CHAPTER 2

Cost Behavior and Cost Estimation

Learning Objectives

1. Identify basic cost behavior patterns and explain how changes in activity level affect total cost and unit cost. (Unit 2.1)
2. Estimate a cost equation from a set of cost data and predict future total cost from that equation. (Unit 2.2)
3. Prepare a contribution format income statement. (Unit 2.3)

Summary of End of Chapter Material

Difficulty: E = Easy, M = Moderate, D = Difficult
Bloom: K = Knowledge, C = Comprehension, AP = Application, AN = Analysis, S = Synthesis, E = Evaluation
IMA: S = Strategy, planning & performance, R = Reporting and control, T = Technology and analytics, B = Business acumen & operations, L = Leadership, E = Professional ethics & values
AICPA ACC: RA = Risk assessment, M = Measurement, R = Reporting, RS = Research, S = System/process management, T = Technology
AICPA BUS: S = Strategic, G = Global, P = Process management, GV = Governance, C = Customer
AICPA PRO: E = Ethics, P = Professional behavior, D = Decision making, CO = Collaboration, L = Leadership, C = Communication, PM = Project Management

Item	L. O.	Difficulty Level	Minutes to Complete	Bloom's Taxonomy	IMA	AICPA ACC	AICPA BUS	AICPA PRO	Ethics Coverage
Unit 2.1									
1	1	M	2	C	S	R	S, P	D	
2	1	M	4	C, K	S	R	S, P	D	
3	1	M	3	C, K	S	R	S, P	D	
4	1	E	2	C	S	R	S, P	D	
5	1	M	4	C, K	S	R	S, P	D	
6	1	M	4	C, K	S	R	S, P	D	
Unit 2.2									
1	2	E	1	K	S	M	S, P	D	
2	2	M	2	C	S	M	S, P	D	
3	2	M	4	K	S	M	S, P	D	
4	2	E	2	C	S	M	S, P	D	
5	2	M	4	C	S	M	S, P	D	
Unit 2.3									
1	3	E	1	K	S	M	S, P	D	
2	3	E	2	K	S	M	S, P	D	
3	3	D	3	C	S	M	S, P	D	
4	3	D	3	C	S	M	S, P	D	
EXERCISES									
2-1*	1	M	12	C	S	R	S, P	D	
2-2	1	M	15	C	S	R	S, P	D	
2-3*	1	M	12	AP	S	M	S, P	D	
2-4*	1	M	15	AP, C	S	M	S, P	D	
2-5*	1	M	15-20	AP, AN	S	M	S, P	D	
2-6	1	D	5-7	AN	S	M	S, P	D	

Item	L. O.	Difficulty Level	Minutes to Complete	Bloom's Taxonomy	IMA	AICPA ACC	AICPA BUS	AICPA PRO	Ethics Coverage
2-7*	1	D	8	AP, AN	S	M	S, P	D	
2-8	2	M	15-20	AP, AN	S	M	S, P	D	
2-9	2	M	20	AP, AN	S	M	S, P	D	
2-10*+	2	M	12	AP, AN	S	M	S, P	D	
2-11*	2	D	20	AP	S	M	S, P	D	
2-12*	2	D	10-15	AP	S	M	S, P	D	
2-13*+	3	M	10-15	AP	S	M	S, P	D	
2-14	3	E	10-15	AN	S	M	S, P	D	
2-15*	3	D	10-15	AP	S	M	S, P	D	
2-16*+	3	M	15	AP	S	M	S, P	D	
2-17	3	E	15	AP	S	M	S, P	D	
2-18*	3	E	10	AP	S	M	S, P	D	
PROBLEMS									
2-19	1	E	20-25	AP, AN	S	M	S, P	D	
2-20*	2	M	20-25	AP, AN	S	M	S, P	D	
2-21*	2	D	15-20	AP, AN	S	M	S, P	D	
2-22*	2	M	20-25	AP, AN	S	M	S, P	D	
2-23	2	D	30-35	AP, AN	S	M	S, P	D	
2-24	1, 3	D	20-25	AP	S	M	S, P	D	
2-25*	2, 3	D	20	AP	S	M	S, P	D	
2-26*	3	D	20-25	AP	S	M	S, P	D	
C&C CONTINUING CASE									
2-27*	1	E	5-7	C	S	M	S, P	D	
2-28*	2, 3	M	10	AP, AN	S	M	S, P	D	
CASES									
2-29*	1	D	20-25	AP	S	M	S, P	D	
2-30		M	10-15	AN	E	R	S, P	E	✔
DATA ANALYTICS PROBLEMS									
2-31	2	M	30-40	AP, AN, E	T, S	T, M	S, P	D	
2-32n	2	M	30-40	AP, AN, S, E	T, S	T, M	S, P	D	

* Revised problem in 4th edition
+ Lightboard video solution available
n New problem

SOLUTIONS TO GUIDED UNIT PREPARATION

Unit 2.1

1. Managers must be able to predict the financial results of their various decisions. The only way to predict results is to know how costs will change or "behave" with changes in activity.

2. A variable cost is a cost that varies in total in proportion to a business activity. Within the relevant range, variable cost per unit is constant. As the level of activity increases, the total cost increases by the same proportion. Examples include commissions, cost of bicycle tires for a bicycle manufacturer, and cost of postage for a direct mail advertiser.

3. A fixed cost is a cost that does not change in total with the activity level. Within the relevant range, the total fixed cost remains constant as the activity level changes. However, the cost per unit varies inversely with changes in activity level. Examples include monthly rent, a manager's salary, and property taxes.

