Management Accounting Information for Decision Making 7th edition Atkinson Solutions Manual

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Chapter 2

Using Costs in Decision Making

QUESTIONS

2-1. Cost information is used in pricing, product planning, budgeting, performance evaluation, and contracting. Examples of specific uses of cost information include deciding whether to introduce a new product or discontinue an existing product (given the price structure), assessing the efficiency of a particular operation, and assessing the cost of serving customer segments

2-2. Variable costs are costs that increase proportionally with changes in the activity level of some variable. Fixed costs are costs that in the short run do not vary with a specified activity. Fixed costs depend on how much of the resource (capacity) is acquired, rather than on how much is used.

2-3. Hospital variable costs are costs that vary proportionally with some underlying level of activity such as number of lab tests (test chemicals used), number of patient admissions (patient arm identification bands produced), number of surgeries (operating room single use surgical supplies), and number of fractures treated (plaster or fiberglass and splints used to prepare casts).

2-4. University fixed costs are those that do not vary with some underlying level of activity such as number of students enrolled or number of courses offered. Examples include depreciation on university buildings, most administrative costs, most faculty salaries, and most clerical costs.

2-5. A mixed cost is one that is partially fixed and then becomes variable with some underlying level of activity. One example is jet fuel – the fixed portion being the cost of the fuel to fly the jet empty while the variable portion will depend on the load carried by the aircraft.

2-6. When the cost object is a unit of production depreciation will be a fixed cost since it is not caused by the unit of production but rather it is an allocation of a portion of the historical cost of the asset. If the machine is used exclusively to produce one type of product the cost is direct to that product line.

2-7. Contribution margin per unit, which is the difference between revenue per unit and variable cost per unit, is the contribution that each unit makes to covering fixed costs and generating a profit. The contribution margin is therefore an important component of the equation to determine the breakeven point and to understand the effect on profit of proposed changes, such as changes in sales volume in response to changes in advertising or sales prices.

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2-8. Contribution margin per unit is the difference between revenue per unit and variable cost per unit. The contribution margin per unit indicates how much the total contribution margin will increase with an additional unit of sales. The contribution margin ratio expresses a similar idea, but as a percentage of sales dollars. Specifically, the contribution margin ratio is the total contribution margin divided by total sales dollars (or contribution margin per unit divided by sales price per unit), and indicates how much the total contribution margin increases with an additional dollar of sales revenue.

2-9. In evaluating whether a business venture will be profitable, the breakeven point is the volume at which the profit equals zero, that is, revenues equal total costs.

2-10. Many organizations use breakeven point as a proxy for risk. The risk of operating at a loss increases as the expected unit sales approach the breakeven point.

2-11. The relevant range refers to the expected range of activity (such as units produced) over which an organization expects to operate. The relevant range idea allows organizations to develop better estimates of costs, both fixed and variable.

2-12. In multi-product cost-volume-profit analysis the constant product mix assumption is needed to develop unique unit sales levels needed to breakeven or achieve a target income. Absent the constant product mix assumption there will be many possible sales levels that can achieve the target profit.

2-13. The contribution margin will increase as the price increases. Therefore the ratio of fixed cost to contribution margin, which identifies the breakeven sales level, will fall. (If you have taken a calculus course you should be able to show that the effect of a price increase on unit sales needed to achieve a given target is target profit/(contribution margin*(1-t)2)

2-14. As the tax rate increases more of the organization's income will be taxed away. Therefore the pre-tax income target will increase in turn increasing the number of units that need to be sold to achieve the target after tax income.

2-15. When a product's price increases the sales quantity needed to achieve a target income will fall. However, the approach to multi-product cost-volume-profit analysis used in this text assumes a constant product mix. This assumption means that when the price of one product increases the target sales of all products will fall.

2-16. The organization has replaced a variable cost (employee wages) with a fixed cost (machine depreciation). Variable cost decreases when production falls but a fixed cost does not. Therefore when demand and production fall variable costs will decline but not fixed costs. Therefore organization risk has increased.

2-17. Organizations use what-if analysis to estimate the effect of changes on the outcome of those changes. Examples include: modelling the effect on cash flows as credit collection policies change, modelling the effect of price and cost changes on income, modelling the effect of changes in the organization's environment (such as competition or economic climate) on income.

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EXERCISES

2-18 (a) Fixed
(b) Variable
(c) Fixed
(d) Fixed
(e) Fixed
(f) Variable
(g) Fixed or variable (if number of production hours worked can vary in the short run);
(h) Fixed
(i) Variable
(j) Fixed

2-19. (a) Variable
(b) Fixed
(c) Fixed or variable (if number of billing clerks can vary in the short run)
(d) Fixed
(e) Fixed
(f) Fixed
(g) Variable
(h) Fixed
(i) Fixed

2-20.

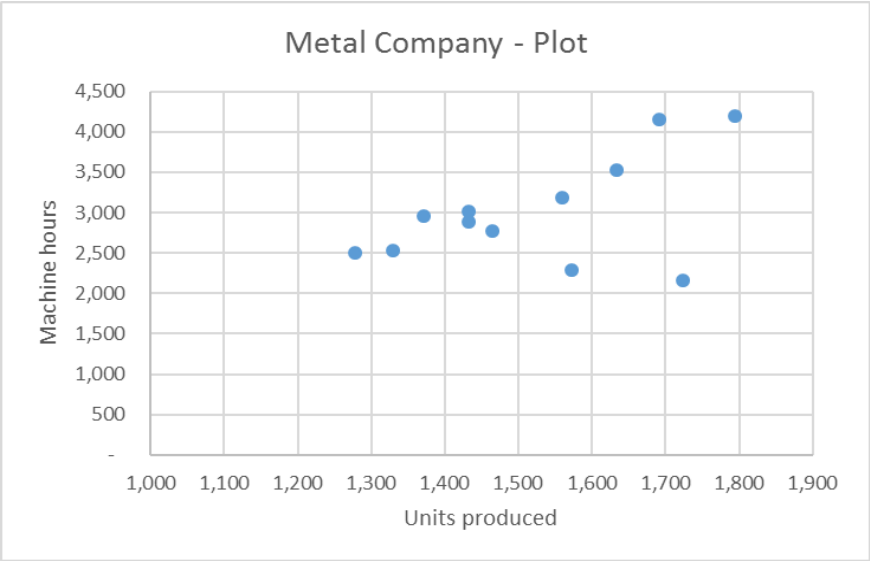
Burger ingredients	Variable
Cooks' wages	Fixed
Server's wages	Fixed
Janitor's wages	Fixed
Depreciation on cooking equipment	Fixed
Paper supplies (wrapping, napkins, and supplies)	Variable
Rent	Fixed
Advertisement in local newspaper	Fixed

