

Chapter 02 - Appendix A Least-Squares Regression Computations

		Question Type	Difficulty	LO1: DM, DL, Manuf. overhead	LO2: Period and product costs	LO3: Variable, fixed, and mixed costs	LO4: High-low method	LO5: Income statement formats	LO6: Direct and indirect costs	LO7: Decision-making cost classifications	LO8: Least squares regression (App 2A)	Professional Exam Adapted	ID	Origin	CMA/CPA origin
	1	T/F	E							x			New,6/27/97,E	E.N.	
	2	T/F	E							x			3/14/2010 M1	E.N.	
	3	T/F	H							x			3/14/2010 N2	E.N.	
	4	Conceptual M/C	E				x			x			8/e:ATB6-29	David Keyes	
	5	Conceptual M/C	M							x			3-17-2010 Conceptual A	E.N.	
	6	M/C	H							x			8/22/2004 Single MC H4	E.N.	
	7	M/C	H							x			8/22/2004 Single MC G4	E.N.	
	8	M/C	H							x			New,6/28/97,A9	E.N.	
2A-	9-														
1	10	Multipart M/C	M							x			8/21/2004 Multi MC G4	E.N.	
2A-	11-														
2	12	Multipart M/C	H							x			7/e: 6-59 to 60	Authors	
2A-	13-														
3	14	Multipart M/C	M							x			8/21/2004 Multi MC I4	E.N.	
2A-	15-														
4	16	Multipart M/C	M							x			8/21/2004 Multi MC H4	E.N.	
	17	Problem	H				x			x			LD9e:CH05P2	Larry	

Chapter 02 - Appendix A Least-Squares Regression Computations

18	Problem	H		x	8/22/2004 Problem J4	Deppe E.N.
19	Problem	H		x	New,6/29/97,A9	E.N.
20	Problem	H	x	x	6/e:5-62	Authors
21	Problem	H		x	8/21/2004 Problem H4	E.N.
22	Problem	H		x	8/21/2004 Problem I4	E.N.

## Chapter 02

### Appendix A Least-Squares Regression Computations

#### True / False Questions

1. In least-squares regression, independent variables are not included in the computations of the slope and intercept.

True   False

2. Least-squares regression selects the values for the intercept and slope of a straight line that minimize the sum of the squared errors.

True   False

3. When analyzing a mixed cost, you should always plot the data in a scattergraph, but it is particularly important to check the data visually on a scattergraph when the R<sup>2</sup> is very high.

True   False

#### Multiple Choice Questions

4. Which of the following methods of analyzing mixed costs can be used to estimate an equation for the mixed cost?

	<b>High-Low</b>	<b>Least-Squares</b>
A)	<b>Yes</b>	<b>Yes</b>
B)	<b>Yes</b>	<b>No</b>
C)	<b>No</b>	<b>Yes</b>
D)	<b>No</b>	<b>No</b>

- A. Option A
- B. Option B
- C. Option C
- D. Option D

5. The least-squares regression method:
- A. fits a line to data by minimizing the sum of the squared errors from the line.
  - B. is generally less accurate than the high-low method.
  - C. can be used only if the fixed cost element is larger than the variable cost element.
  - D. can be used only if the fixed cost element is smaller than the variable cost element.

6. The management of Ferry Corporation would like for you to analyze their repair costs, which are listed below:

	Machine-Hours	Repair Costs
February.....	2,131	\$33,085
March.....	2,160	\$33,103
April.....	2,117	\$33,070
May.....	2,180	\$33,137
June.....	2,102	\$33,013
July.....	2,196	\$33,167
August.....	2,128	\$33,054
September.....	2,191	\$33,140

Management believes that repair cost is a mixed cost that depends on the number of machine-hours. Using the least-squares regression method, the estimates of the variable and fixed components of repair cost would be closest to:

- A. \$1.64 per machine-hour plus \$29,566 per month
- B. \$0.92 per machine-hour plus \$31,132 per month
- C. \$1.37 per machine-hour plus \$30,157 per month
- D. \$15.39 per machine-hour plus \$33,096 per month

7. Moeller Inc.'s inspection costs are listed below:

	<b>Units Produced</b>	<b>Inspection Costs</b>
<b>March</b> .....	<b>125</b>	<b>\$9,079</b>
<b>April</b> .....	<b>152</b>	<b>\$10,473</b>
<b>May</b> .....	<b>121</b>	<b>\$8,884</b>
<b>June</b> .....	<b>175</b>	<b>\$11,689</b>
<b>July</b> .....	<b>191</b>	<b>\$12,507</b>
<b>August</b> .....	<b>180</b>	<b>\$11,939</b>
<b>September</b> .....	<b>182</b>	<b>\$12,055</b>
<b>October</b> .....	<b>177</b>	<b>\$11,795</b>

Management believes that inspection cost is a mixed cost that depends on the number of units produced. Using the least-squares regression method, the estimates of the variable and fixed components of inspection cost would be closest to:

- A. \$51.76 per unit plus \$2,621 per month
- B. \$51.99 per unit plus \$2,584 per month
- C. \$67.86 per unit plus \$11,053 per month
- D. \$52.23 per unit plus \$2,550 per month

8. Your boss would like you to estimate the fixed and variable components of a particular cost. Actual data for this cost over four recent periods appear below.