4. Discretionary fixed costs are fixed costs that can be changed over the short run. Committed fixed costs cannot be changed over the short run.

5. A mixed cost is a cost that has both fixed and variable components. As the level of activity increases, the total cost increases and the cost per unit decreases. Examples include electricity cost, party hall rental when the charge includes a flat fee plus a cost per guest, and t-shirt printing when the charge includes a set-up fee plus a charge for each t-shirt printed.

6. A step cost is a cost that is fixed over a small range of activity. Total cost will not change as activity levels increase if the level of activity is within a certain range. However, once the activity level exceeds this range, total cost will increase. Examples include maintenance costs when a new maintenance worker is needed per 10 machines, nurse salaries per 5 patients on a hospital floor, and hotel room rates per 4 students on a class trip.

Unit 2.2

1. TC = (VC × x) + FC

2. With a scattergraph, a line is drawn to best fit the data points. The point at which the line intersects the y-axis is the value for fixed costs. The slope of the line, change in total cost divided by change in activity, is the variable cost per unit.

3. The high-low method uses the highest and lowest points within a data range to construct a total cost line. The variable cost per unit is calculated by dividing the change in total cost by the change in activity. The fixed cost is calculated by plugging the variable cost in the formula TC = (VC × x) + FC and using either the high point or low point of activity.

4. Regression analysis is preferable as it produces a line with the least amount of error and is relatively easy to use in Excel or ~~other~~ another spreadsheet ~~software~~application.

5. The relevant range is the normal level of operating activity. The relevant range applies to the whole company and is valid for all cost relationships. The steps in a step cost are ranges that are only valid for that particular cost. The steps in the range are smaller than the relevant range.

Unit 2.3

1. Contribution margin is the difference between sales and variable cost.

2. Contribution margin ratio is the contribution margin divided by sales. The variable cost ratio is 1 minus the contribution margin ratio. The larger the variable cost ratio, the smaller the contribution margin will be, since the two ratios must add to 100%.

3. If the variable cost per unit increases and the selling price decreases, the contribution margin per unit will decrease. The change in fixed cost has no bearing on the contribution margin.

4. A product's contribution margin can be increased by increasing the selling price per unit or decreasing variable costs per unit. Total contribution margin can be increased by selling more units.

SOLUTIONS TO EXERCISES

Exercise 2-1

a. fixed
b. variable
c. fixed
d. fixed
e. step
f. variable
g. mixed

Exercise 2-2

a. variable
b. fixed
c. step
d. mixed
e. variable
f. fixed
g. mixed
h. variable
i. variable
j. fixed

Exercise 2-3

a. TC(200 returns) = (200 × $12 per return) + $650 fee = $3,050
TC(325 returns) = (325 × $12 per return) + $650 fee = $4,550
TC(500 returns) = (500 × $12 per return) + $650 fee = $6,650

b. Cost per unit (200) = $3,050 ÷ 200 = $15.25
Cost per unit (325) = $4,550 ÷ 325 = $14.00
Cost per unit (500) = $6,650 ÷ 500 = $13.30

c. As the number of returns increased from 200 to 500, the fixed cost of $650 decreased on a per unit basis.

Exercise 2-4

	Answer	Reasoning
Balloons	variable	The total cost increases as activity increases and the cost per unit remains constant at $2.50 per bouquet.
Insurance	fixed	The total cost remains constant across all activity levels.
Delivery	variable	The total cost increases as activity increases and the cost per unit remains constant at $6.00 per delivery.
Employee compensation	mixed	The total cost increases as activity increases and the cost per unit decreases as activity increases.
Advertising	fixed	The total cost remains constant across all activity levels.

Per unit costs (variable and mixed costs only):

	2,000	4,000	6,000
Balloons	$\frac{\$5,000}{2,000 \text{ bouquets}} = \$2.50$	$\frac{\$10,000}{4,000 \text{ bouquets}} = \$2.50$	$\frac{\$15,000}{6,000 \text{ bouquets}} = \$2.50$
Delivery	$\frac{\$12,000}{2,000 \text{ bouquets}} = \$6.00$	$\frac{\$24,000}{4,000 \text{ bouquets}} = \$6.00$	$\frac{\$36,000}{6,000 \text{ bouquets}} = \$6.00$
Employee compensation	$\frac{\$15,000}{2,000 \text{ bouquets}} = \$7.50$	$\frac{\$23,000}{4,000 \text{ bouquets}} = \$5.75$	$\frac{\$29,000}{6,000 \text{ bouquets}} = \$4.83$

Exercise 2-5

		Home Visits			
	F, V, M	15,000	20,000	25,000	30,000
Employee wages	variable	***$225,000***	$300,000	$375,000	$450,000
Billing services	mixed	***$62,000***	$ 82,000	102,000	$122,000
Medical supplies	variable	$120,000	$160,000	200,000	***$240,000***
Insurance	fixed	***$15,000***	$ 15,000	***$15,000***	$15,000

Variable cost per unit:

Employee wages:

$$\frac{\$450{,}000 - \$300{,}000}{30{,}000 - 20{,}000} = \$15 \text{ per visit}$$

Billing services:

$$\frac{\$122{,}000 - \$82{,}000}{30{,}000 - 20{,}000} = \$4 \text{ per visit}$$

Medical supplies:

$$\frac{\$200{,}000 - \$120{,}000}{25{,}000 - 15{,}000} = \$8 \text{ per visit}$$