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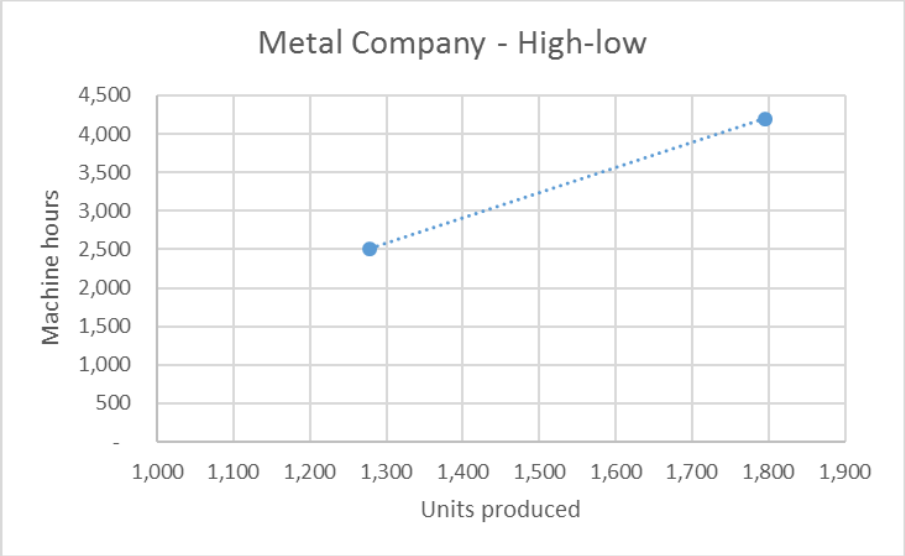
2-21 Metal Company

a) Plot



This plot is labelled "Scatter" in Excel spreadsheets and "XY (Scatter)" in Open Office (points only).

b) High-low method



The pairs for lowest and highest levels of activity are (1,278, 2,507) and (1,795, 4,200) respectively.

The plot represents the line between the two pairs for those extreme levels of activity.

Therefore, the slope of the high-low charge will be:

$$\text{Slope} = \frac{4{,}200 - 2{,}507}{1{,}795 - 1{,}278} = 3.2747 \; machine\ hour\ per\ unit\ produced$$

$$\text{Total machine hours (MH)} = \text{Variable MH} + \text{Fixed MH}$$

$$= \text{Variable MH per unit produced} * \text{Units produced} + \text{Fixed MH}$$

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$$= 3.2747 * \text{Units produced} + \text{Fixed MH}$$

Fixed machine hours = Total MH - 3.2747 * Units produced = 4,200 - 3.2747 * 1,795 = -1,678

Total machine hours = 3.2747 * Units produced - 1,678

c) This exercise in curve fitting has no objective solution. However, students can compare the result of their estimate to the regression equation, which is:

Total machine hours = 2.0935 * Units produced - 173.92

This result provides a good opportunity to illustrate to students the danger of going outside the range of activity to estimate costs. The fixed cost in this range of activity appears to be approximately $2,500.

How to estimate the total machine hours equation?

Method 1: Determine the Slope and the Intercept of the Equation

Week	Units produced	Machine hours
1	1,692	4,153
2	1,330	2,529
3	1,559	3,184
4	1,633	3,531
5	1,432	2,893
6	1,572	2,282
7	1,372	2,955
8	1,433	3,016
9	1,795	4,200
10	1,464	2,772
11	1,723	2,166
12	1,278	2,507

Slope	2.0935	=SLOPE(C2:C13,B2:B13)
Intercept	-173.92	=INTERCEPT(C2:C13,B2:B13)

Total machine hours = 2.0935 * Units produced - 173.92

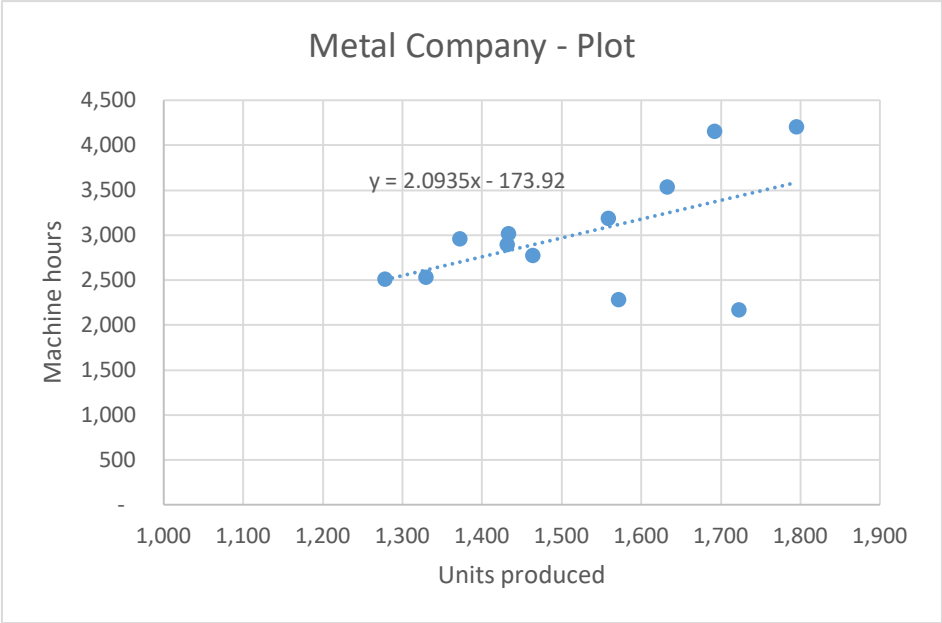
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Or

Method 2: Equation of the Scattered Plot's Trend Line

Work from the scattered plot from Question a). Insert a trend line, and tick the box to show its equation on the plot.



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Or

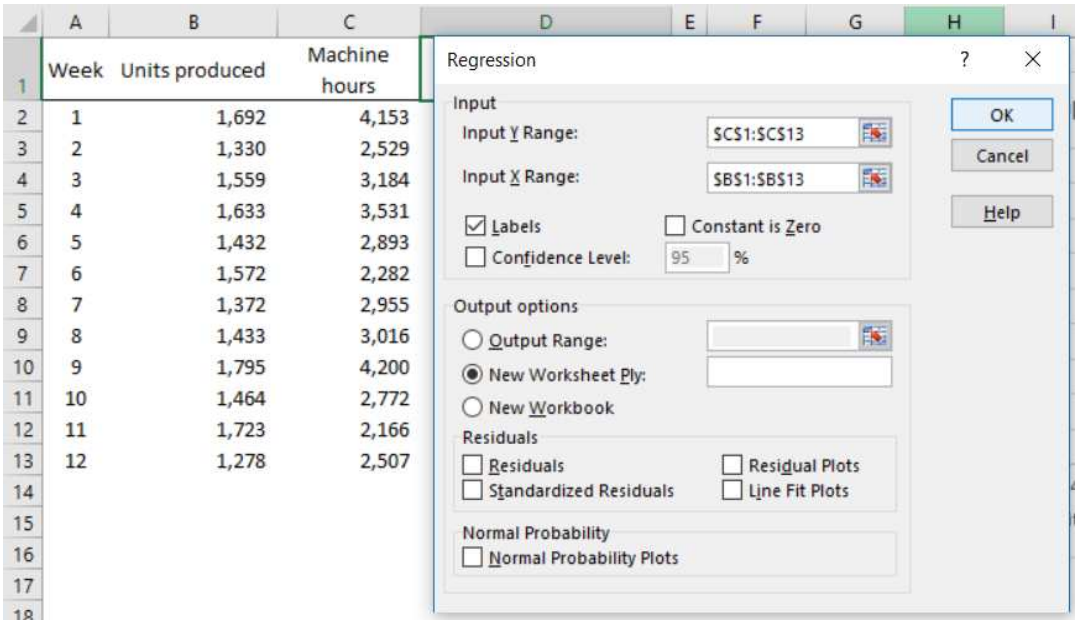
Method 3: Run a regression in a spreadsheet (ex. Excel).
(You do not have to know how to do this; it is for your knowledge.)