	<b>Activity</b>	<b>Cost</b>
<b>Period 1</b> .....	<b>24</b>	<b>\$378</b>
<b>Period 2</b> .....	<b>23</b>	<b>\$367</b>
<b>Period 3</b> .....	<b>20</b>	<b>\$342</b>
<b>Period 4</b> .....	<b>25</b>	<b>\$386</b>

Using the least-squares regression method, what is the cost formula for this cost?

- A.  $Y = \$156.64 + \$9.20X$
- B.  $Y = \$0.00 + \$16.01X$
- C.  $Y = \$164.54 + \$8.86X$
- D.  $Y = \$169.97 + \$6.10X$

Descoteaux Inc.'s inspection costs are listed below:

	<b>Units Produced</b>	<b>Inspection Costs</b>
<b>February</b> .....	<b>415</b>	<b>\$6,100</b>
<b>March</b> .....	<b>365</b>	<b>\$5,624</b>
<b>April</b> .....	<b>434</b>	<b>\$6,315</b>
<b>May</b> .....	<b>449</b>	<b>\$6,453</b>
<b>June</b> .....	<b>391</b>	<b>\$5,874</b>
<b>July</b> .....	<b>366</b>	<b>\$5,627</b>
<b>August</b> .....	<b>441</b>	<b>\$6,380</b>
<b>September</b> .....	<b>392</b>	<b>\$5,887</b>

Management believes that inspection cost is a mixed cost that depends on units produced.

9. Using the least-squares regression method, the estimate of the variable component of inspection cost per unit produced is closest to:

- A. \$9.87
- B. \$14.84
- C. \$9.26
- D. \$9.97

10. Using the least-squares regression method, the estimate of the fixed component of inspection cost per month is closest to:

- A. \$1,979
- B. \$6,033
- C. \$5,624
- D. \$2,021

Carr Company reports the following data for the first six months of the year:

<b>Month</b>	<b>Machine Hours</b>	<b>Electrical Cost</b>
<b>January</b> .....	<b>400</b>	<b>\$40</b>
<b>February</b> .....	<b>300</b>	<b>\$30</b>
<b>March</b> .....	<b>400</b>	<b>\$50</b>
<b>April</b> .....	<b>300</b>	<b>\$40</b>
<b>May</b> .....	<b>200</b>	<b>\$30</b>
<b>June</b> .....	<b>200</b>	<b>\$20</b>

11. Using the least-squares regression method, the estimated variable electrical cost per machine hour is closest to:

- A. \$0.91
- B. \$0.10
- C. \$0.20
- D. \$0.25

12. Using the least-squares regression method, the estimated monthly fixed component of the electrical cost is closest to:

- A. \$5
- B. \$20
- C. \$6
- D. \$10

Gelrud Corporation's recent utility costs are listed below:

	<b>Machine-Hours</b>	<b>Utility Costs</b>
<b>March</b> .....	<b>2,443</b>	<b>\$19,941</b>
<b>April</b> .....	<b>2,419</b>	<b>\$19,804</b>
<b>May</b> .....	<b>2,483</b>	<b>\$20,161</b>
<b>June</b> .....	<b>2,424</b>	<b>\$19,801</b>
<b>July</b> .....	<b>2,475</b>	<b>\$20,127</b>
<b>August</b> .....	<b>2,409</b>	<b>\$19,733</b>
<b>September</b> .....	<b>2,453</b>	<b>\$19,983</b>
<b>October</b> .....	<b>2,480</b>	<b>\$20,147</b>

Management believes that utility cost is a mixed cost that depends on machine-hours.

13. Using the least-squares regression method, the estimate of the variable component of utility cost per machine-hour is closest to:

- A. \$8.15
- B. \$5.78
- C. \$5.57
- D. \$5.85

14. Using the least-squares regression method, the estimate of the fixed component of utility cost per month is closest to:

- A. \$19,733
- B. \$5,809
- C. \$19,962
- D. \$5,628

Recent maintenance costs of Prideaux Corporation are listed below:

	<b>Machine-Hours</b>	<b>Maintenance Costs</b>
<b>February</b> .....	<b>632</b>	<b>\$8,774</b>
<b>March</b> .....	<b>587</b>	<b>\$8,334</b>
<b>April</b> .....	<b>666</b>	<b>\$9,093</b>
<b>May</b> .....	<b>620</b>	<b>\$8,667</b>
<b>June</b> .....	<b>580</b>	<b>\$8,275</b>
<b>July</b> .....	<b>575</b>	<b>\$8,241</b>
<b>August</b> .....	<b>617</b>	<b>\$8,650</b>
<b>September</b> .....	<b>588</b>	<b>\$8,368</b>

Management believes that maintenance cost is a mixed cost that depends on machine-hours.