Fixed cost (using the low point):

Employee wages:

$300,000 – (20,000 visits × $15) = $0

Billing services:

$82,000 – (20,000 visits × $4) = $2,000

Medical supplies:

$120,000 – (15,000 visits × $8) = $0

Exercise 2-5, continued

Total cost:

Employee wages:
(15,000 visits × $15) + $0 = $225,000

Billing services:
(15,000 ~~hours~~ visits × $4) + $2,000 = $62,000

Medical supplies:
(30,000 ~~hours~~ visits × $8) + $0 = $240,000

Insurance:
(15,000 visits × $0) + $15,000 = $15,000
(30,000 visits × $0) + $15,000 = $15,000

Exercise 2-6

Undoubtedly, some of your costs are fixed and will not change with the number of units sold. For example, you probably pay rent to the mall ~~to set up~~each month for your kiosk. Total rent does not change with the number of video games sold. Other costs may be mixed, and these costs will include a fixed component as well. Using the unit cost you calculated, your estimate will be too high if you sell more units next year and too low if you sell fewer games next year.

Exercise 2-7

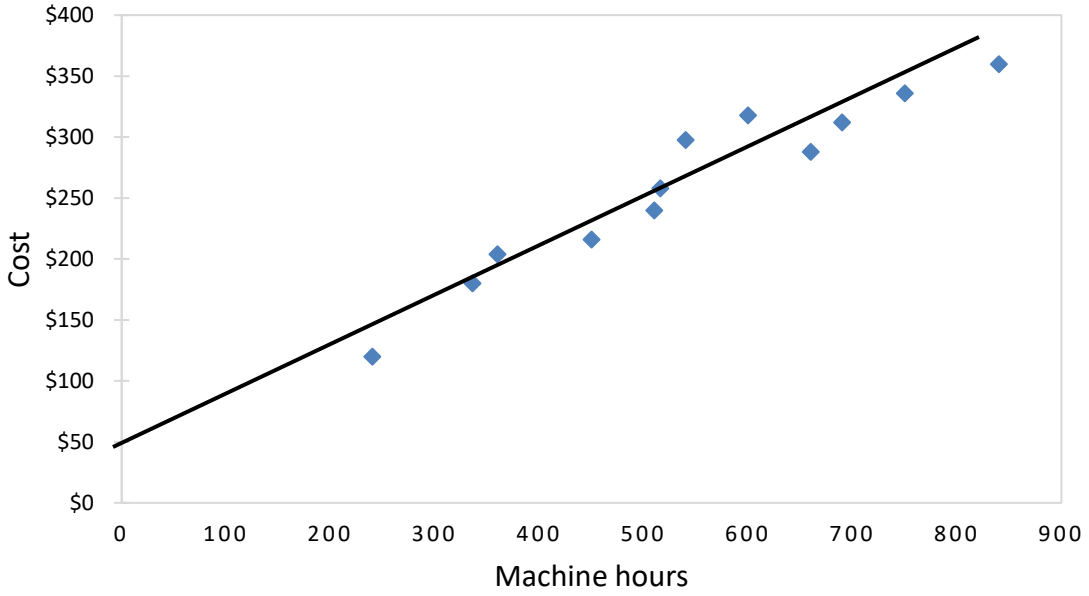
a. No effect – total fixed costs do not change with changes in quantity.

b. Decrease – The unit cost would decrease because the increase in accounting quantity would lower the fixed costs per unit, which would lower the unit cost of the 737 Next Generation plane.

NOTE: While the annual report states that these fixed infrastructure costs will not vary with changes in production rates, it is possible that a large increase in volume may push Boeing to a new relevant range. If this shift occurs, total fixed costs will likely increase.

Exercise 2-8

a.



Note: Students may draw lines that differ from the one above. That will affect the equation they use in the remaining parts of the exercise.

b. The line intersects the y-axis at $50, representing total fixed costs. The line passes through the point (520, $260), so the slope can be calculated as follows:

$$\frac{\$260 - \$50}{520 - 0} = \$0.404 \text{ per machine hour}$$

The equation of the line is: y = ($0.404 × MH) + $50

c. Total cost = ($0.404 × 750 MH) + $50 = $353

d. The line is merely an estimation of what costs will be. Since the line does not intersect the actual cost at which machine hours is 750, then the cost estimate will not equal the actual cost.

Exercise 2-9

a. Variable cost = $\frac{\$360 - \$120}{840 - 240}$ = $0.40 per machine hour

b. Fixed cost using the low point = $120 – ($0.40 × 240) = $24
Fixed cost using the high point = $360 – ($0.40 × 840) = $24

c. Total cost = ($0.40 × MH) + $24

d. Total cost = ($0.40 × 750 MH) + $24 = $324

e. The equation of the line was determined using two points, neither of which was 750 machine hours. Since the line does not intersect the actual cost at which machine hours is 750, then the cost estimate will not equal the actual cost.