In Excel, you might need to activate the analysis tool pack to be able to run regressions and other variance analyses.

- Go to: File > Options > Add-ins > Manage: Excel Add-ins > Go
- Tick box « Analysis Toolpak » > OK

Run the regression in Excel:

- Go to: Data > (Analysis >) Data Analysis > Regression
- Input Y Range: Choose the dataset of the dependent variable (here, the machine hours)
  Input X Range: Choose the dataset of the independent variable (here, the units)
  If you selected the column heads, tick « Labels »



Week	Units produced	Machine hours
1	1,692	4,153
2	1,330	2,529
3	1,559	3,184
4	1,633	3,531
5	1,432	2,893
6	1,572	2,282
7	1,372	2,955
8	1,433	3,016
9	1,795	4,200
10	1,464	2,772
11	1,723	2,166
12	1,278	2,507

The output notably displays the two coefficients we need to estimate the total machine hours:

Regression Statistics	
Multiple R	0.520564
R Square	0.270987
Adjusted R Square	0.198086
Standard Error	593.0205
Observations	12

Total machine hours = 2.0935 * Units produced - 173.92

ANOVA

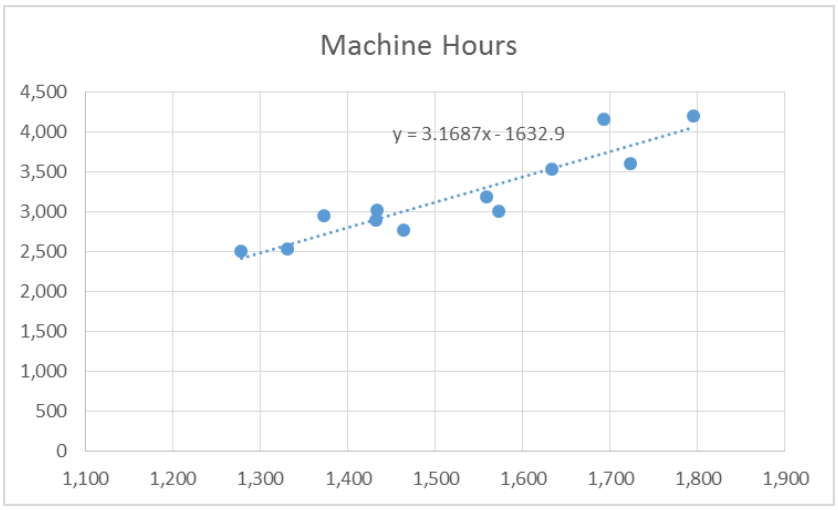
	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	1307232	1307232	3.717177	0.082707852
Residual	10	3516733	351673.3		
Total	11	4823965			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-173.918	1663.184	-0.10457	0.918785	-3879.7236	3531.887	-3879.72	3531.887
Units produced	2.093476	1.085829	1.927998	0.082708	-0.32590127	4.512853	-0.3259	4.512853

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2-22. a) Hours



Units

b) Answers will vary.

2-23. a) The regression results suggest that each chair requires approximately 2.635 labor hours and each table requires 6.52 labor hours.

With a production plan of 500 chairs and 150 tables:
Total budgeted labor hours = 500 * 2.635 + 150 * 6.515 = 2,295 hours

With labor priced at $30 per hour the budgeted cost would be $68,850 (2295 * $30)

b) The number of observations, the r-squared, and t statistics associated with this estimate all seem reasonable implying that the confidence in this result would be well placed.

c) Other information would relate to whether the proposed level of operations is within previous levels, whether any changes in production technology are planned, whether there is any reason to expect that labor will be more or less in the upcoming period, and whether the budgeted labor rate is reasonable.

2-24. Contribution margin per unit = $10-2-3-1.5 = $3.50
Breakeven sales quantity = $5,000,000/$3.50 = 1,428,572 (rounded up)

2-25. Contribution margin per unit = $25-8.60-3.60-1.80 = $11.00
Total fixed cost $5,000,000 + $2,500,000 = $7,500,000
Target profit = $500,000
Unit sales required = ($7,500,000 + $500,000)/11 = 727,273 (rounded up)
Dollar sales required = 727,273 * 25 = $18,181,825

Alternatively:
Contribution margin ratio = 11/25
Dollar sales required = ($7,500,000 + $500,000) / (11/25) = 18,181,818*
*difference due to rounded "unit sales required"

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2-26. a) Contribution margin per unit = $1,000 – $500 – $100 = $400
Contribution margin ratio = (Contribution margin)/Sales = $400/$1,000 = 0.40

b) Let Q = the number of units sold to break even
Sales revenue – Costs = Income
(Price * Quantity) – Variable costs – Fixed costs = Income
$1,000Q – $600Q – $3,500,000 = $0
$400Q – $3,500,000 = 0
Q = 8,750 units

c) Because the variable cost per unit will decrease, the contribution margin per unit will increase. The breakeven point equals (fixed costs)/(contribution margin), so the breakeven point will decrease. Specifically, the new contribution margin per unit is $1,000 – $450 – $100 = $450 and the new breakeven point is $3,500,000/$450 = 7,778 units (rounded).

2-27. Let Q = the number of units sold to achieve target profit
Sales revenue – Costs = Income
Target income is 10% of sales dollars = 10% x price x quantity
(Price * Quantity) – Variable costs – Fixed costs = 10% * (Price * Quantity)
$6Q - $4.5Q - $5,400,000 = 10% * $6 x Q
0.9Q = $5,400,000 Q = 6,000,000 units

2-28. a) Let R = sales dollars necessary for a before-tax target profit of $250,000
The contribution margin ratio = ($1,260,000 – $570,000)/$1,260,000 = 0.547619 (rounded).
Sales revenue – Variable costs – Fixed costs = Income
Contribution margin – Fixed costs = Income
0.547619 R – $480,500 = $250,000
R = ($250,000 + $480,500)/0.547619
R = $1,333,956.64

b) Let R = sales dollars necessary to break even
Contribution margin – Fixed costs = 0
0.547619 R – $480,500 = $0
R = $480,500/0.547619
R = $877,434.86

2-29. a) Estimated revenue per full one-way flight: $50,000
Variable cost per full one-way flight: $45,000
Load factor to break even 90%: ($45,000/$50,000)

b) Fixed cost: $1,000,000
Target pre-tax profit: $250,000
Average load factor: 95%

Contribution margin per one-way flight at 95% load factor: $2,500 ($50,000 * 95% - $45,000)

Contribution margin per round-trip flight at 95% load factor: $5,000 ($2,500 * 2)

Required number of round-trip flights at 95% load factor:
250 ([$1,000,000 + $250,000]/$5,000)

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2-30.