15. Using the least-squares regression method, the estimate of the variable component of maintenance cost per machine-hour is closest to:

- A. \$9.36
- B. \$9.49
- C. \$14.06
- D. \$9.23

16. Using the least-squares regression method, the estimate of the fixed component of maintenance cost per month is closest to:

- A. \$2,859
- B. \$8,241
- C. \$8,550
- D. \$2,782



**Essay Questions**

17. The Stephens Leadership Center provides training seminars in personal development and time management. The company is relatively new and management is seeking information regarding the Center's cost structure. The following information has been gathered since the inception of the business in January of the current year:

<b>Month</b>	<b>Seminars Offered</b>	<b>Costs Incurred</b>
<b>January</b> .....	<b>10</b>	<b>\$17,000</b>
<b>February</b> .....	<b>12</b>	<b>\$18,800</b>
<b>March</b> .....	<b>15</b>	<b>\$20,900</b>
<b>April</b> .....	<b>18</b>	<b>\$23,762</b>
<b>May</b> .....	<b>16</b>	<b>\$21,800</b>
<b>June</b> .....	<b>13</b>	<b>\$19,400</b>

Required:

- a. Using the high-low method, estimate the variable cost per seminar and the total fixed cost per month.
- b. Using the least-squares method, estimate the variable cost per seminar and the total fixed cost per month.

18. Dillenbeck Printing Corp., a book printer, has provided the following data:

	<b>Titles Printed</b>	<b>Press Setup Cost</b>
<b>February</b> .....	<b>33</b>	<b>\$3,170</b>
<b>March</b> .....	<b>34</b>	<b>\$3,203</b>
<b>April</b> .....	<b>46</b>	<b>\$3,688</b>
<b>May</b> .....	<b>28</b>	<b>\$2,996</b>
<b>June</b> .....	<b>44</b>	<b>\$3,607</b>
<b>July</b> .....	<b>42</b>	<b>\$3,551</b>
<b>August</b> .....	<b>43</b>	<b>\$3,586</b>
<b>September</b> .....	<b>39</b>	<b>\$3,413</b>

Management believes that the press setup cost is a mixed cost that depends on the number of titles printed. (A specific book that is to be printed is called a "title". Typically, thousands of copies will be printed of each title. Specific steps must be taken to setup the presses for printing each title—for example, changing the printing plates. The costs of these steps are the press setup costs.)

Required:

Estimate the variable cost per title printed and the fixed cost per month using the least-squares regression method.

19. Below are cost and activity data for a particular cost over the last four periods. Your boss has asked you to analyze this cost so that management will have a better understanding of how this cost changes in response to changes in activity.

	<b>Activity</b>	<b>Cost</b>
<b>Period 1</b> .....	<b>46</b>	<b>\$292</b>
<b>Period 2</b> .....	<b>40</b>	<b>\$271</b>
<b>Period 3</b> .....	<b>42</b>	<b>\$279</b>
<b>Period 4</b> .....	<b>41</b>	<b>\$267</b>

Required:

Using the least-squares regression method, estimate the cost formula for this cost.

20. Executive Training, Inc., provides a personal development seminar that is popular with many companies. The number of seminars offered over the last five months, along with the total costs of offering these seminars, follows:

	<b>Seminars Offered</b>	<b>Costs Incurred</b>
<b>April</b> .....	<b>55</b>	<b>\$15,400</b>
<b>May</b> .....	<b>45</b>	<b>\$14,000</b>
<b>June</b> .....	<b>60</b>	<b>\$18,000</b>
<b>July</b> .....	<b>50</b>	<b>\$14,700</b>
<b>August</b> .....	<b>75</b>	<b>\$19,000</b>

Required:

- a. Using the high-low method, estimate the variable cost per seminar and the total fixed cost per month.
- b. Using the least-squares regression method, compute the variable cost per seminar and the total fixed cost per month. (Round off to the nearest whole dollar.)

21. Galarneau Inc. maintains a call center to take orders, answer questions, and handle complaints. The costs of the call center for a number of recent months are listed below:

	<b>Calls Taken</b>	<b>Call Center Cost</b>
<b>February</b> .....	<b>7,851</b>	<b>\$85,115</b>
<b>March</b> .....	<b>7,820</b>	<b>\$84,934</b>
<b>April</b> .....	<b>7,861</b>	<b>\$85,178</b>
<b>May</b> .....	<b>7,860</b>	<b>\$85,161</b>
<b>June</b> .....	<b>7,825</b>	<b>\$84,965</b>
<b>July</b> .....	<b>7,836</b>	<b>\$85,009</b>
<b>August</b> .....	<b>7,879</b>	<b>\$85,262</b>
<b>September</b> .....	<b>7,866</b>	<b>\$85,201</b>

Management believes that the cost of the call center is a mixed cost that depends on the number of calls taken.

Required:

Estimate the variable cost per call and fixed cost per month using the least-squares regression method.

22. The management of Ferriman Corporation would like to better understand the behavior of the company's warranty costs. Those costs are listed below for a number of recent months:

	<b>Product Returns</b>	<b>Warranty Cost</b>
<b>April</b> .....	<b>24</b>	<b>\$2,972</b>
<b>May</b> .....	<b>23</b>	<b>\$2,928</b>
<b>June</b> .....	<b>27</b>	<b>\$3,141</b>
<b>July</b> .....	<b>39</b>	<b>\$3,752</b>
<b>August</b> .....	<b>36</b>	<b>\$3,569</b>
<b>September</b> .....	<b>35</b>	<b>\$3,551</b>
<b>October</b> .....	<b>26</b>	<b>\$3,071</b>
<b>November</b> .....	<b>37</b>	<b>\$3,636</b>

Management believes that warranty cost is a mixed cost that depends on the number of product returns.

Required:

Estimate the variable cost per product return and the fixed cost per month using the least-squares regression method.