Exercise 2-10

a. Variable cost = $\frac{\$9,900 - \$6,800}{1,150 - 750}$ = $7.75 per instrument

b. Fixed cost using the low point = $6,800 – ($7.75 × 750) = $987.50

c. Total cost = ($7.75 × # of instruments) + $987.50

d. Total cost = ($7.75 × 900 instruments) + $987.50 = $7,962.50

Exercise 2-11

	Answer	Calculations
Balloons	y = $2.50x + $0	$VC = \frac{\$15,000 - \$5,000}{6,000 - 2,000} = \$2.50$ FC = $15,000 – $2.50(6,000) = $0
Insurance	y = $6,000	Since the total cost is constant, no calculations are needed.
Delivery	y = $6.00x + $0	$VC = \frac{\$36,000 - \$12,000}{6,000 - 2,000} = \$6.00$ FC = $36,000 – $6.00(6,000) = $0
Employee Compensation	y = $3.50x + $8,000	$VC = \frac{\$29,000 - \$15,000}{6,000 - 2,000} = \$3.50$ FC = $29,000 – $3.50(6,000) = $8,000
Advertising	y = $1,500	Since the total cost is constant, no calculations are needed.

Exercise 2-12

a. Current system = (.04 × sales) + $50,000
Salary and 5% = (.05 × sales) + $20,000
25% commission = .25 × sales

b.

	Current system	Salary and 5% commission	25% commission
Sales revenue	$900,000	$1,100,000	$1,300,000
Cost of goods sold[a]	270,000	330,000	390,000
Gross profit	630,000	770,000	910,000
Compensation expense	86,000[b]	75,000[c]	325,000[d]
Operating income	$544,000	$695,000	$585,000

The salary + 5% commission results in the most profitable result for the company.

[a]0.3 × Sales revenue
[b]$50,000 + ($900,000 × 0.04)
[c]$20,000 + ($1,100,000 × 0.05)
[d]$1,300,000 × 0.25

Exercise 2-13

			Per Unit
Sales revenue		$65,000	$50
Variable expenses:			
Cost of goods sold	$20,800		16
Commissions expense	3,900		3
Shipping expense	2,600		2
Total variable expenses			21
		27,300	
Contribution margin		37,700	$ 29
Fixed expenses:			
Salaries expense	8,000		
Advertising expense	2,500		
Total fixed expenses			
		10,500	
Operating income		$27,200	

Exercise 2-14

	a.	b.	c.	d.
Sales revenue	***$295,000***	$425,000	***$267,000***	$700,000
Variable expenses	210,000	***275,000***	86,000	***300,000***
Contribution margin	85,000	150,000	***181,000***	400,000
Fixed expenses	***58,000***	70,000	120,000	***200,000***
Operating income	27,000	***80,000***	***61,000***	***200,000***
Income taxes	***16,500***	18,000	16,000	55,000
Net income	$10,500	***$62,000***	$45,000	$145,000

Exercise 2-15

			Per Unit
Sales revenue		$35,200	$16.00
Variable costs:			
Cost of goods sold	$19,800		9.00
Operating expenses	6,600[a]		3.00
Total variable expenses		26,400	12.00
Contribution margin		8,800	$ 4.00
Fixed operating expenses		2,100[b]	
Operating Income		$ 6,700	

Units sold = $35,200 sales revenue ÷ $16.00 per unit = 2,200 units

[a]2,200 units × $3 per unit

[b]$8,700 total operating ~~costs~~ expenses – $6,600 variable cost

Exercise 2-16

a.

Sales price	$10.00
Less variable costs:	
Towel, water, protein shake	2.65
Contribution margin	$7.35

b. $\frac{\$7.35}{\$10.00} = 73.5\%$

c.

			Per Unit
Sales revenue		$45,000	$10.00
Variable expenses:			
Towel, water, shake		11,925	2.65
Contribution margin		33,075	$7.35
Fixed expenses:			
Instructor salaries expense	$6,000		
Management salary expense	6,500		
Rent expense	1,800		
Depreciation expense	1,350		
Utilities & insurance expense	1,425		
Total fixed expenses		17,075	
Operating Income		$16,000	

Exercise 2-17

a.

Sales revenue		$50,000
Variable expenses:		
Cost of goods sold	$26,250	
Selling expense (75%)	6,000[a]	
Administrative expense (25%)	3,250[b]	
Total variable expenses		35,500
Contribution margin		14,500
Fixed expenses:		
Selling expense (25%)	2,000[c]	
Administrative expense (75%)	9,750[d]	
Total fixed expenses		11,750
Operating Income		$2,750

[a]$8,000 × 0.75
[b]$13,000 × 0.25
[c]$8,000 × 0.25
[d]$13,000 × 0.75

b. $50,000 ÷ $2 per cookie = 25,000 cookies

c. $14,500 ÷ 25,000 cookies = $0.58 per cookie

d. $14,500 ÷ $50,000 = 29%

Exercise 2-18

a. $\frac{\$87,000}{\$15 \text{ per unit}}$ = 5,800 phone covers

b. $\frac{\$37,410}{5,800 \text{ units}}$ = $6.45 per phone cover

c. $\frac{\$6.45}{\$15.00}$ = 43%

SOLUTIONS TO PROBLEMS

Problem 2-19

a.

