

$$= \$12{,}240{,}000$$

Unit cost = Total annual cost/number of units produced
= (\$12,240,000/yr.)/(10,000,000 trans./yr.)
= \$1.22/trans.

c. Unit cost for 100,000,000 transactions per year:

$$\text{Total annual cost} = \$12{,}000{,}000 + \frac{(\$120/\text{hr.})}{(5{,}000\ \text{trans./hr.})}(100{,}000{,}000\ \text{trans.})$$

$$= \$14{,}400{,}000$$

Unit cost = Total annual cost/number of units produced
= ($14,400,000/yr.)/(100,000,000 trans./yr.)
= $0.14/trans.

d. High volume leads to low unit costs.

7. a. Spurance:
Total cost = Fixed costs + (Variable costs/unit)(No. produced)
= $3,500 + $1.25/unit(8,300 units)
= $13,875

Yamamoto:
Total cost = $8,000 + $0.85/unit(8,300 units)
= $15,055

The Spurance system has a lower cost if the demand is 8,300 briefcases per year.

b. Spurance:
Total cost = $3,500 + $1.25/unit(19,800 units)
= $28,250

Yamamoto:
Total cost = $8,000 + $0.85/unit(19,800 units)
= $24,830

If Slimline needs to stitch 19,800 cases per year, Yamamoto's system would have the lower cost.

c. Let X = No. of units produced for the two alternatives to have equal costs.

$$\$3{,}500 + \$1.25/\text{unit}\ (X) = \$8{,}000 + \$0.85/\text{unit}\ (X)$$
$$0.4\ X = 4{,}500$$
$$X = 11{,}250\ \text{units}$$

The indifference point is 11,250 units. Here the total costs of both alternatives are equal.

9. a. Old X-ray at 15,000:

Total cost = $40,000 + ($4.00/X-ray)(15,000 X-rays/yr.)

$= \$100,000$

New X-ray at 15,000:

Total cost $= \$120,000 + (\$1.00/\text{X-ray})(15,000 \text{ X-rays/yr.})$
$= \$135,000$

b. Old X-ray at 20,000:

Total cost $= \$40,000 + (\$4.00/\text{X-ray})(20,000 \text{ X-rays/yr.})$
$= \$120,000$

New X-ray at 20,000:

Total cost $= \$120,000 + (\$1.00/\text{X-ray})(20,000 \text{ X-rays/yr.})$
$= \$140,000$

c. Set the cost equations for each machine equal to each other and solve for X, which is the point where the two options have equal cost.

$$\$40,000 + (4.00/\text{X-ray})(X) = \$120,000 + (\$1.00/\text{X-ray})(X)$$
$$3(X) = 80,000$$
$$X = 26,667$$

11. a. To cover the overhead expenses:

$$X = \frac{P + FC}{C}$$

$$X = \frac{0 + \$7,000}{\$10/\text{visit}}$$

$$X = 700 \text{ visits/month}$$

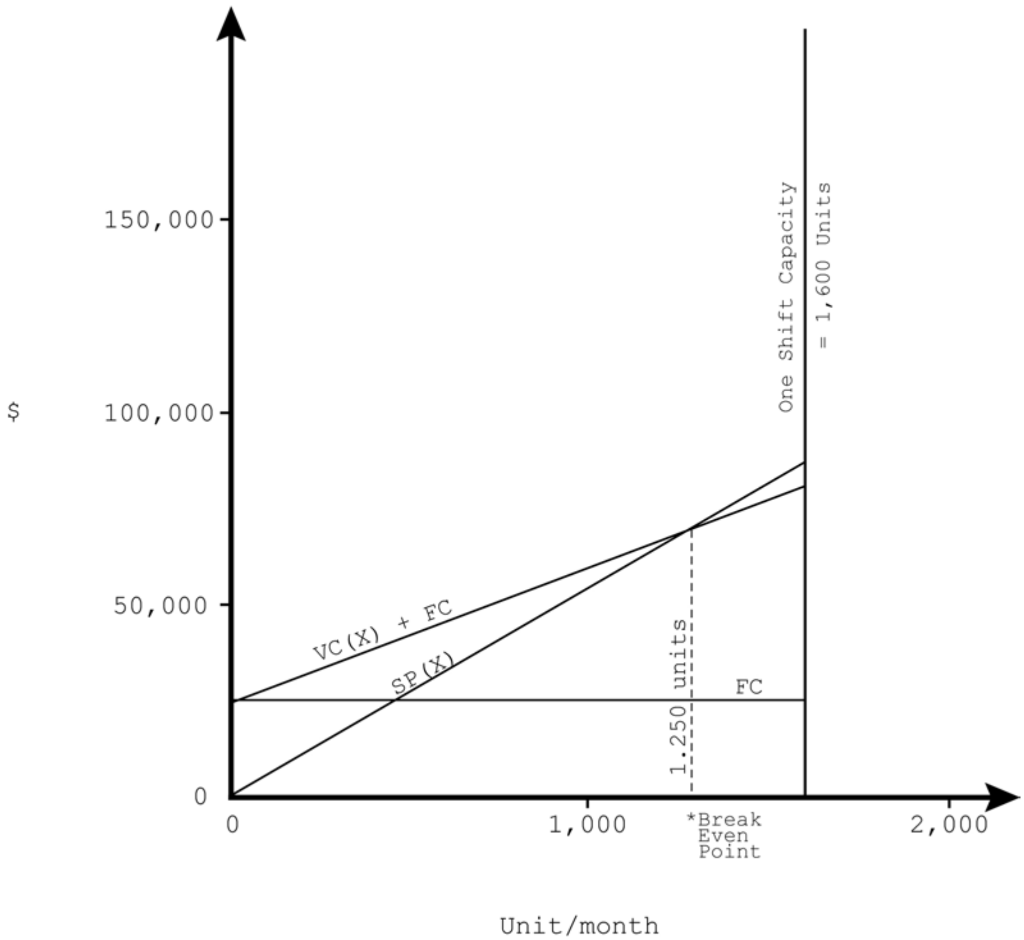
700 visits are needed to cover the overhead.