## Chapter 02 Appendix A Least-Squares Regression Computations **Answer Key**

### **True / False Questions**

1. In least-squares regression, independent variables are not included in the computations of the slope and intercept.

**FALSE**

*AACSB: Reflective Thinking*

*AICPA BB: Critical Thinking*

*AICPA FN: Measurement*

*Bloom's: Knowledge*

*Learning Objective: 02A-08 Analyze a mixed cost using a scattergraph plot and the least-squares regression method*

*Level: Easy*

2. Least-squares regression selects the values for the intercept and slope of a straight line that minimize the sum of the squared errors.

**TRUE**

*AACSB: Reflective Thinking*

*AICPA BB: Critical Thinking*

*AICPA FN: Measurement*

*Bloom's: Knowledge*

*Learning Objective: 02A-08 Analyze a mixed cost using a scattergraph plot and the least-squares regression method*

*Level: Easy*

3. When analyzing a mixed cost, you should always plot the data in a scattergraph, but it is particularly important to check the data visually on a scattergraph when the  $R^2$  is very high.

**FALSE**

*AACSB: Reflective Thinking*

*AICPA BB: Critical Thinking*

*AICPA FN: Measurement*

*Bloom's: Knowledge*

*Learning Objective: 02A-08 Analyze a mixed cost using a scattergraph plot and the least-squares regression method*

*Level: Hard*

**Multiple Choice Questions**

4. Which of the following methods of analyzing mixed costs can be used to estimate an equation for the mixed cost?

	<b>High-Low</b>	<b>Least-Squares</b>
A)	<b>Yes</b>	<b>Yes</b>
B)	<b>Yes</b>	<b>No</b>
C)	<b>No</b>	<b>Yes</b>
D)	<b>No</b>	<b>No</b>

- A.** Option A
- B. Option B
- C. Option C
- D. Option D

*AACSB: Reflective Thinking*  
*AICPA BB: Critical Thinking*  
*AICPA FN: Measurement*  
*Bloom's: Knowledge*

*Learning Objective: 02A-04 Analyze a mixed cost using a scattergraph plot and the high-low method*

*Learning Objective: 02A-08 Analyze a mixed cost using a scattergraph plot and the least-squares regression method*

*Level: Easy*

5. The least-squares regression method:

- A.** fits a line to data by minimizing the sum of the squared errors from the line.
- B. is generally less accurate than the high-low method.
- C. can be used only if the fixed cost element is larger than the variable cost element.
- D. can be used only if the fixed cost element is smaller than the variable cost element.

*AACSB: Reflective Thinking*  
*AICPA BB: Critical Thinking*  
*AICPA FN: Measurement*  
*Bloom's: Comprehension*

*Learning Objective: 02A-08 Analyze a mixed cost using a scattergraph plot and the least-squares regression method*

*Level: Medium*



6. The management of Ferry Corporation would like for you to analyze their repair costs, which are listed below:

	<b>Machine-Hours</b>	<b>Repair Costs</b>
<b>February</b> .....	<b>2,131</b>	<b>\$33,085</b>
<b>March</b> .....	<b>2,160</b>	<b>\$33,103</b>
<b>April</b> .....	<b>2,117</b>	<b>\$33,070</b>
<b>May</b> .....	<b>2,180</b>	<b>\$33,137</b>
<b>June</b> .....	<b>2,102</b>	<b>\$33,013</b>
<b>July</b> .....	<b>2,196</b>	<b>\$33,167</b>
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Management believes that repair cost is a mixed cost that depends on the number of machine-hours. Using the least-squares regression method, the estimates of the variable and fixed components of repair cost would be closest to:

- A. \$1.64 per machine-hour plus \$29,566 per month
- B. \$0.92 per machine-hour plus \$31,132 per month
- C. \$1.37 per machine-hour plus \$30,157 per month**
- D. \$15.39 per machine-hour plus \$33,096 per month

Using Microsoft Excel, the solution is:

<b>Intercept</b> .....	<b>\$30,157</b>	<b>Fixed cost</b>
<b>Slope</b> .....	<b>\$1.37</b>	<b>Variable cost</b>
<b>RSQ</b> .....	<b>0.93</b>	

*AACSB: Analytic*

*AICPA BB: Critical Thinking*

*AICPA FN: Measurement*

*Bloom's: Application*

*Learning Objective: 02A-08 Analyze a mixed cost using a scattergraph plot and the least-squares regression method*

*Level: Hard*

7. Moeller Inc.'s inspection costs are listed below:

	Units Produced	Inspection Costs
March.....	125	\$9,079
April.....	152	\$10,473
May.....	121	\$8,884
June.....	175	\$11,689
July.....	191	\$12,507
August.....	180	\$11,939
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October.....	177	\$11,795

Management believes that inspection cost is a mixed cost that depends on the number of units produced. Using the least-squares regression method, the estimates of the variable and fixed components of inspection cost would be closest to:

- A. \$51.76 per unit plus \$2,621 per month
- B. \$51.99 per unit plus \$2,584 per month**
- C. \$67.86 per unit plus \$11,053 per month
- D. \$52.23 per unit plus \$2,550 per month

Using Microsoft Excel, the solution is:

Intercept.....	\$2,584	Fixed cost
Slope.....	\$51.99	Variable cost
RSQ.....	1.00	

AACSB: Analytic

AICPA BB: Critical Thinking

AICPA FN: Measurement

Bloom's: Application

Learning Objective: 02A-08 Analyze a mixed cost using a scattergraph plot and the least-squares regression method

Level: Hard

8. Your boss would like you to estimate the fixed and variable components of a particular cost. Actual data for this cost over four recent periods appear below.