Minutes	Cost per minute	Total Cost
10	$5.00	$50
100	$0.50	$50
250	$0.20	$50
500	$0.10	$50

b. This is a fixed cost because total cost remains fixed while the cost per minute decreases as minutes used increases.

c. 1,000 × $0.02 = $20; prefer $0.02 per minute instead of $50 per month

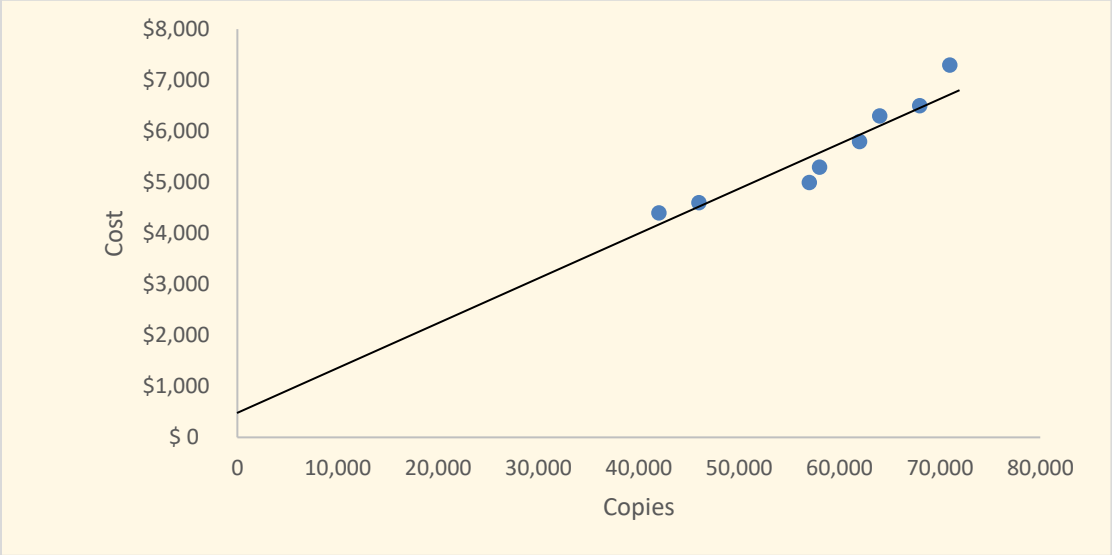
3,000 × $0.02 = $60; prefer $50 per month

indifferent where $50 = $0.02x
x = 2,500 minutes

d. You should determine which phone plan to buy based on how many minutes you expect to use in one month.

Problem 2-20

a.



NOTE: Students may draw lines that differ from the one above, which will affect the equation they develop for this part of the solution.

The line intersects the y-axis at $500, representing total fixed costs. The line passes through the point (68,000, $6,500), so the slope can be calculated as follows:

$$\frac{\$6{,}500 - \$500}{68{,}000 - 0} = \$0.088 \text{ per copy}$$

The equation of the line is: y = $0.088/copy + $500

b. Variable cost = $\frac{\$7{,}300 - \$4{,}400}{71{,}000 - 42{,}000}$ = $0.10 per copy

c. Fixed cost = $7,300 – ($.10 × 71,000) = $200

d. y = $0.10x + $200

e. September cost = ($0.10 × 62,000) + $200 = $6,400. The equation is just an approximation of the relationship between cost and copies. Since the June cost was not one of the points used to construct the line, then it is not surprising that the two figures are not equal.

Problem 2-21

a. Variable cost = $\frac{\$80,000 - \$59,000}{8,300 - 3,300}$ = \$4.20 per labor hour
   Fixed cost = \$80,000 – (\$4.20 × 8,300) = \$45,140 ***or***
   Fixed cost = \$59,000 – (\$4.20 × 3,300) = \$45,140

b. Total cost = (\$4.20 × 4,200) + \$45,140 = \$62,780

c. Additional overhead = \$4.20 × 350 = \$1,470

d. In regression analysis, the cost equation is calculated using all of the data points. In the high-low method, only two points are used to determine the cost equation. In either case, they are both estimates.

Problem 2-22

a. Variable cost = $\frac{\$8,885 - \$6,605}{76,900 - 48,400}$ = \$0.08 per spike set sold

b. Fixed cost = \$8,885 – (\$0.08 × 76,900) = \$2,733 or
   Fixed cost = \$6,605 – (\$0.08 × 48,400) = \$2,733

c. Marketing cost = (\$0.08 × sets sold) + \$2,733

d. February sales volume and costs are much lower than the others.

e. Variable cost = $\frac{\$8,885 - \$8,265}{76,900 - 64,500}$ = \$0.05 per spike set sold
   Fixed cost = \$8,885 – (\$0.05 × 76,900) = \$5,040 or
   Fixed cost = \$8,265 – (\$0.05 × 64,500) = \$5,040

   Marketing cost = (\$0.05 × sets sold) + \$5,040

f. The second equation is better for estimating future costs because the endpoints used to estimate the line are more consistent with the normal sales volumes and costs.

Problem 2-23

a. **Passengers:**

Variable cost = $\frac{\$25,480 - \$19,990}{2,480 - 2,030}$ = $12.20 per passenger

Fixed cost = $25,480 – ($12.20 × 2,480) = ($4,776)

Fuel expense = ($12.20 × passengers) – $4,776

Passenger miles:

Variable cost = $\frac{\$25,459 - \$22,435}{580,214 - 361,214}$ = $0.0138 per passenger mile

Fixed cost = $25,459 – ($0.0138 × 580,214) = $17,452

Fuel expense = ($0.0138 × passenger miles) + $17,452

Train Miles:

Variable cost = $\frac{\$25,459 - \$22,225}{3,515 - 3,025}$ = $6.60 per train mile

Fixed cost = $25,459 – ($6.60 × 3,515) = $2,260

Fuel expense = ($6.60 × train miles) + $2,260

b. The formula based on passengers doesn't make sense as the fixed cost is negative. While this might have some predictive ability, it doesn't help managers understand any causal relationship between the number of passengers and fuel expense.

c. Logically, train miles would seem to have the most predictive ability since the miles a train travels and fuel costs should be directly related. While passenger miles would likely provide information related to the fuel expended due to weight (more passengers, greater weight), it is unlikely that one more passenger mile will have the same impact on fuel expenses that one more train mile will have.