Variable Costs	
Carpenter labor to make shelves	$600,000
Wood to make the shelves	450,000
Sales commissions based on number of units sold	180,000
Miscellaneous variable manufacturing overhead	350,000
Total variable costs	$1,580,000
Variable Cost per Unit ($1,580,000)/50,000	$31.60
Contribution Margin per Unit ($70.00 - $31.60)	$38.40
Fixed Costs	
Sales staff salaries	$80,000
Office and showroom rental expenses	150,000
Depreciation on carpentry equipment	50,000
Advertising	200,000
Miscellaneous fixed manufacturing overhead	150,000
Rent for the building where the shelves are made	300,000
Depreciation for office equipment	10,000
Total fixed costs	$940,000
Sales Units Required to Earn a Target Profit of $500,000 ($940,000 + $500,000)/$31.60	45,570 (rounded up)

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2-31. a)

	Alligators		Dolphins		Total
Units sold	140,000		60,000		200,000
Sales mix percentage*	70.00%		30.00%		
		Weighted average**		Weighted average**	Sum of weighted averages
Sales price per Unit	$20.00	$14.00	$25.00	$7.50	$21.50
Variable costs per Unit	8.00	5.60	10.00	3.00	8.60
Unit CM	$12.00	$8.40	$15.00	$4.50	$12.90
* 140,000/(140,000 + 60,000) = .7; 60,000/(140,000 + 60,000) = .3					
** $20 × .7 = $14; $8 × .7 = $5.60; $25 × .3 = $7.50; $10 × .3 = $3					

Breakeven units = $1,290,000/$12.90 = 100,000 units. Of these, 100,000 × 0.7 = 70,000 will be alligators and 100,000 × 0.3 = 30,000 will be dolphins.

b)

	Alligators		Dolphins		Total
Units sold	60,000		140,000		200,000
Sales mix percenta	30.00%		70.00%		
		Weighted average**		Weighted average**	Sum of weighted averages
Sales price	$20.00	$6.00	$25.00	$17.50	$23.50
Variable costs	8.00	2.40	10.00	7.00	9.40
Unit CM	$12.00	$3.60	$15.00	$10.50	$14.10
* 60,000/(140,000 + 60,000) = .3; 140,000/(140,000 + 60,000) = .7					
** $20 × .3 = $6; $8 × .3 = $2.40; $25 × .7 = $17.50; $10 × .7 = $7					

Breakeven units = $1,290,000/$14.10 = 91,489.36, which we round up to 91,490 units. Of these, 91,490 × 0.3 = 27,447 will be alligators and 91,490 × 0.7 = 64,043 will be dolphins.

c) In part (b), the sales mix percentage for the higher-CM product (dolphins) is greater than in part (a). Consequently, fewer total units are required to break even (91,490 in part (b) versus 100,000 in part (a)).

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2-32.

	Alpha		Beta		Total
Units sold	1		3		4
Sales mix percenta	25.00%		75.00%		
		Weighted average**		Weighted average**	Sum of weighted averages
Unit CM	$7.00	$1.75	$3.00	$2.25	$4.00
* 1/(1 + 3) = .25; 3/(1+ 3) = .75					
** $7 × .25 = $1.75; $3 × .75 = $2.25					

Breakeven units = ($3,000,000+$1,800,000)/$4.00 = 1,200,000 units. Of these, 1,200,000 × 0.25 = 300,000 will be Alphas and 1,200,000 × 0.75 = 900,000 will be Betas.

2-33.

	Start		End		Total
Units sold	2		3		5
Sales mix percentage*	40.00%		60.00%		
		Weighted average**		Weighted average**	Sum of weighted averages
Unit CM	$8.00	$3.20	$10.00	$6.00	$9.20
* 2/(2 + 3) = .40; 3/(2+ 3) = .60					
** $8 × .4 = $3.20; $10 × .6 = $6.00					

Breakeven units = $9,200,000/$9.20 = 1,000,000 units. Of these, 1,000,000 × 0.4 = 400,000 will be Starts and 1,000,000 × 0.6 = 600,000 will be Ends.

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2-34.

	Owl	Cardinal	Blue jay	
Selling Price	$45.00	$57.00	$62.00	
Variable Cost	23.00	37.00	45.00	
Contribution Margin	$22.00	$20.00	$17.00	
Budget Unit Sales	20,000	10,000	15,000	45,000
Fixed Cost				$700,000
Sales Mix Percentage	44.44%	22.22%	33.33%	
WACM (contribution margin * %)	$9.78	$4.44	$5.67	$19.89

Total unit sales to breakeven = Fixed Cost/weighted average contribution margin
= 700,000/19.89 = 35,194 (rounded up)

2-35.

	X	Y	Z	
Contribution Margin	$6.00	$7.50	$10.00	
Sales Mix Percentage	30.00%	60.00%	10.00%	
WACM (contribution margin * %)	$1.80	$4.50	$1.00	$7.30
Total Sales Required to Breakeven				
Fixed Cost/Weighted Average Contribution Margin				150,000
(1,095,000 / 7.30)				
Breakeven Product Sales	45,000	90,000	15,000	

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2-36. a)

	Costing Projects		Transfer Pricing Projects		Total
Total Projects	50		75		125
Sales mix percentage*	40.00%		60.00%		
		Weighted average**		Weighted average**	Sum of weighted averages
Revenue per Job	$10,000	$4,000	$15,000	$9,000	$13,000
Variable Cost per Job	4,500	1,800	11,500	6,900	8,700
Job Contribution Margin	$5,500	$2,200	$3,500	$2,100	$4,300
* 50/(50 + 75) = .4; /(75/(50+75)) = .6					
** $5,500 × .4 = $2,200 $3,500 × .6 = $2,100					

Breakeven required sales = $473,000/$4,300 = 110. Of these, 111 × 0.6 = 66 will be Transfer Pricing projects and 110 × 0.4 = 44 (rounded) will be Costing projects.

b) Required sales to earn a target profit of $86,000 = $(473,000+$86,000)/$4,300 = 130. Of these, 130 × 0.6 = 78 will be Transfer Pricing projects and 130 × 0.4 = 52 will be Consulting projects.

2-37. Using the text formula

$$\text{Required unit sales} = \frac{\dfrac{\text{target after-tax profit}}{1 - \text{tax rate}} + \text{fixed cost}}{\text{contribution margin per unit}}$$

$$\text{Required unit sales} = \frac{\dfrac{\$2{,}100{,}000}{1 - .3} + \$3{,}000{,}000}{\$10 - \$7} = 2{,}000{,}000$$

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2-38. a) Using the text formula

$$\text{Required unit sales} = \frac{\frac{\text{target after-tax profit}}{1 - \text{tax rate}} + \text{fixed cost}}{\text{contribution margin per unit}}$$

$$\text{Required unit sales} = \frac{\frac{\$0}{1 - .3} + \$400{,}000}{\$5 - \$4} = 400{,}000$$

b) Using the text formula

$$\text{Required unit sales} = \frac{\frac{\text{target after-tax profit}}{1 - \text{tax rate}} + \text{fixed cost}}{\text{contribution margin per unit}}$$

$$\text{Required unit sales} = \frac{\frac{\$140{,}000}{1 - .3} + \$400{,}000}{\$5 - \$4} = 600{,}000$$

2-39. Revenue – Variable Cost – Fixed Cost * (1 – tax rate) = after tax income
Let v be the variable cost per unit

($200 * 100,000 – v * 100,000 – 10,000,000)* (1-.25) = $600,000

20,000,000 – 100,000v – 10,000,000 = 800,000

v = $92.00 per unit

2-40. a) Contribution Margin per unit = $30-7-6-2-3 = $12.00

After tax income = (500,000*12 – 4,500,000)*(1-.3) = $1,050,000

b) Breakeven unit sales = $\frac{4{,}500{,}000}{12} = 375{,}000$

c) Contribution Margin per unit = $28-7-6-2-2.8 = $10.20

After tax income = ((500,000*1.1*10.20) – 4,500,000)*(1-.3) = $777,000

Income will fall by $273,000 if this decision is undertaken.

d) Contribution Margin per unit = $30-6.3-5.4-1.8-3 = $13.50

Let x be the annual ceiling rental paid for the machine

After tax income = ((500,000*13.50) – 4,500,000 - x)*(1-.3) = $1,050,000

x = $750,000

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2-41. a)

$$\text{BE} = \frac{280{,}000}{(2.80 - 2.10)} = 400{,}000 \text{ kilometers}$$

b)

$$\text{Target} = \frac{280{,}000 + 70000}{(2.80 - 2.10)} = 500{,}000 \text{ kilometers}$$

c)

$$\text{Target} = \frac{\frac{29{,}400}{(1 - .3)} + 280{,}000}{(2.80 - 2.10)} = 460{,}000 \text{ kilometers}$$

d) Let x be the number of kilometers at which Maureen would be indifferent

2.1x + 280,000 = 1.9x + 380,000: x = 500,000 kilometers

Alternatively:

Let X be the number of units, Vi be the variable inside cost, Fi be the fixed inside cost, Vo be the variable outside cost, and Fo be the outside fixed cost.