	Activity	Cost
Period 1.....	24	\$378
Period 2.....	23	\$367
Period 3.....	20	\$342
Period 4.....	25	\$386

Using the least-squares regression method, what is the cost formula for this cost?

A.  $Y = \$156.64 + \$9.20X$

B.  $Y = \$0.00 + \$16.01X$

**C.  $Y = \$164.54 + \$8.86X$**

D.  $Y = \$169.97 + \$6.10X$

Using Microsoft Excel, the slope and intercept are:

Intercept.....	\$164.54
Slope .....	\$8.86
RSQ .....	1.00

Therefore, the cost formula is \$164.54 per activity plus \$8.86 per unit or:

$Y = \$164.54 + \$8.86X$

*AACSB: Analytic*

*AICPA BB: Critical Thinking*

*AICPA FN: Measurement*

*Bloom's: Application*

*Learning Objective: 02A-08 Analyze a mixed cost using a scattergraph plot and the least-squares regression method*

*Level: Hard*

Descoteaux Inc.'s inspection costs are listed below:

	<b>Units Produced</b>	<b>Inspection Costs</b>
<b>February</b> .....	<b>415</b>	<b>\$6,100</b>
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Management believes that inspection cost is a mixed cost that depends on units produced.

9. Using the least-squares regression method, the estimate of the variable component of inspection cost per unit produced is closest to:

- A. \$9.87
- B. \$14.84
- C. \$9.26
- D.** \$9.97

Using Microsoft Excel functions, the solution is:

Variable cost per unit produced = Slope = \$9.97

*AACSB: Analytic*

*AICPA BB: Critical Thinking*

*AICPA FN: Measurement*

*Bloom's: Application*

*Learning Objective: 02A-08 Analyze a mixed cost using a scattergraph plot and the least-squares regression method*

*Level: Medium*

10. Using the least-squares regression method, the estimate of the fixed component of inspection cost per month is closest to:

- A.** \$1,979
- B. \$6,033
- C. \$5,624
- D. \$2,021

Using Microsoft Excel functions, the solution is:

Fixed cost per month = Intercept = \$1,979

*AACSB: Analytic*

*AICPA BB: Critical Thinking*

*AICPA FN: Measurement*

*Bloom's: Application*

*Learning Objective: 02A-08 Analyze a mixed cost using a scattergraph plot and the least-squares regression method*

*Level: Medium*

Carr Company reports the following data for the first six months of the year:

<b>Month</b>	<b>Machine Hours</b>	<b>Electrical Cost</b>
<b>January</b> .....	<b>400</b>	<b>\$40</b>
<b>February</b> .....	<b>300</b>	<b>\$30</b>
<b>March</b> .....	<b>400</b>	<b>\$50</b>
<b>April</b> .....	<b>300</b>	<b>\$40</b>
<b>May</b> .....	<b>200</b>	<b>\$30</b>
<b>June</b> .....	<b>200</b>	<b>\$20</b>

11. Using the least-squares regression method, the estimated variable electrical cost per machine hour is closest to:

- A. \$0.91
- B. \$0.10**
- C. \$0.20
- D. \$0.25

Using Microsoft Excel functions, the solution is:

Variable electrical cost per machine hour = Slope = \$0.10

*AACSB: Analytic*

*AICPA BB: Critical Thinking*

*AICPA FN: Measurement*

*Bloom's: Application*

*Learning Objective: 02A-08 Analyze a mixed cost using a scattergraph plot and the least-squares regression method*

*Level: Hard*

12. Using the least-squares regression method, the estimated monthly fixed component of the electrical cost is closest to:

- A. \$5**
- B. \$20
- C. \$6
- D. \$10

Using Microsoft Excel functions, the solution is:

Fixed electrical cost per month = Intercept = \$5.00

*AACSB: Analytic*

*AICPA BB: Critical Thinking*

*AICPA FN: Measurement*

*Bloom's: Application*

*Learning Objective: 02A-08 Analyze a mixed cost using a scattergraph plot and the least-squares regression method*

*Level: Hard*

Gelrud Corporation's recent utility costs are listed below:

	<b>Machine-Hours</b>	<b>Utility Costs</b>
<b>March</b> .....	<b>2,443</b>	<b>\$19,941</b>
<b>April</b> .....	<b>2,419</b>	<b>\$19,804</b>
<b>May</b> .....	<b>2,483</b>	<b>\$20,161</b>
<b>June</b> .....	<b>2,424</b>	<b>\$19,801</b>
<b>July</b> .....	<b>2,475</b>	<b>\$20,127</b>
<b>August</b> .....	<b>2,409</b>	<b>\$19,733</b>
<b>September</b> .....	<b>2,453</b>	<b>\$19,983</b>
<b>October</b> .....	<b>2,480</b>	<b>\$20,147</b>

Management believes that utility cost is a mixed cost that depends on machine-hours.