Problem 2-24

a. Cost of goods sold – variable
Advertising expense – fixed
Salaries and wages expense – mixed
Insurance expense – fixed
Postage expense – variable

b. Sales price = \$3,000 ÷ 1,000 windows = \$3.00 per window

Cost of goods sold = \$1,200 ÷ 1,000 windows = \$1.20 per window

Variable salaries expense = $\frac{\$1{,}100 - \$700}{3{,}000 - 1{,}000}$ = \$0.20 per window

Fixed salaries expense = \$1,100 – (.2 × 3,000) = \$500

Postage expense = \$400 ÷ 1,000 windows = \$0.40 per window

~~Fixed salaries expense = \$1,100 – (.2 × 3,000) = \$500~~

		2,500 windows	Per Unit
Sales revenue		\$7,500	\$3.00
Variable expenses:			
Cost of goods sold	3,000		1.20
Salaries expense	500		0.20
Postage expense	1,000		0.40
Total variable expenses		4,500	1.80
Contribution margin		3,000	\$1.20
Fixed expenses:			
Advertising expense	400		
Salaries expense	500		
Insurance expense	200		
Total fixed expenses		1,100	
Operating Income		\$1,900	

Problem 2-25

a. coats sold = $750,000 ÷ $200 = 3,750 units

variable selling expense = $6.00 × 3,750 units = $22,500

variable administrative expense = 6% × $750,000 = $45,000 ÷ 3,750 = $12 per unit

fixed selling expense = $41,060 – $22,500 = $18,560

fixed administrative expense = $68,600 – $45,000 = $23,600

			Per Unit
Sales revenue		$750,000	$200.00
Variable expenses:			
Cost of goods sold	525,000		140.00
Selling expense	22,500		6.00
Administrative expense	45,000		12.00
Total variable expenses		592,500	158.00
Contribution margin		157,500	$ 42.00
Fixed expenses:			
Selling expense	18,560		
Administrative expense	23,600		
Total fixed expenses		42,160	
Operating Income		$115,340	

b. Operating expenses = $158x + $42,160

c. $42 × 4,000 = $168,000

Problem 2-26

a.

			Per Unit
Sales revenue		$34,000	$40
Variable expenses:			
Service expense	$17,000		20
Bookkeeping expense	2,550		3
Total variable expenses		19,550	23
Contribution margin		14,450	$17
Fixed expenses:			
Vans expense	2,000		
Salaries expense	3,000		
Total fixed expenses		5,000	
Operating Income		$9,450	

b. $9,450 + (150 × $17) = $12,000

Problem 2-26, continued

c.

	850	1,000	1,100
Current cost: \$3 × customers × 12 months	\$30,600	\$36,000	\$39,600
Option 1: \$20,400 + (\$1 × customers × 12 months)	\$30,600	\$32,400	\$33,600
Option 2: \$27,000 + \$5,000	\$32,000	\$32,000	\$32,000

d. Mr. Harris needs to evaluate what he thinks future demand for his services will be. If he thinks he will have more customers, then he should consider switching to option 1 or 2 before prices increase. He also needs to think about the stability of his customer base. If he services fewer than 850 customers, options 1 and 2 will be more expensive than the current arrangement.

SOLUTIONS TO CASES

Case 2-27

	Cost	Behavior
a.	Monthly sales staff payroll of $650 plus 5% sales commission on jerseys	mixed
b.	$100 monthly rental for credit card processing equipment	fixed
c.	Cost of goods sold of $22.00 per jersey	variable
d.	The cost of price tags attached to each jersey	variable
e.	Inventory insurance that costs $2 per $1,000 of sales	step
f.	Website hosting cost of $25 per month	fixed

Case 2-28

a. $30.00x – $24.00x – $240,000 = operating profit

b. ($24.00 × 55,000) + $240,000 = $1,320,000 + $240,000 = $1,560,000

c. Fixed selling expenses will increase by $20,000 to $165,000, so total fixed expenses will increase by $20,000 to $260,000.

d.

			Per Unit
Sales revenue		$1,950,000	$30.00
Variable expenses:			
Cost of goods sold	$1,430,000		22.00
Sales commission expense	97,500		1.50
Tags	32,500		0.50
Total variable expenses		1,560,000	24.00
Contribution margin		390,000	$ 6.00
Fixed expenses:			
Selling expense	165,000		
Administrative expense	95,000		
Total fixed expenses		260,000	
Operating Income		$ 130,000	

Case 2-29

a.

Ad development	$7,200	
Placement[a]	1,500	($1.50 × 1,000)
Click-through	6,000	($0.60 × .01 × 1,000,000)
	$14,700	

[a] $\frac{\text{1,000,000 ad impressions}}{\text{1,000}}$ = 1,000 (impressions are priced per thousand)

b. customers = 1,000,000 × .01 × .20 = 2,000

$\frac{\$14,700}{2,000} = \$7.35$ per customer

c. You need to work backwards to solve this problem:

Since only 20% of those who click through make a purchase, it will take 5 click-throughs to generate one customer (1 ÷ .20).

Since only 1% of banner ad viewers click through to the site, 500 more banner ads need to be placed (5 ÷ .01)

Cost of 500 placements = (500 ÷ 1,000) x $1.50	$0.75
Cost of 5 click-throughs = 5 × $0.60	$3.00
	$3.75

Case 2-30

a. No, it wasn't ethical. The family and friends are not legitimate customers, and they are driving up Bohlander's cost.