b.
$$X = \frac{\$3,000 + \$7,000}{\$10/\text{visit}}$$

$$X = 1,000 \text{ visits/month}$$

1,000 visits are needed to ensure a $3,000 profit.

13. a. For one shift:
SP = $55/unit
VC = $35/unit
FC = $25,000/month

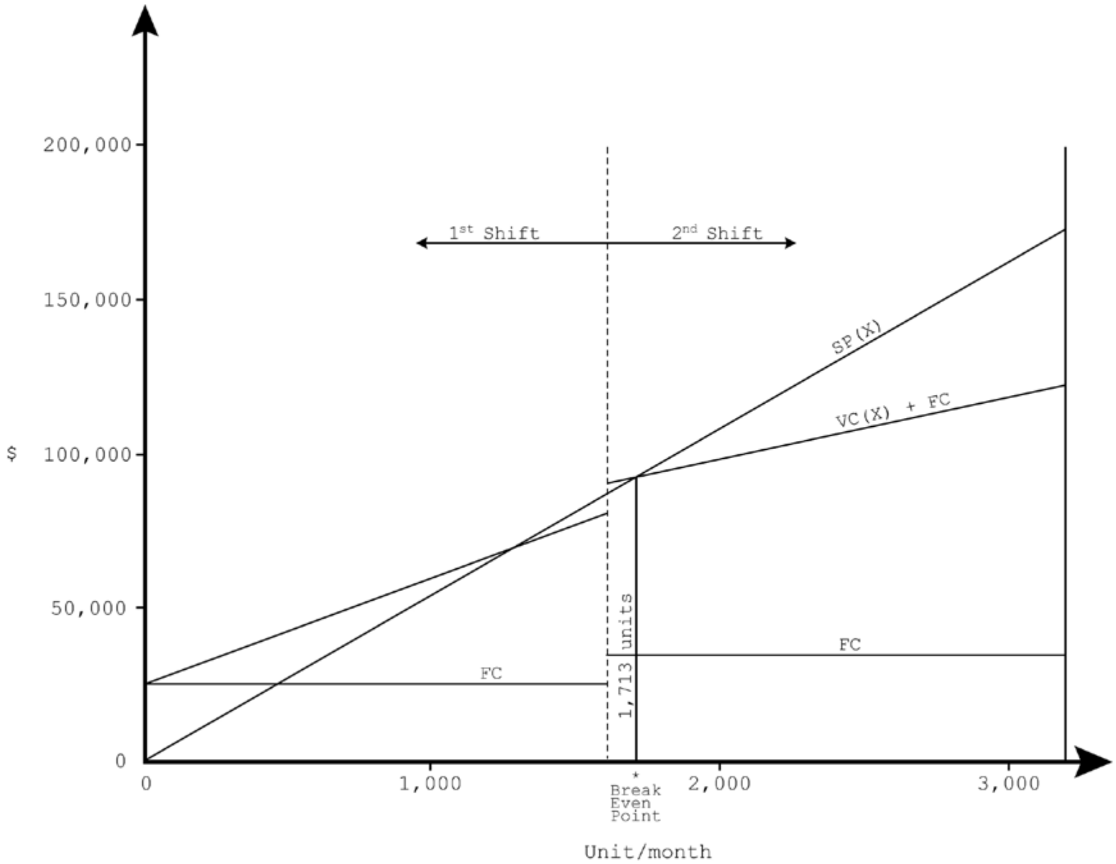


b. For two shifts:

Assume first shift capacity is used completely before the output from second shift is used.