13. Using the least-squares regression method, the estimate of the variable component of utility cost per machine-hour is closest to:

- A. \$8.15
- B. \$5.78
- C. \$5.57
- D.** \$5.85

Using Microsoft Excel functions, the solution is:  
Utility cost per machine-hour = Slope = \$5.85

*AACSB: Analytic*

*AICPA BB: Critical Thinking*

*AICPA FN: Measurement*

*Bloom's: Application*

*Learning Objective: 02A-08 Analyze a mixed cost using a scattergraph plot and the least-squares regression method*

*Level: Medium*

14. Using the least-squares regression method, the estimate of the fixed component of utility cost per month is closest to:

- A. \$19,733
- B. \$5,809
- C. \$19,962
- D. \$5,628**

Using Microsoft Excel functions, the solution is:  
Fixed utility cost per month = Intercept = \$5,628

*AACSB: Analytic*

*AICPA BB: Critical Thinking*

*AICPA FN: Measurement*

*Bloom's: Application*

*Learning Objective: 02A-08 Analyze a mixed cost using a scattergraph plot and the least-squares regression method*

*Level: Medium*

Recent maintenance costs of Prideaux Corporation are listed below:

	<b>Machine-Hours</b>	<b>Maintenance Costs</b>
<b>February</b> .....	<b>632</b>	<b>\$8,774</b>
<b>March</b> .....	<b>587</b>	<b>\$8,334</b>
<b>April</b> .....	<b>666</b>	<b>\$9,093</b>
<b>May</b> .....	<b>620</b>	<b>\$8,667</b>
<b>June</b> .....	<b>580</b>	<b>\$8,275</b>
<b>July</b> .....	<b>575</b>	<b>\$8,241</b>
<b>August</b> .....	<b>617</b>	<b>\$8,650</b>
<b>September</b> .....	<b>588</b>	<b>\$8,368</b>

Management believes that maintenance cost is a mixed cost that depends on machine-hours.



15. Using the least-squares regression method, the estimate of the variable component of maintenance cost per machine-hour is closest to:

- A. \$9.36
- B. \$9.49**
- C. \$14.06
- D. \$9.23

Using Microsoft Excel functions, the solution is:  
Maintenance cost per machine-hour = Slope = \$9.49

*AACSB: Analytic*

*AICPA BB: Critical Thinking*

*AICPA FN: Measurement*

*Bloom's: Application*

*Learning Objective: 02A-08 Analyze a mixed cost using a scattergraph plot and the least-squares regression method*

*Level: Medium*

16. Using the least-squares regression method, the estimate of the fixed component of maintenance cost per month is closest to:

- A. \$2,859
- B. \$8,241
- C. \$8,550
- D. \$2,782**

Using Microsoft Excel functions, the solution is:  
Fixed maintenance cost per month = Intercept = \$2,782

*AACSB: Analytic*

*AICPA BB: Critical Thinking*

*AICPA FN: Measurement*

*Bloom's: Application*

*Learning Objective: 02A-08 Analyze a mixed cost using a scattergraph plot and the least-squares regression method*

*Level: Medium*

**Essay Questions**

17. The Stephens Leadership Center provides training seminars in personal development and time management. The company is relatively new and management is seeking information regarding the Center's cost structure. The following information has been gathered since the inception of the business in January of the current year:

<b>Month</b>	<b>Seminars Offered</b>	<b>Costs Incurred</b>
<b>January</b> .....	<b>10</b>	<b>\$17,000</b>
<b>February</b> .....	<b>12</b>	<b>\$18,800</b>
<b>March</b> .....	<b>15</b>	<b>\$20,900</b>
<b>April</b> .....	<b>18</b>	<b>\$23,762</b>
<b>May</b> .....	<b>16</b>	<b>\$21,800</b>
<b>June</b> .....	<b>13</b>	<b>\$19,400</b>

Required:

- a. Using the high-low method, estimate the variable cost per seminar and the total fixed cost per month.
- b. Using the least-squares method, estimate the variable cost per seminar and the total fixed cost per month.

a. High-Low Method:

Month.....	Number of Seminars	Costs Incurred
April (high activity level).....	18	\$23,762
January (low activity level) .....	<u>10</u>	<u>17,000</u>
Change observed.....	<u>8</u>	<u>\$ 6,762</u>

Variable cost = Change in Cost/Change in activity = \$6,762/8 seminars = \$845.25 per seminar

Fixed cost element = Total cost - Variable cost element  
 = \$23,762 - (\$845.25 per seminar × 18 seminars) = \$8,547.50

Cost formula for seminar costs: \$8,547.50 per month plus \$845.25 per seminar held

b. Least-Squares Method:

$$n = 6$$

$$\text{sum}X = 84$$

$$\text{sum}Y = 121,662$$

$$\text{sum}XY = 1,737,816$$

$$\text{sum}X^2 = 1,218$$

$$b = \frac{[n(\text{sum}XY) - (\text{sum}X)(\text{sum}Y)]}{[n(\text{sum}X^2) - (\text{sum}X)^2]}$$

$$= \frac{[6(1,737,816) - (84)(121,662)]}{[6(1,218) - (84)^2]}$$

$$= \$822.57 \text{ (rounded to the nearest whole cent)}$$

$$a = \frac{[(\text{sum}Y) - b(\text{sum}X)]}{n}$$

$$= \frac{[(121,662) - 822.57(84)]}{6}$$

$$= \$8,761 \text{ (rounded to the nearest whole dollar)}$$

The cost formula is \$8,761 per month plus \$822.57 per seminar. A similar answer can be obtained using Microsoft Excel.

