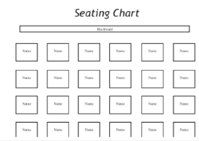
Does seat location matter?





Do students who sit in the front rows do better than students who sit farther away? A teacher randomly assigned 30 students to seats at the beginning of the semester and then recorded their exam scores at the end of the semester. Here are the results:

Row	1	1	1	1	1	1	2	2	2	2	2	2	3	3	3	3	3	3
Score	76	77	94	99	88	90	83	85	74	79	77	79	90	88	68	78	83	79

Row	4	4	4	4	4	4	5	5	5	5	5	5
Score	94	72	101	70	63	76	76	65	67	96	79	96

Put these data into two lists. Name row number “row” and exam score “score”.

1. Is this an observational study or an experiment? Why?

2. Why is it important to randomly assign the students to seats rather than letting each student choose his or her own seat?

3. How many variables are we measuring?_____ Are they categorical or quantitative?_____________

What is the explanatory variable (x)?__________________ Response variable(y)?_____________

4. Use your calculator to make a scatterplot. Sketch it below.

4. Find the least squares regression line (LSRL):____

5. What is the slope of the LSRL:_________ Interpret the slope in the context of the problem.

Does the negative slope provide convincing evidence that sitting closer causes higher achievement, or is it plausible that the association is purely by chance because of random assignment?

In order to answer this question, we need to know more about “purely by chance because of random assignment”. If we assume that seat location has NO effect on Exam Score, then we could just randomly assign all 30 Exam Scores to each of the seat locations.

6. We will do this by using our calculators.
Name a new list “sample1”. In the formula cell do the following. Menu, 3: Data, 5:Random, 5: Sample. Type in randSamp(score, 30, 1). This will randomly assign each score into a new row.

Make a new scatterplot and calculate a new LSR line. ________________________________

What is the new slope? ____________________________________

7. Repeat this process in #6 labeling the new list “sample2”.

Make a new scatterplot and calculate a new LSR line. ________________________________

What is the new slope? ____________________________________

8. Do #6 one more time labeling the new list “sample3”

Make a new scatterplot and calculate a new LSR line. ________________________________

What is the new slope? ____________________________________

Sampling Distribution of b

You may have heard that your nose and ears grow through your whole life. While it is true that your nose and ears get bigger throughout life, it's not because they grow, but because of gravity. The cartilage in your nose and ears break down as we age and the "growth" people observe is the result of drooping. To quantify the expansion of ears over time, a random sample of 30 adults were selected. For each adult, their age (in years) was recorded and their ear height (cm) was measured. Below is the regression output. Is there evidence of a positive linear relationship between age and ear height? Assume the conditions for inference are met.

Regression Analysis: Age versus Ear Height

Predictor	Coef	SE Coef	T	P
Constant	2.8871	0.3145	9.1800	0.0000
Age	0.0021	0.0059	0.3559	0.7246

s = 0.3613 R-Sq = 0.825 R-Sq(adj) = 0.918

a. What is the estimate for α? Interpret this value.

b. What is the estimate for β? Interpret this value.

c. What is the estimate for σ? Interpret this value.

d. Give the standard error of the slope SE_b. Interpret this value.

Confidence Interval for Slope (b)

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Row	1	1	1	1	1	1	2	2	2	2	2	2	3	3	3	3	3	3
Score	76	77	94	99	88	90	83	85	74	79	77	79	90	88	68	78	83	79

Row	4	4	4	4	4	4	5	5	5	5	5	5
Score	94	72	101	70	63	76	76	65	67	96	79	96

LSR line: _______________ Slope b = __________ $SE_b = 1.33$

1. We want to construct a 95% confidence interval for the slope of the population regression line. Identify the parameter and statistic.

Parameter _________________________ Statistic __________________________

2. There are five conditions to check.

(1) **Linear:** The **scatterplot** needs to show a linear relationship. Also, the **residual plot** doesn't have a leftover curved pattern.

(2) Independent:

(3) **Normal:** A **dotplot of the residuals** cannot show strong skew or outliers.

(4) **Equal SD:** The residual plot does not show a clear sideways Christmas tree pattern.

(5) Random:

3. Construct the Interval:

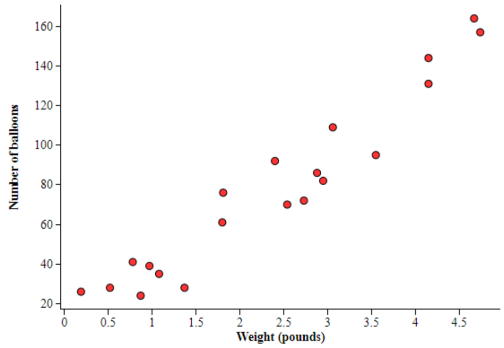
4. Conclusion:

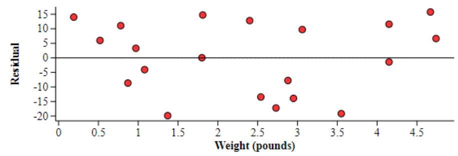
A thrill-seeker wanted to try to travel across a large field while being suspended in the air by holding onto balloons. In order to determine the number of balloons needed per pound of weight, he did a preliminary study. He selects a random sample of 20 rocks of various sizes. He weighed each one and also determined how many balloons are needed to lift the rock. Here is output from a least-squares regression analysis of the data.