Inside cost = XVi + Fi : Outside cost = XVo + Fo

Set inside cost equal to outside cost

XVi + Fi = XVo + Fo

X * (Vi – Vo) = Fo – Fi

X = (Fo – Fi)/(Vi – Vo) = (380,000 – 280,000)/(2.1 −1.9) = 500,000

The intuition is this is how many units of X it takes for the variable cost savings to recover the fixed cost increment. Beyond this the outside option is preferred.

2-42. a) Contribution margin per unit = $20-5-6-1 = $8

Planned income = 2,000,000 * $8 - $8,000,000 - $2,400,000 = $5,600,000

b)

$$\text{Target} = \frac{8{,}000{,}000 + 2{,}400{,}000}{(20 - 12)} = 1{,}300{,}000$$

c)

$$\text{Target} = \frac{\frac{2{,}100{,}000}{(1 - .3)} + 10{,}400{,}000}{(20 - 12)} = 1{,}675{,}000$$

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2-43. a) Contribution margin per unit = $30 – $19.50 = $10.50

Contribution margin ratio = (Contribution margin)/Sales = $10.50/$30 = 0.35

b) Let Q = the number of units sold to break even

Sales revenue – Costs = Income

(Price * Quantity) – Variable costs – Fixed costs = Income

$30Q – $19.50Q – $147,000 = $0
$10.50Q – $147,000 = 0
Q = 14,000 units

c) Let X = the number of units sold to generate revenue necessary to earn pre-tax income of 20% of revenue

Sales revenue – Costs = Income

(Price × Quantity) – Variable costs – Fixed costs = Income

$30X – $19.50X – $147,000 = 0.2 × $30X
$10.50X – $147,000 = $6X
X = 32,667 units (rounded)

Desired revenue = $30X = $30 × 32,667 = $980,010

Alternatively, let R = sales revenue necessary to earn pre-tax income of 20% of revenue

Sales revenue – Variable costs – Fixed costs = Income

R – 0.65R – $147,000 = 0.2R
R = $147,000/0.15 = $980,000

d) Let Q = the number of units sold to generate after-tax profit of $109,200

(Before-tax income) / (1 – 0.35) = $109,200

Before-tax income = $109,200/0.65 = $168,000

$30Q – $19.50Q – $147,000 = $168,000
$10.50Q = $315,000
Q = $315,000/$10.50 = 30,000 units

e) Let Q = necessary increase in sales units

Incremental sales revenue – Incremental variable costs – Incremental fixed costs = $0

$30Q – $19.50Q – $38,500 = $0
Q = 3,667 units (rounded)

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2-44. a)

$$\text{Break Even Quantity} = \frac{1{,}000{,}000 + 500{,}000}{6} = 250{,}000 \text{ units}$$

b)

$$\text{Quantity Required} = \frac{1{,}000{,}000 + 500{,}000 + 300{,}000}{6} = 300{,}000 \text{ units}$$

c)

	Gripper	Gripper Plus	Total
Total Units	300,000	100,000	400,000
Contribution Margin	$6.00	$10.00	
Sales mix percentage*	75.00%	25.00%	
Weighted Average Contribution Margin	$4.50	$2.25	$7.00

*300/(300 + 100) = 0.75
100/(300 + 100) = 0.25

$$\text{Required Total Sales} = \frac{\frac{187{,}500}{(1-.25)} + 1{,}500{,}000}{7.00} = 250{,}000$$

Gripper sales = 250,000 x 0.75 = 187,500

Gripper plus sales = 250,000 x 0.25 = 62,500

2-45. a)

$$\text{Breakeven Quantity} = \frac{450{,}000 + 500{,}000}{(90 - 20 - 15 - 6 - 9)} = 23{,}750$$

b)

$$\text{Required Unit Sales} = \frac{\frac{120{,}000}{(1-.25)} + 950{,}000}{40} = 27{,}750$$

2-46. a)

	Bric	Brac	Total
Total Units	800,000	400,000	1,200,000
Contribution Margin	$11.00	$13.00	
Budget Total Contribution Margin			$14,000,000
Fixed Costs			10,000,000
Expected Profit			$4,000,000
Sales mix percentage	66.67%	33.33%	
Weighted Average Contribution Margin			$11.6667

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b)

Breakeven Total Sales = $\frac{10{,}000{,}000}{11.6667} = 857{,}140$ (rounded)

Bric sales = 857,140 * 2/3 = 571,427 (rounded)

Brac sales = 857,140 * 1/3 = 285,713 rounded)

c)

Required Total Sales = $\frac{\frac{910{,}000}{(1-.3)} + 10{,}000{,}000}{11.6667} = 968{,}569$ (rounded)

Bric sales = 968,569 * 2/3 = 645,713 (rounded)

Brac sales = 968,569 * 1/3 = 322,856 rounded)

2-47. a)

	Regular	Custom	Deluxe	
Selling Price	$13.00	$18.00	$21.00	
Variable Cost	6.00	9.00	15.00	
Contribution Margin	$7.00	$9.00	$6.00	
Budget Unit Sales	13,000	10,000	8,000	31,000
Fixed Cost				$200,000
Sales Mix Percentage	41.94%	32.26%	25.81%	
Weighted Average Contribution Margin	$2.9355	$2.9032	$1.5484	$7.3871

Total Units Needed to Breakeven = $\frac{200{,}000}{7.3871} = 27{,}074$

Regular Units = 27,074 * (13000/31000) = 11,354 (rounded)

Custom Units = 27,074 * (10000/31000) = 8,734 (rounded)

Deluxe Units = 27,074 * (8000/31000) = 6,987 (rounded)

b)

Required Unit Sales = $\frac{\frac{50{,}000}{(1-.3)} + 200{,}000}{7.3871} = 36{,}744$

Regular Units = 36,744 * (13000/31000) = 15,409 (rounded)

Custom Units = 36,744 * (10000/31000) = 11,853 (rounded)

Deluxe Units = 36,744 * (8000/31000) = 9,482 (rounded)

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2-48. Product Contribution Margin per unit = $0.40 - $0.25 = $0.15

a) Current Monthly Profit = 1,000,000 * 0.15 - $60,000 = $90,000

Target new monthly profit = $135,000 (90,000 * 1.5)

New Monthly Income pre Advertising cost with sales doubled = 2,000,000 * 0.15 – 60,000 = 240,000