*AACSB: Analytic*

*AICPA BB: Critical Thinking*

*AICPA FN: Measurement*

*Bloom's: Application*

*Learning Objective: 02A-04 Analyze a mixed cost using a scattergraph plot and the high-low method*

*Learning Objective: 02A-08 Analyze a mixed cost using a scattergraph plot and the least-squares regression method*

*Level: Hard*

18. Dillenbeck Printing Corp., a book printer, has provided the following data:

	<b>Titles Printed</b>	<b>Press Setup Cost</b>
<b>February</b> .....	<b>33</b>	<b>\$3,170</b>
<b>March</b> .....	<b>34</b>	<b>\$3,203</b>
<b>April</b> .....	<b>46</b>	<b>\$3,688</b>
<b>May</b> .....	<b>28</b>	<b>\$2,996</b>
<b>June</b> .....	<b>44</b>	<b>\$3,607</b>
<b>July</b> .....	<b>42</b>	<b>\$3,551</b>
<b>August</b> .....	<b>43</b>	<b>\$3,586</b>
<b>September</b> .....	<b>39</b>	<b>\$3,413</b>

Management believes that the press setup cost is a mixed cost that depends on the number of titles printed. (A specific book that is to be printed is called a "title". Typically, thousands of copies will be printed of each title. Specific steps must be taken to setup the presses for printing each title—for example, changing the printing plates. The costs of these steps are the press setup costs.)

Required:

Estimate the variable cost per title printed and the fixed cost per month using the least-squares regression method.

The solution using Microsoft Excel functions is:

Variable cost per title printed = Slope = \$39.53

Fixed cost per month = Intercept = \$1,875

The solution using the formulas in the text is:

$$n = 8$$

$$\text{sum}X = 309$$

$$\text{sum}Y = \$27,214$$

$$\text{sum}XY = \$1,062,203$$

$$\text{sum}X^2 = 12,215$$

$$\begin{aligned} b &= [n(\text{sum}XY) - (\text{sum}X)(\text{sum}Y)]/[n(\text{sum}X^2) - (\text{sum}X)^2] \\ &= [8(\$1,062,203) - (309)(\$27,214)]/[8(12,215) - (309)^2] \\ &= \$39.53 \end{aligned}$$

$$\begin{aligned} a &= [(\text{sum}Y) - b(\text{sum}X)]/n \\ &= [(\$27,214) - \$39.53(309)]/8 \\ &= \$1,875 \end{aligned}$$

Any difference in the solutions is due to rounding errors when the formulas are used.

## Chapter 02 - Appendix A Least-Squares Regression Computations

*AACSB: Analytic*

*AICPA BB: Critical Thinking*

*AICPA FN: Measurement*

*Bloom's: Application*

*Learning Objective: 02A-08 Analyze a mixed cost using a scattergraph plot and the least-squares regression method*

*Level: Hard*

19. Below are cost and activity data for a particular cost over the last four periods. Your boss has asked you to analyze this cost so that management will have a better understanding of how this cost changes in response to changes in activity.

	Activity	Cost
Period 1.....	46	\$292
Period 2.....	40	\$271
Period 3.....	42	\$279
Period 4.....	41	\$267

Required:

Using the least-squares regression method, estimate the cost formula for this cost.

The solution using Microsoft Excel functions is:

Variable cost = Slope = \$3.94

Fixed cost = Intercept = \$110.80

Therefore, the cost formula is \$110.80 per period plus \$3.94 per unit of activity or:

$$Y = \$110.80 + \$3.94X$$

The solution using the formulas in the text is:

$$n = 4$$

$$\text{sum}X = 169$$

$$\text{sum}Y = 1,109$$

$$\text{sum}XY = 46,937$$

$$\text{sum}X^2 = 7,161$$

$$b = [n(\text{sum}XY) - (\text{sum}X)(\text{sum}Y)] / [n(\text{sum}X^2) - (\text{sum}X)^2]$$

$$= [4(46,937) - (169)(1,109)] / [4(7,161) - (169)^2]$$

$$= \$3.94 \text{ (rounded to nearest whole cent)}$$

$$a = [(\text{sum}Y) - b(\text{sum}X)] / n$$

$$= [(1,109) - 3.94(169)] / 4$$

$$= \$111 \text{ (rounded to nearest whole dollar)}$$

Cost formula:  $Y = \$111 + \$3.94X$ .

*AACSB: Analytic*

*AICPA BB: Critical Thinking*

*AICPA FN: Measurement*

*Bloom's: Application*

*Learning Objective: 02A-08 Analyze a mixed cost using a scattergraph plot and the least-squares regression method*

*Level: Hard*

20. Executive Training, Inc., provides a personal development seminar that is popular with many companies. The number of seminars offered over the last five months, along with the total costs of offering these seminars, follows:

	<b>Seminars Offered</b>	<b>Costs Incurred</b>
<b>April</b> .....	<b>55</b>	<b>\$15,400</b>
<b>May</b> .....	<b>45</b>	<b>\$14,000</b>
<b>June</b> .....	<b>60</b>	<b>\$18,000</b>
<b>July</b> .....	<b>50</b>	<b>\$14,700</b>
<b>August</b> .....	<b>75</b>	<b>\$19,000</b>

Required:

- a. Using the high-low method, estimate the variable cost per seminar and the total fixed cost per month.
- b. Using the least-squares regression method, compute the variable cost per seminar and the total fixed cost per month. (Round off to the nearest whole dollar.)

a. Using the high-low method, estimate the variable cost per seminar and the total fixed cost per month.