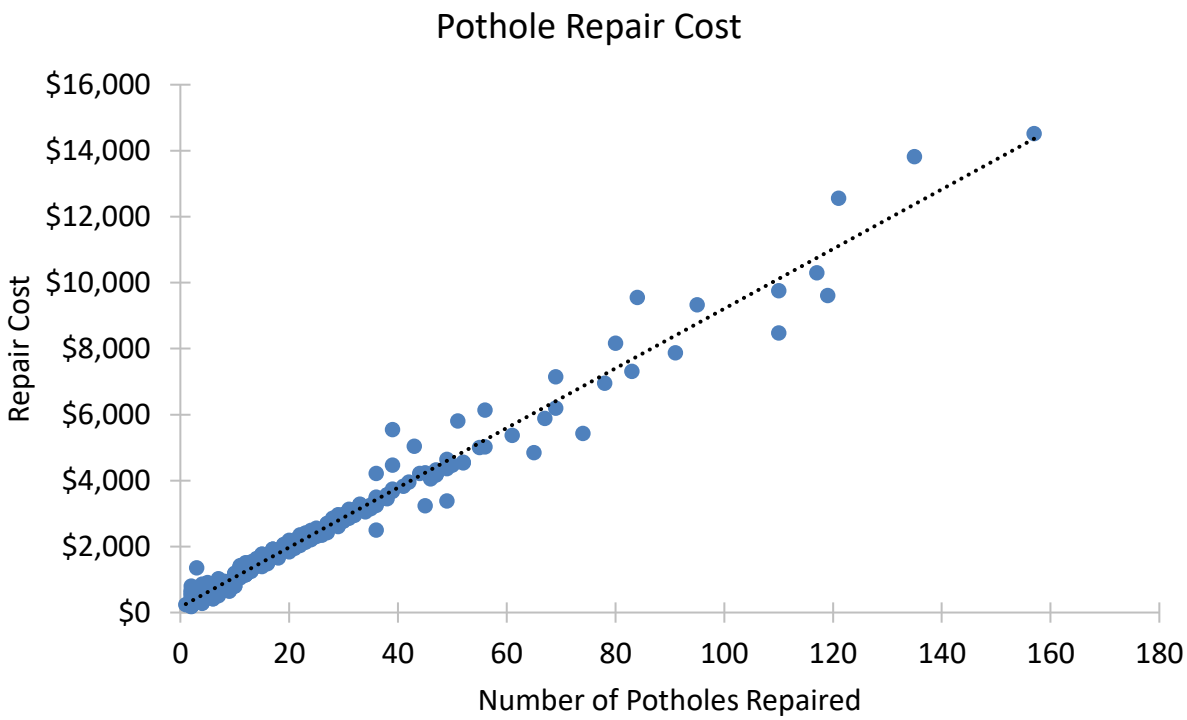
b. No, it wouldn't change. While the purchase is an unintended benefit, the motivation behind Sami's actions was fraudulent.

c. As a result of Sami's actions, Bohlander will experience a higher click-through rate and a lower purchase rate than expected. These "artificial" rates could influence future expectations for similar ad campaigns. Additionally, Bohlander will incur increased advertising expenses as a result of the additional click-throughs ($0.60 per click-through).

SOLUTIONS TO DATA ANALYTICS CASE

Case 2-31

a.



The dotted line is the linear estimation for pothole repair cost. It appears that as the number of potholes in a work order increases, there is more variability in the total cost to repair those potholes. This variability appears to occur around a volume of 40 potholes.

b. Low point: 1 pothole, $245 repair cost

High point: 157 potholes, $14,519 repair cost

$$\text{Variable repair cost} = \frac{\$14{,}519 - \$245}{157 \text{ potholes} - 1 \text{ pothole}} = \$91.50 \text{ per pothole}$$

Fixed repair cost = $14,519 – ($91.50 × 157) = $153.50 per work order

Cost estimate = $153.50 + ($91.50 × number of potholes repaired)

Case 2-31, continued

c. Slope from Excel = $90.4453

Intercept from Excel = $165.5404

Cost function = $165.5404 + ($90.4453 × number of potholes repaired)

d. The high-low estimate is similar to the regression estimate. It is possible, however, that these cost equations may not be useful when the number of potholes in a repair order exceeds 40, since the data shows greater variability at that point.

