

Least Squares Regression Quiz

1. The height h and collar size c , both in centimeters, measured from a sample of boys were used to create the regression line $\hat{c} = -94 + 0.9h$. The line is used to predict collar size from height, both in centimeters, for boys' shirt collars. Which of the following has no logical interpretation in context?
- (A) The predicted collar size of a boy with height 140 cm
 - (B) The h values in the sample
 - (C) The c values in the sample
 - (D) The slope of the regression line
 - (E) The c -intercept of the regression line

Answer E

Correct. The c -intercept of the regression line can be determined when the value of h is 0 centimeters. It is not meaningful to predict the collar size of a boy with a height of 0 centimeters.

2. A researcher studying a specific type of tree creates a least-squares regression line for relating the height and the diameter, both in meters, of a fully grown tree. The results are shown in the following computer output.

Variable	DF	Estimate	SE	T
Intercept	1	5	4.00	2.50
Diameter	1	30	2.50	13.20

Which of the following values represents the predicted change in the height of the tree for each one-meter increase in the diameter of the tree?

- (A) 30
- (B) 5
- (C) 4
- (D) 2.5
- (E) $\frac{1}{30}$

Answer A

Correct. The value 30 is the slope of the model; it represents the predicted change in height for each one-meter increase in diameter.

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3. Dairy farmers are aware there is often a linear relationship between the age, in years, of a dairy cow and the amount of milk produced, in gallons per week. The least-squares regression line produced from a random sample is $\widehat{\text{Milk}} = 40.8 - 1.1(\text{Age})$. Based on the model, what is the difference in predicted amounts of milk produced between a cow of 5 years and a cow of 10 years?
- (A) A cow of 5 years is predicted to produce 5.5 fewer gallons per week.
- (B) A cow of 5 years is predicted to produce 5.5 more gallons per week. ✓
- (C) A cow of 5 years is predicted to produce 1.1 fewer gallons per week.
- (D) A cow of 5 years is predicted to produce 1.1 more gallons per week.
- (E) A cow of 5 years and a cow of 10 years are both predicted to produce 40.8 gallons per week.

Answer B

Correct. The difference of 5 years produces a 5.5 gallon per week difference in favor of the younger cow.

4. A set of bivariate data was used to create a least-squares regression line. Which of the following is minimized by the line?
- (A) The sum of the residuals
- (B) The sum of the squared residuals ✓
- (C) The sum of the absolute values of the residuals
- (D) The influence of outliers
- (E) The slope

Answer B

Correct. The least-squares regression line minimizes the sum of the squares of the residuals.

5. A restaurant manager collected data to predict monthly sales for the restaurant from monthly advertising expenses. The model created from the data showed that 36 percent of the variation in monthly sales could be explained by monthly advertising expenses. What was the value of the correlation coefficient?
- (A) 0.64
- (B) 0.60 ✓
- (C) 0.40
- (D) 0.36
- (E) 0.13

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Answer B

Correct. The proportion of the variation explained by the explanatory variable is the coefficient of determination r^2 , and the correlation coefficient is the square root of r^2 . In this case, the correlation of determination is 36 percent, meaning $r^2 = 0.36$, so $r = \sqrt{0.36} = 0.60$. The correlation coefficient has the value 0.60.

6. The least-squares regression line $\hat{S} = 0.5 + 1.1L$ models the relationship between the listing price and the actual sales price of 12 houses, with both amounts given in hundred-thousands of dollars. Let L represent the listing price and S represent the sales price.

Which of the following is the best interpretation of the slope of the regression line?

- (A) For each hundred-thousand-dollar increase in the listing price, the sales price will increase by \$1.1.
- (B) For each hundred-thousand-dollar increase in the listing price, the sales price will increase by \$110,000.
- (C) For each hundred-thousand-dollar increase in the listing price, the sales price will decrease by \$110,000.
- (D) For each hundred-thousand-dollar increase in the listing price, the sales price is predicted to increase by \$1.1.
- (E) For each hundred-thousand-dollar increase in the listing price, the sales price is predicted to increase by \$110,000. ✓

Answer E

Correct. Nondeterministic language (predicted, on average, estimated, etc.) is used, and the correct increase is indicated.