	Cost	Activity
High level of activity .....	\$19,000	75
Low level of activity .....	14,000	45
Difference.....	\$ 5,000	30

Variable cost = Change in cost ÷ Change in activity  
 = \$5,000 ÷ 30 seminars = \$166.67 per seminar

Fixed cost = Total cost - Variable cost  
 = \$19,000 - (\$166.67 per seminar × 75 seminars)  
 = \$19,000 - \$12,500  
 = \$6,500

b. Using Microsoft Excel functions, the estimates are:  
 Variable cost per seminar = Slope = \$177.92  
 Total fixed cost per month = Intercept = \$6,078.30

Using the formulas in the text, the solution is:

n=5  
 sumX=285  
 sumY=\$81,100  
 sumXY=\$4,717,000  
 sumX<sup>2</sup>=16,775

Least squares formulas:

$b = [n(\sum XY) - (\sum X)(\sum Y)] \div [n(\sum X^2) - (\sum X)^2]$   
 =  $[5(4,717,000) - (285)(81,100)] \div [5(16,775) - (285)^2]$   
 = \$178 per seminar  
 $a = [(\sum Y) - b(\sum X)] \div n$   
 =  $[(81,100) - 178(285)] \div 5$   
 = \$6,074 per month

The two solutions differ due to rounding error.

AACSB: Analytic

AICPA BB: Critical Thinking

AICPA FN: Measurement

Bloom's: Application

Learning Objective: 02A-04 Analyze a mixed cost using a scattergraph plot and the high-low method

Learning Objective: 02A-08 Analyze a mixed cost using a scattergraph plot and the least-squares regression method

Level: Hard



21. Galarneau Inc. maintains a call center to take orders, answer questions, and handle complaints. The costs of the call center for a number of recent months are listed below:

	<b>Calls Taken</b>	<b>Call Center Cost</b>
<b>February</b> .....	<b>7,851</b>	<b>\$85,115</b>
<b>March</b> .....	<b>7,820</b>	<b>\$84,934</b>
<b>April</b> .....	<b>7,861</b>	<b>\$85,178</b>
<b>May</b> .....	<b>7,860</b>	<b>\$85,161</b>
<b>June</b> .....	<b>7,825</b>	<b>\$84,965</b>
<b>July</b> .....	<b>7,836</b>	<b>\$85,009</b>
<b>August</b> .....	<b>7,879</b>	<b>\$85,262</b>
<b>September</b> .....	<b>7,866</b>	<b>\$85,201</b>

Management believes that the cost of the call center is a mixed cost that depends on the number of calls taken.

Required:

Estimate the variable cost per call and fixed cost per month using the least-squares regression method.

Using Microsoft Excel functions, the solution is:

Variable cost per call = Slope = \$5.74

Fixed cost per month = Intercept = \$40,083

*AACSB: Analytic*

*AICPA BB: Critical Thinking*

*AICPA FN: Measurement*

*Bloom's: Application*

*Learning Objective: 02A-08 Analyze a mixed cost using a scattergraph plot and the least-squares regression method*

*Level: Hard*

22. The management of Ferriman Corporation would like to better understand the behavior of the company's warranty costs. Those costs are listed below for a number of recent months:

	Product Returns	Warranty Cost
April .....	24	\$2,972
May .....	23	\$2,928
June .....	27	\$3,141
July .....	39	\$3,752
August .....	36	\$3,569
September .....	35	\$3,551
October .....	26	\$3,071
November .....	37	\$3,636

Management believes that warranty cost is a mixed cost that depends on the number of product returns.

Required:

Estimate the variable cost per product return and the fixed cost per month using the least-squares regression method.

The solution using Microsoft Excel functions is:

Variable cost per product return = Slope = \$51.08

Fixed cost per month = Intercept = \$1,750

The solution using the formulas in the text is:

$$n = 8$$

$$\text{sum}X = 247$$

$$\text{sum}Y = \$26,620$$

$$\text{sum}XY = \$836,954$$

$$\text{sum}X^2 = 7,921$$

$$b = [n(\text{sum}XY) - (\text{sum}X)(\text{sum}Y)]/[n(\text{sum}X^2) - (\text{sum}X)^2]$$

$$= [8(\$836,954) - (247)(\$26,620)]/[8(7,921) - (247)^2]$$

$$= \$51.08$$

$$a = [(\text{sum}Y) - b(\text{sum}X)]/n$$

$$= [(\$26,620) - \$51.08(247)]/8 = \$1,750$$

AACSB: Analytic

AICPA BB: Critical Thinking

AICPA FN: Measurement

Bloom's: Application

Learning Objective: 02A-08 Analyze a mixed cost using a scattergraph plot and the least-squares regression method

Level: Hard