Maximum that can be spent on advertising = $240,000 - $135,000 = $105,000

b) In order to keep the same breakeven point with fixed costs constant the contribution margin must remain the same. Therefore if the variable cost increases by $0.30 the price must increase by $0.30.

c) Let Q be the required number of units

0.5Q - .25Q – 60,000 = 90,000
0.25Q = $150,000
Q = 600,000

2-49. a) Breakeven point old machine = $120,000/(18-14) = 30,000 units

Breakeven point new machine = $240,000/(20-14) = 40,000 units

b) Revenue – Variable costs – Fixed Cost = 10% revenue

Let Q be the required sales

20Q – 14Q – 240000 = 20Q * 10%
4Q = 240000
Q = 60,000 units

c) Let Q be the sales level

(18-14)Q – 120000 = (20-14)Q – 240000
2Q = 120,000
Q = 60,000

d) Because the new machine has higher fixed costs it is the higher risk alternative

e) Let Q by the sales level. Set the profit to sales ratio for the two machines equal

$$\frac{(18-14)\text{Q}-120000}{18\text{Q}} = \frac{(20-14)\text{Q}-240000}{20\text{Q}}$$

Multiply both sides of the equation by Q and then solve for Q

Q = 68,571

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2-50. Initial Position

	Standard	Deluxe	Pro	Total
Unit Sales	100,000	50,000	50,000	
Sales Price per Unit	$30.00	$40.00	$50.00	
Variable Manufacturing Cost per Unit	17.00	20.00	25.00	
Variable Selling Cost per Unit	3.00	4.00	5.00	
Contribution Margin per Unit	$10.00	$16.00	$20.00	
Total Contribution Margin	$1,000,000	$800,000	$1,000,000	$2,800,000

a) Income will drop by $44,000 relative to the base case

	Standard	Deluxe	Pro	Total
Unit Sales	95,000	65,000	50,000	
Sales Price per Unit	$30.00	$36.00	$50.00	
Variable Manufacturing Cost per Unit	17.00	20.00	25.00	
Variable Selling Cost per Unit	3.00	3.60	5.00	
Contribution Margin per Unit	$10.00	$12.40	$20.00	
Total Contribution Margin	$950,000	$806,000	$1,000,000	$2,756,000

b) Income will increase by $6,000 over the base case

	Standard	Deluxe	Pro	Total
Unit Sales	102,000	51,000	51,000	
Sales Price per Unit	$30.00	$40.00	$50.00	
Variable Manufacturing Cost per Unit	17.00	20.00	25.00	
Variable Selling Cost per Unit	3.00	4.00	5.00	
Contribution Margin per Unit	$10.00	$16.00	$20.00	
Total Contribution Margin	$1,020,000	$816,000	$1,020,000	$2,856,000
Less Advertising Increment				50,000
New Income before other Fixed Costs				$2,806,000

Alternatively: Increase in base contribution margin – Advertising cost = Gain
= $2,800,000 * 2% - 50000 = $6,000

c) Not necessarily. By trying to upsell the sales staff may antagonize customers leading to lost sales.

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2-51.

Units Sold	1,200	**Per Unit**
Sales	$300,000	$250.00
Variable Cost	150,000	125.00
Contribution Margin	$150,000	$125.00
Fixed Cost	200,000	
Income	-$50,000	

a) Breakeven point = 200,000/125 = 1,600 units

b) Let Q be the unit increase required

125Q = 22500 Q = 180 units or 11.25% increase

c) The proposed change will increase income by $67,500 (17,500 – 50,000)

*$250 x 0.90) x 2,400 = $540,000

	Initial	**Change**
Units Sold	1,200	2,400
Sales*	$300,000	$540,000
Variable Cost	150,000	300,000
Contribution Margin	$150,000	$240,000
Fixed Cost	200,000	222,500
Income	-$50,000	$17,500

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2-52.

	Per 100 Packets
Selling price	$35.00
Variable costs:	
- Raw materials	16.00
- Direct labor	7.00
- Manufacturing support	4.00
- Selling expenses	1.60
- Total variable costs per 100 packets	$28.60
Contribution Margin	$6.40
Annual fixed costs:	
- Manufacturing support	$192,000
- Selling and administrative	276,000
- Total fixed costs	$468,000

a)

$$\text{Total Units Needed to Breakeven} = \frac{468{,}000}{6.40} = 73{,}125$$

b)

$$\text{Total Units Needed} = \frac{468{,}000 + 500{,}000}{6.40} = 151{,}250$$

c) 6.4 - (7.00 x 0.05) = 6.05
468,000/6.05 = 77,355 (rounded)

d) Current contribution margin to sales ratio = 6.40/35

Revenue – Variable Cost/Revenue = 6.40/35

[P – (28.60 + 0.35)] / P = 6.40/35
1 – (28.95 / P) = 0.1829
0.8171 = (28.95 / P)
P =$35.43

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2-53. a)

	Panda	Zebra	Total
Contribution Margin	$4.00	$7.00	
Budget Unit Sales	800,000	400,000	1,200,000
Fixed Cost			$4,500,000
Sales Mix Percentage	66.67%	33.33%	
Weighted Average Contribution Margin	$2.6667	$2.3333	$5.0000
Fixed Cost	$4,500,000		
Target Profit	0		
Total	$4,500,000		
Sales Needed	900,000		
Panda Sales	600,000		
Zebra Sales	300,000		

b)

	Panda	Zebra	Total
Contribution Margin	$4.00	$7.00	
Budget Unit Sales	800,000	400,000	1,200,000
Fixed Cost			$4,500,000
Sales Mix Percentage	66.67%	33.33%	
Weighted Average Contribution Margin	$2.6667	$2.3333	$5.0000
Fixed Cost	$4,500,000		
Target Profit	600,000		
Total	$5,100,000		
Sales Needed	1,020,000		
Panda Sales	680,000		
Zebra Sales	340,000		

c) Increased contribution = 120,000* x 5 = $600,000 = Maximum promotion cost
*(1,200,000 x 0.10)

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2-54.

Product	Total Sales Without Special Promotion	Total Sales With Special Promotion	Difference
Hamburgers	$1.09 × 20,000 = $21,800	$0.69 × 24,000 = $16,560	($5,240)
Chicken	—	—	—
Sandwiches	1.29 × 10,000 = $12,900	1.29 × 9,200 = $11,868	(1,032)
French fries	0.89 × 20,000 = $17,800	0.89 × 22,400 = $19,936	2,136
			($4,136)

Product	Variable Costs Without Special Promotion	Variable Costs With Special Promotion	Difference
Hamburgers	$0.51 × 20,000 = $10,200	$0.51 × 24,000 = $12,240	($2,040)
Chicken	—	—	—
Sandwiches	0.63 × 10,000 = $6,300	0.63 × 9,200 = $5,796	504
French fries	0.37 × 20,000 = $7,400	0.37 × 22,400 = $8,288	(888)
			($2,424)

Decrease in sales with special promotion		$4,136
Increase in variable costs with special promotion		2,424
Decrease in contribution margin with special promotion	$6,560	
Incremental advertising expenses with special promotion	4,500	
Decrease in profit with special promotion		($11,060)

Therefore, Andrea should not go ahead with this special promotion. A countervailing argument is the creation of new customers who may stay with the firm and generate additional contribution margin in the future.