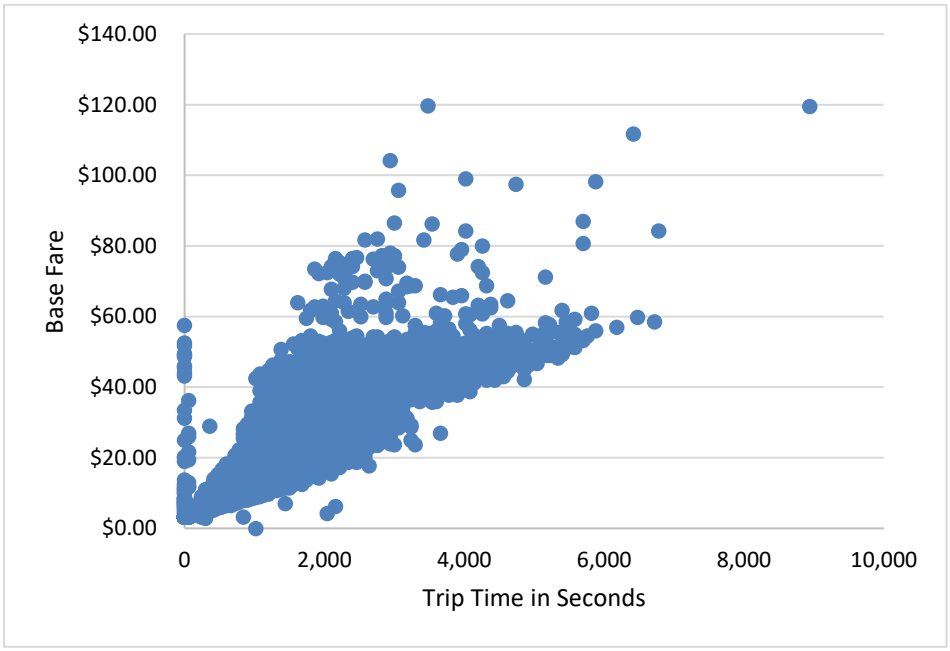
e. It is possible that repair materials, as well as worker speed, may vary with the outside temperature, so including that temperature may provide additional explanatory power and improve future cost estimates, provided forecasted temperatures are available when estimates are made. If temperature is added to the prediction model, average past daily temperatures could be used until updated weather forecasts are available.

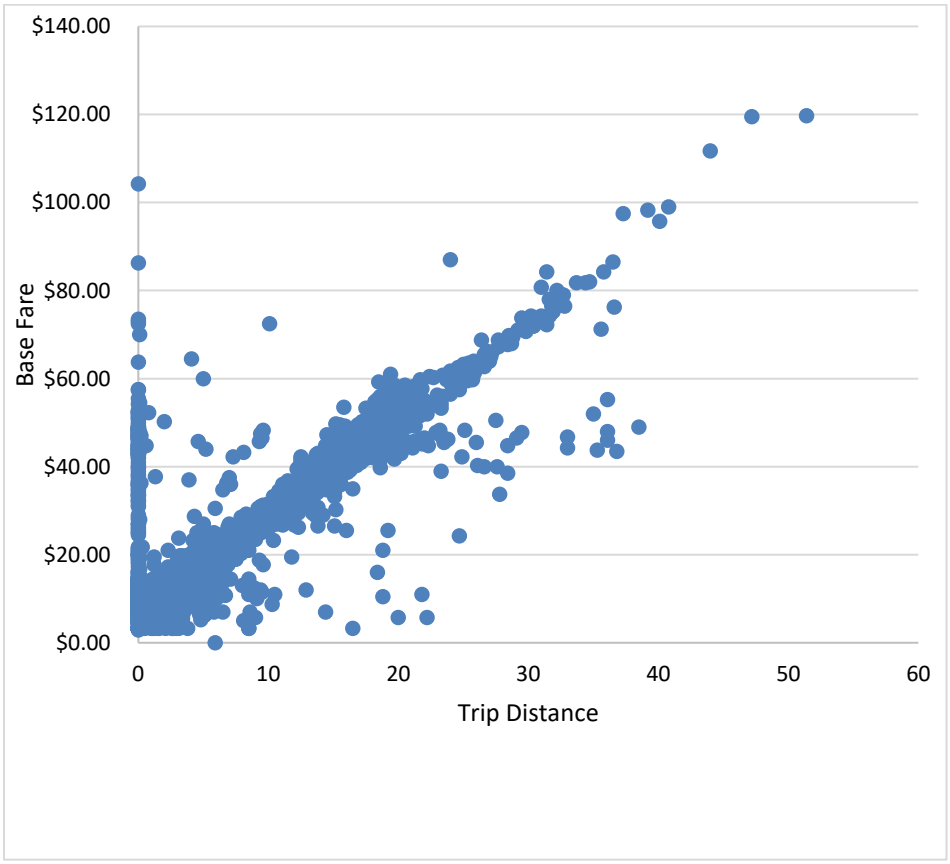
Another possible factor of interest is the type of repair material. For instance, some repairs may be asphalt while others may be concrete.

The size and skill level of the work crew will also have an impact on the repair costs.

Case 2-32

a.


$140.00
$120.00
$100.00
$80.00
$60.00
$40.00
$20.00
$0.00
Base Fare
0
2,000
4,000
6,000
8,000
10,000
Trip Time in Seconds


$140.00
$120.00
$100.00
$80.00
$60.00
$40.00
$20.00
$0.00
Base Fare
0
10
20
30
40
50
60
Trip Distance

Case 2-32, continued

There is a strong linear relationship between trip distance in miles and base fare. While there appears to be a linear relationship between trip length in seconds and base fare, there is more variation than with miles. There are trips of zero distance and/or zero time. There appear to be some trips that are likely outliers.

b. Fare = ($2.19 × miles) + $5.70

c. Fare = ($0.01 × seconds) + $2.45

d. 2.5 miles: ($2.19 × 2.5 miles) + $5.70 = $11.18
850 seconds: ($0.01 × 850 seconds) + $2.45 = $10.95

e. Fare = ($2.25 × miles) + $4.87
Fare = ($0.01 × seconds) + $2.29

2.5 miles: ($2.25 × 2.5 miles) + $4.87 = $10.50
850 seconds: ($0.01 × 850 seconds) + $2.29 = $10.79

f. Consider using multiple regression with both miles and seconds as independent variables.

g. Answers will vary depending on the locations students choose.