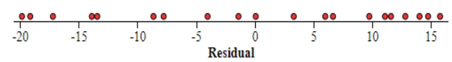
Regression Analysis: Number of Balloons versus Weight

Predictor	Coef	SE Coef	T	P
Constant	6.211	5.5831	1.1127	0.2805
Weight	30.4126	2.0416	14.8968	0.000

s = 12.2625   R-Sq = 0.9250   R-Sq(adj) = 0.9208







Construct and interpret a 90% confidence interval for the slope of the population regression line.

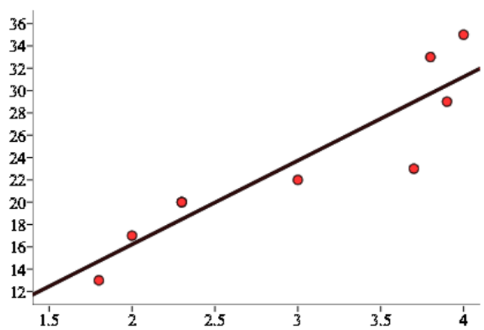
Significance Test for Slope

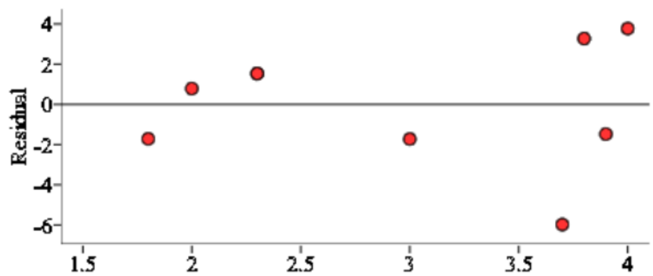
Is there a relationship between GPA and ACT scores? A teacher randomly sampled 9 or her 101 students and recorded their GPA and ACT scores.

Student #	83	69	96	89	57	13	24	37	91
GPA	3.7	2.3	4.0	3.8	3.0	1.8	2.0	2.3	3.9
ACT	23	20	35	33	22	13	17	20	29

Here is the Minitab output as well as graphs of the data.

Predictor	Coef	SE Coef	T	P
Constant	1.201	0.0874	13.72	0
GPA	7.507	1.29	5.82	0.0006511
S = 3.252686	R-Sq = 82.8%		R-Sq(adj) = 76.5%	

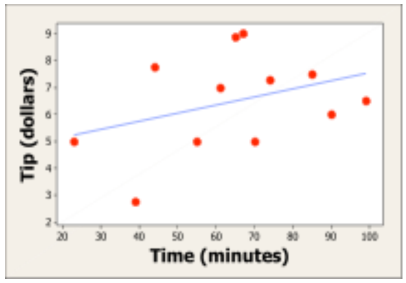


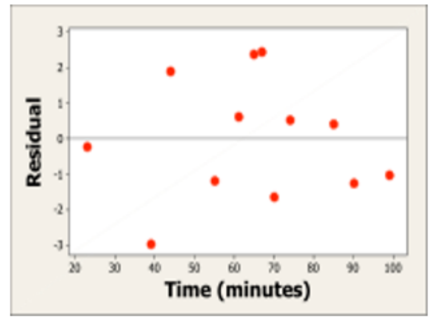


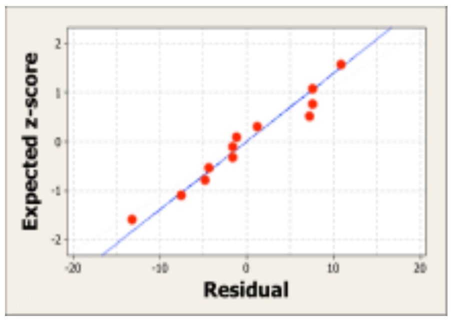
Do the data provide significant evidence that there is a positive linear relationship between GPA and ACT?

Do customers who stay longer at buffets give larger tips? Charlotte, an AP® Statistics student who worked at a Brunch buffet, decided to investigate this question for her second-semester project. While she was doing her job as a hostess, she obtained a random sample of receipts, which included the length of time (in minutes) the party was in the restaurant and the amount of the tip (in dollars). Here are the data, along with some output from a least-squares regression analysis.

Time (minutes)	Tip (dollars)
23	5.00
39	2.75
44	7.75
55	5.00
61	7.00
65	8.88
67	9.01
70	5.00
74	7.29
85	7.50
90	6.00
99	6.50





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Predictor          Coef        SE Coef      T      P
Constant           4.535       1.657        2.74 0.021
Time (minutes)     0.03013     0.02448      1.23 0.247

S = 1.77931   R-Sq = 13.2%   R-Sq(adj) = 4.5%
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Do these data provide convincing evidence of a positive linear relationship between the amount of time and amount of tip for customers at this Brunch buffet?