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2-55. The new product income

	Sales Units	
	1	120,000
Revenue	$105.00	$12,600,000
Direct Materials Cost	30.00	3,600,000
Direct Labor Cost	20.00	2,400,000
Variable Manufacturing Overhead	10.00	1,200,000
Sales Commission	10.50	1,260,000
Total Variable Cost	$70.50	8,460,000
	$34.50	$4,140,000
Fixed Cost		2,000,000
Incremental Income		$2,140,000

Lost contribution margin on old product = 60000*20 = $1,200,000

Incremental income = ($2,140,000 – 1,200,000) = $940,000

2-56. Let y be the number of flights and x be the number of passengers

The margin provided by each flight = (200-5)*x – 5000

Total margin provided by all flights = $y * (195*x - 5000)$

Income = $[y * (195*x - 5000)] - 400{,}000$

In part a set y equal to 70 and solve for x

$70 * (195x - 5000) - 400{,}000 = 0$: x=55

In part b set x = 90 (150 * 60%) and solve for y

$[y * ((195*90) - 5000)] - 400{,}000 = 500{,}000$: y=72

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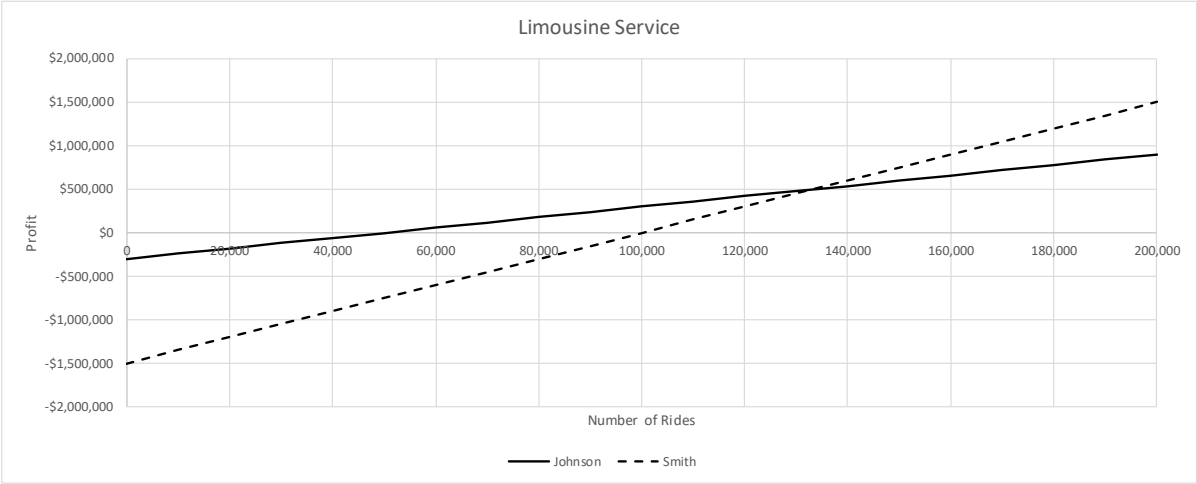
2-57. a) Johnson Co. breakeven point in number of rides =
(Fixed costs)/(Unit contribution margin) = $300,000/$6 = 50,000 rides

Smith Co. breakeven point in number of rides =
(Fixed costs)/(Unit contribution margin) = $1,500,000/$15 = 100,000 rides

b) Let x be the number of rides.

Johnson Co.'s profit function is:
$30x – $24x – $300,000 = $6x – $300,000

Smith Co.'s profit function is:
$30x – $15x – $1,500,000 = $15x – $1,500,000



c) We cannot say which firm's cost structure is more profitable as profits depend on sales volume. If sales drop to below 133,333 rides, Johnson Company's cost structure leads to more profits. However, if sales remain above 133,334 rides, then Smith Company's cost structure leads to more profits.

d) The contribution margin generated must first cover the fixed costs and then the balance remaining after the fixed costs are fully covered goes toward profits. If the contribution margin is not sufficient to cover the fixed costs, then a loss occurs for the period. Once the breakeven point has been reached, profit will increase by the unit contribution margin for each additional unit sold. Here, Smith Company is more risky because it has higher fixed costs to cover and a higher unit contribution margin, which makes its profits more sensitive to decreases in the sales activity level.

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2-58. Wage rate = $3,600 ÷ 150 hours = $24/hour.

Neighboring laboratory charges $80 / 2 hours = $40/hour, which also equals $100 / 2.5 and $160 / 4.

a)

Month	Simple Routine	Simple Non-routine	Complex	Total Hours	Equivalent Workers
June	800	250	450	4,025.0	26.83
July	600	200	400	3,300.0	22.00
August	750	225	450	3,862.5	25.75

Workers Hired	In-house Wages*	Hours Short			Outside Hours	Outside Charges	Total Cost
		June	July	August			
20	$216,000	1,025	300	862.5	2,187.5	$87,500	$303,500
21	226,800	875	150	712.5	1,737.5	69,500	296,300
22	237,600	725	0	562.5	1,287.5	51,500	289,100
23	248,400	575	0	412.5	987.5	39,500	287,900
24	259,200	425	0	262.5	687.5	27,500	286,700
25	270,000	275	0	112.5	387.5	15,500	285,500
26	280,800	125	0	0.0	125.0	5,000	285,800
27	291,600	0	0	0.0	0.0	0	291,600

*$3,600 per month × 3 months = $10,800 for one worker for a quarter.

In-house wages equal $10,800 times the number of workers hired.
Dr. Barker should employ 25 workers at a total cost of $285,500.

b) Outside charges will exceed the monthly wages of an additional worker hired by Barrington if the number of outside hours exceeds $3,600 ÷ $40 = 90. Therefore, Barrington should hire an additional employee when the outside services are expected to exceed 90 hours in any month, which corresponds to 90 ÷ 150 = 0.6 equivalent workers.

Month	Simple Routine	Simple Non-routine	Complex	Total Hours	Equivalent Workers
June	800	250	450	4,025.0	26.83
July	600	200	400	3,300.0	22.00
August	750	225	450	3,862.5	25.75

Therefore, Barrington should hire 27 workers in June, 22 in July, and 26 in August.

Month	Workers Hired	Fixed Cost	Outside Hours	Outside Charges	Total Cost
June	27	$97,200	0	0	$ 97,200
July	22	79,200	0	0	79,200
August	26	93,600	0	0	93,600
Total cost					$270,000

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CASES

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The A Votre Santé (AVS) case is multi-faceted in that it requires students to incorporate operational measures into product costing results, and also to understand cost accounting from a variety of perspectives, such as:

- Product versus period costs
- Variable versus fixed costs
- Activity based costing
- Relevant costs and opportunity costs

Additionally, the case questions require both quantitative and qualitative analyses of the business issues faced by AVS. AVS has been used in a graduate-level managerial accounting class for MBAs, and would be most appropriate for an advanced undergraduate or a graduate-level accounting or MBA course.

