



PROJECT-SET

Statistics Education for Teachers

Crime & Coffee #2

Grading Rubric with Answers

Task adopted from www.illustrativemathematics.org aligned with standard S-ID.B6

Written task aligned with LR: Loop 3

Grade each question below using the following three grades: Essentially Correct (E), Partially Correct (P), and Incorrect (I).

Example answers for each category are given below each question.

Once each of the questions is graded in this manner, the results will then be tallied to give an overall score for the task. For each E, a person will receive 1 point. For each P, a person will receive $\frac{1}{2}$ point. For each I, a person will receive 0 points. The overall grade will be one of the following:

- 4 Complete Response**
- 3/3.5 Substantial Response**
- 2/2.5 Developing Response**
- 1/1.5 Minimal Response**

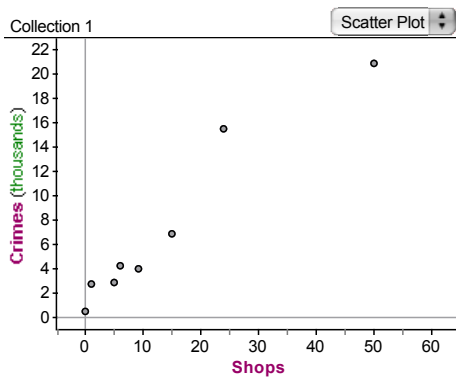
Please write the amount of points earned and the word to describe the points earned (complete, substantial, developing, or minimal) on the front page of each person's paper.

Many counties in the United States are governed by a county council. At public county council meetings, county residents are usually allowed to bring up issues of concern. At a recent public County Council meeting, one resident expressed concern that 3 new coffee shops from a popular coffee shop chain were planning to open in the county, and the resident believed that this would create an increase in property crimes in the county. (Property crimes include burglary, larceny-theft, motor vehicle theft, and arson -- From <http://www.fbi.gov/about-us/cjis/ucr/crime-in-the-u.s/2010/crime-in-the-u.s.-2010/property-crime> accessed on December 5, 2012.)

To support this claim, the resident presented the following data:

County	Shops	Crimes
A	9	4000
B	1	2700
C	0	500
D	6	4200
E	15	6800
F	50	20800
G	5	2800
H	24	15400

In order to have a better visual depiction of the data, here is a scatterplot:



1. Find the sample linear regression line using technology. Write the equation here.
Crimes = 415.739 Shops + 1433.6

Grading Category	Solutions, Explanations, and Sample Answers
Essentially Correct (E)	An essentially correct answer will provide an accurate equation.
Partially Correct (P)	A partially correct answer would have a regression equation with either the intercept or slope incorrect.
Incorrect (I)	An incorrect answer would fail to meet the criteria of E and P.

2. (a) By looking at the scatterplot, make an estimate of the value of the correlation coefficient. Explain your estimate.

(b) Based on the regression line, think about what a residual plot would look like. You can sketch one or plot one using technology, if it helps you visualize. What is the relationship between the correlation and the residuals?

- a) **The relationship between the number of coffee shops and the number of crimes is positive. The relationship also appears to be strongly linear with the points aligning quite well with a straight line. Thus, I chose a large and positive correlation estimate.**
- b) **The smaller the residuals, the higher the correlation.**

Grading Category	Solutions, Explanations, and Sample Answers
Essentially Correct (E)	An essentially correct answer will have correct answers to both (a) and (b). To get a correct answer for (a), the guess of the correlation must be positive and close to 1. The explanation must illustrate understanding of the meaning of correlation with regards to the points on the plot. The correct answer to (b) would note that the residuals and the correlation are inversely related (smaller the residuals, the higher the correlation or the larger the residuals, the smaller the correlation).
Partially Correct (P)	A partially correct answer would have a correct answer to (a) or (b), but not both.
Incorrect (I)	An incorrect answer would fail to meet the criteria of E and P.

3. (a) Compute the correlation coefficient using technology. Is it close to your prediction in #2? Explain.
- (b) What does the correlation coefficient signify? Can you describe the meaning of the correlation coefficient in the context of the problem?

- a) **$r = .968$**
- b) **The correlation measures the strength and direction of the linear relationship between the number of coffee shops and the number of crimes. In this case, there is almost a perfect linear relationship since the correlation coefficient is so close to 1.**

Grading Category	Solutions, Explanations, and Sample Answers
Essentially Correct (E)	An essentially correct answer will have correct answers for both (a) and (b). The correct answer to A would provide the correct r . A correct answer answer to (b) would make some reference to the variance being explained by the predictor variable.
Partially Correct (P)	A partially correct answer would have a correct answer to (a) or (b), but not both.
Incorrect (I)	An incorrect answer would fail to meet the criteria of E and P.

4. Is the following statement accurate? Explain. "The more coffee shops there are, the more crimes there are. To reduce crime, one should reduce coffee shops."

No. This statement implies causality while we only have high correlation. Correlation does not imply causation.

Grading Category	Solutions, Explanations, and Sample Answers
Essentially Correct (E)	An essentially correct answer will mention that correlation does not imply causation. The answer would recognize that the statement is using causal language.
Partially Correct (P)	A partially correct answer would mention that correlation does not imply causation but not clearly make the connection that the statement may be making a causal statement.
Incorrect (I)	An incorrect answer would fail to meet the criteria of E and P.