SP = $55/unit

VC on First shift = $35.00/unit - $.50 saving in material
= $34.50/unit
VC on Second shift = $35.00/unit - $.50 + $1.00 shift differential
= $35.50/unit
FC = $35,000/month



c. To calculate the zero profit point in this case, it is necessary to use the following profit equation. (X = total units produced and sold)

```
      P = SP(X) - [FC + VC(X)]
      0 = $55/unit(X) - [$35,000 + $34.50/unit(1,600 units)
           + $35.50/unit(X - 1,600)]
        = 55(X) - 35,000 - 55,200 - 35.50(X) + 56,800
19.5(X) = 33,400
      X = 1,713 units/month
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d.

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$24,000 = $55/unit(X) - [$35,000 + $34.50/unit(1,600 units)
           + $35.50/unit(X - 1,600)]
$24,000 = 55(X) - 35,000 - 55,200 - 35.50(X) + 56,800
 19.5(X)= 57,400
      X = 2,944 units/month
```

e. If the price drops by $5.00 per unit, the zero profit point (break-even point) will increase.

```
      0 = $50/unit(X) - [$35,000 + $34.50/unit(1,600 units)
           + $35.50/unit(X - 1,600)]
      0 = 50(X) - 35,000 - 55,200 - 35.50(X) + 56,800
14.5(X) = 33,400
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$X = 2{,}303$ units/month

Also, it will no longer be possible to achieve a $24,000 monthly profit because the volume needed to generate this profit exceeds two shift capacity of 3,200 units/month.

$$\$24{,}000 = \$50/\text{unit}(X) - [\$35{,}000 + \$34.50/\text{unit}(1{,}600 \text{ units}) + \$35.50/\text{unit}(X - 1{,}600)]$$
$$\$24{,}000 = 50(X) - 35{,}000 - 55{,}200 - 35.50(X) + 56{,}800$$
$$14.5(X) = 57{,}400$$
$$X = 3{,}959 \text{ units/month}$$

15.

	Nuts	Bolts	Washers
Mix	.4	.4	.2
Contribution/unit	$.04	$.03	$.029

a. Calculate weighted contribution:

$$WC = \sum_{i=1}^{n} M_i(SP_i - VC_i)$$

$$WC = (\$.04/\text{unit})(.4) + (\$.03/\text{unit})(.4) + (\$.029/\text{unit})(.2)$$
$$= .016 + .012 + .0058$$
$$= .0338$$

$$X = \frac{P + FC}{WC}$$

$$X = \frac{0 + \$2{,}500{,}000}{\$.0338/\text{unit}}$$

$$X = 73{,}964{,}497 \text{ units}$$

73,964,497 units/year have to be produced to cover their costs.

73,964,497 units(.4) = 29,585,799 nuts
73,964,497 units(.4) = 29,585,799 bolts
73,964,497 units(.2) = 14,792,899 washers

b.
$$X = \frac{\$1{,}500{,}000 + \$2{,}500{,}000}{\$.0338/\text{unit}}$$

$$X = 118{,}343{,}195 \text{ units}$$

To report a $1,500,000 profit, 118,343,195 units must be produced.

118,343,195 units(.4) = 47,337,278 nuts
118,343,195 units(.4) = 47,337,278 bolts
118,343,195 units(.2) = 23,668,639 washers

c. If the price of a bolt is raised by $.01, its contribution/unit will be .10 - .06 = $.04/unit

$$
\begin{aligned}
WC &= (\$.04/unit)(.4) + (\$.04/unit)(.4) + (\$.029/unit)(.2) \\
&= .016 + .016 + .0058 \\
&= \$.0378/unit
\end{aligned}
$$

$$X = \frac{P + FC}{WC}$$

$$X = \frac{\$1,500,000 + \$2,500,000}{\$.0378/unit}$$

$$X = 105,820,106 \text{ units}$$

The volume required would be reduced from 118,343,195 to 105,820,106 units each year.

105,820,106 units(.4) = 42,328,042 nuts
105,820,106 units(.4) = 42,328,042 bolts
105,820,106 units(.2) = 21,164,021 washers