The detail in the case is rich enough to support a variety of analyses. Alternative uses could be to have the student construct a cost of goods manufactured statement or a traditional financial statement, both of which reinforce the differences between product and period costs. Additionally, alternative decision analysis questions could be developed using the variable and fixed cost structures described in the case. Case question number two is only one example of a potential decision analysis question.

a) Contribution Margin Income Statement

To develop the contribution margin income statement, you first have to calculate the number of bottles of wine produced by AVS. This number is dependent upon the yield from the grapes. The relevant calculations are as follows:

Yield:	Chardonnay Grapes		Generic Grapes	
Pounds harvested	100,000		60,000	
Loss in processing	10,000	10%	3,000	5%
Yield:	90,000		57,000	

Bottles of wine produced:

	Chardonnay		Blanc de	
	Estate	Regular	Blanc	Total
Pounds of grapes:				
Chardonnay grapes	72,000	18,000	0	90,000
Generic grapes	0	9,000	48,000	57,000
Total pounds of grapes	72,000	27,000	48,000	147,000
Bottles (3 lb./bottle)	24,000	9,000	16,000	49,000

Continued

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The contribution margin income statement (Teaching Note Exhibit 1) is fairly straightforward, with the following concepts or calculations causing the most difficulty:

- The inclusion of liquor taxes and sales commissions in variable costs: These are both period expenses, but are clearly based upon the number of bottles sold, and therefore are included in the variable costs.
- Where to include the wine master expense: Since the wine master is paid according to number of blends, not number of bottles, this expense is listed as a fixed cost. Arguably, it could be listed as a variable cost, given that the cost will be based on the number of wines produced. As part of the discussion we will examine the rationale behind listing wine master as a fixed or a variable expense.
- Barrel expense: The case states that the barrels produce the equivalent of 40 cases of wine. A case of wine is post-fermentation/bottling and therefore after the 10% loss has occurred. The barrels contain the wine at the start of the process. Therefore, there have to be enough barrels to hold all the wine at the beginning of the process, not at the end. This factor results in 63 (62.5) barrels being required for the harvest[1].
- Teaching Note: Exhibit 1: Contribution Margin Income Statement

Sales	Price	Number of Bottles		
Chardonnay - Estate	$22	24,000	$528,000	
Chardonnay (non-Estate)	$16	9,000	$144,000	
Blanc de Blanc	$11	16,000	$176,000	
Total Revenues		49,000	$848,000	100.0% of sales
				Average revenue per bottle = $17.3061
Variable Costs				
Grapes			$124,000	
Bottle, labels, corks			122,500	
Harvest labor			14,500	
Crush labor			2,400	
Indirect materials			6,329	
Liquor taxes			147,000	
Sales distribution			98,000	
Barrels			4,725	
Total Variable Costs			$519,454	61.3% of sales
Contribution Margin			$328,546	38.7% of sales

Continued

[1] Each case of wine requires 36 pounds of grapes (post-fermenting). A barrel holds the equivalent of 40 cases of wine (post-fermenting), or 1,440 pounds of grapes (40 × 36). To convert the post-fermenting grapes to pre-fermenting grapes, they must be divided by 0.9, or 1,440/0.9 equals 1,600 pounds of grapes. The harvest of 100,000 pounds of grapes therefore requires 62.5 barrels for storage (100,000/1,600).

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Table continued

Fixed Costs		
Admin. rent and office	$ 20,000	
Depreciation	8,100	
Lab expenses	8,000	
Production office	12,000	
Sales	30,000	
Supervisor	55,000	
Utilities	5,500	
Waste treatment	2,000	
Wine master	15,000	
Administrative salary	75,000	
Total Fixed Costs	$230,600	
Operating Margin	$ 97,946	11.6% of sales
		Average Net Income per bottle = $2.00

b) Additional Purchase Opportunity, Quantitative Analysis

Part b asks, "What is the maximum amount that AVS would pay to buy an additional pound of Chardonnay grapes?" There are three parts to calculating this answer: the benefit from the additional Chardonnay wine to be sold, the relevant costs related to producing this wine and the opportunity cost of not producing as much Blanc de Blanc wine.

Teaching Note: Exhibit 2 displays the calculations relevant to this decision. Chardonnay regular wine requires a 2 to 1 mixture of Chardonnay and generic white grapes. Therefore, the 18,000 (20,000 x .9) pounds of Chardonnay grapes will be combined with 9,000 pounds of generic white grapes. The 27,000 pounds of grapes will result in an additional 9,000 bottles of new Chardonnay regular wine being produced. However, it will also result in a 3,000-bottle decrease in the amount of Blanc de Blanc wine produced, since some generic grapes will now be used for the Chardonnay-regular wine. Recall that only Chardonnay wine is processed in barrels.

Continued

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Teaching Note Exhibit 2: Decision Analysis, Additional Grape Purchase

			(along with 1 lb. of generic grapes)
Additional Chardonnay Product Line			
Sales Revenue	$126,000		9,000 bottles × $14/bottle
Costs			
Generic grapes	$6,079		9,000 pounds × $0.6754*/pound
Bottle, labels, corks	22,500		# bottles × $2.50
Indirect materials	1,163		# bottles × $1.55/12
Liquor taxes	27,000		$3/bottle
Sales distribution	18,000		$2/bottle
Barrels	975		13 barrels** × $300/4 years
Wine master	5,000		
Total costs	$80,716		
Gain from new Chardonnay	$45,283		
Lost Sales of Blanc de Blanc Wine			
Sales Revenue	$33,000		3,000 bottles × $11/bottle
Costs			
Generic grapes	$6,079		9,000 pounds × $0.6754/pound
Bottle, labels, corks	7,500		# bottles × $2.50
Indirect materials	387.5		# bottles × $1.55/12
Liquor taxes	9,000		$3/bottle
Sales distribution	6,000		$2/bottle
Total costs	$28,966		
Lost Contribution Margin	$4,034		
Net Impact	$41,249		
Required 15% Return on Sales	$18,900		15%
Total Net Benefit	$22,349		
Pounds of Grapes	20,000		
Maximum Price per Pound	$1.12		
*($38,500 / 57,000 lbs.)			
** (20,000 / 1,600)			
Note: some amounts may not foot by $1, due to rounding			

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c) Additional Purchase Opportunity, Qualitative Analysis

The following factors would support AVS's decision to purchase the additional grapes:

- Potential increase in market share
- Diversification of suppliers
- Ability to leverage fixed costs over more production
- If quality of purchased grapes is perceived to be better
- To block a competitor from buying the grapes
- Ability to focus time and effort on wine making (rather than harvesting and crushing)
- Creates an incentive for the current grower to control costs

The following factors would support AVS's decision to reject the grape purchase:

- Poor quality of the grapes
- An additional AVS Chardonnay wine creates confusion in the marketplace
- Lack of control over the harvest and crush process
- Lack of confidence in the additional sales forecast
- Inability of the current capacity (e.g. bottling line, space) to support additional production
- Inability to use the additional barrels purchased in future years
- Cannibalization of the current Chardonnay, Chardonnay-Estate or Blanc de Blanc sales
- Reliability concerns with the new supplier
- Other hidden costs

Summary

The AVS case is based upon actual wine industry data, although the data has been simplified to reinforce the teaching points and concepts. It is also true to the wine making process, with the exception of AVS's process of making the Chardonnay regular wine from the fermented Chardonnay and Blanc de Blanc wines. This can be done, but most commonly the juice from the wine grapes is combined at the start of the fermenting process, so that they can ferment together. Because of the different yield rates in the fermenting process, the case had the wines ferment separately and blend at the end.

Note: The full case, which includes activity-based cost analysis, can be taught in a 75-minute class, or by omitting the decision analysis question 50 minutes would be sufficient. The case author has also used it to teach the differences between the financial income statement reporting (product and period costs) and the contribution margin income statement reporting (variable and fixed costs), and then assigned decision analysis and/or the ABC costing as an additional assignment.

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