financialalgebra

9.2 Correlation vs Causation
Student Activity Packet
UNIT: PAYING FOR COLLEGE & STATISTICAL ANALYSIS

Name:

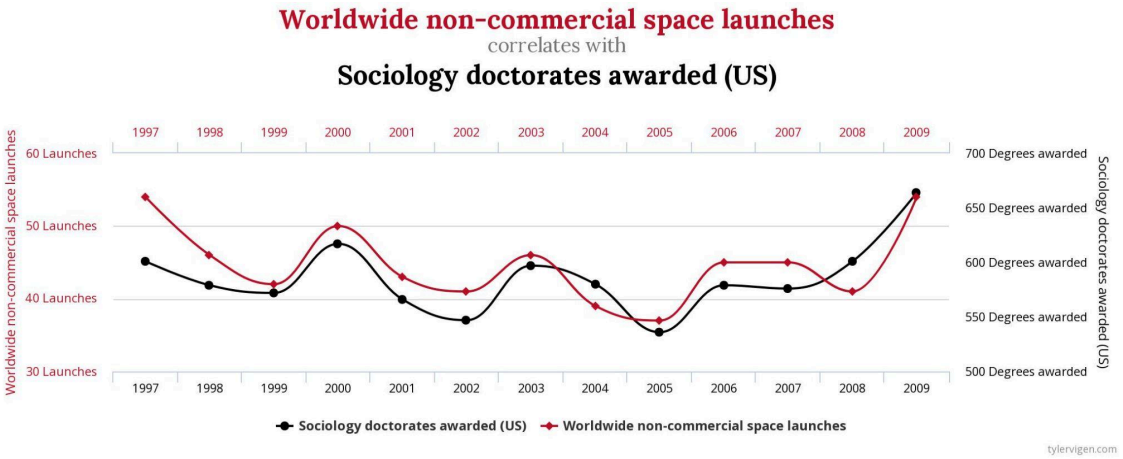
IN THIS LESSON, YOU WILL:

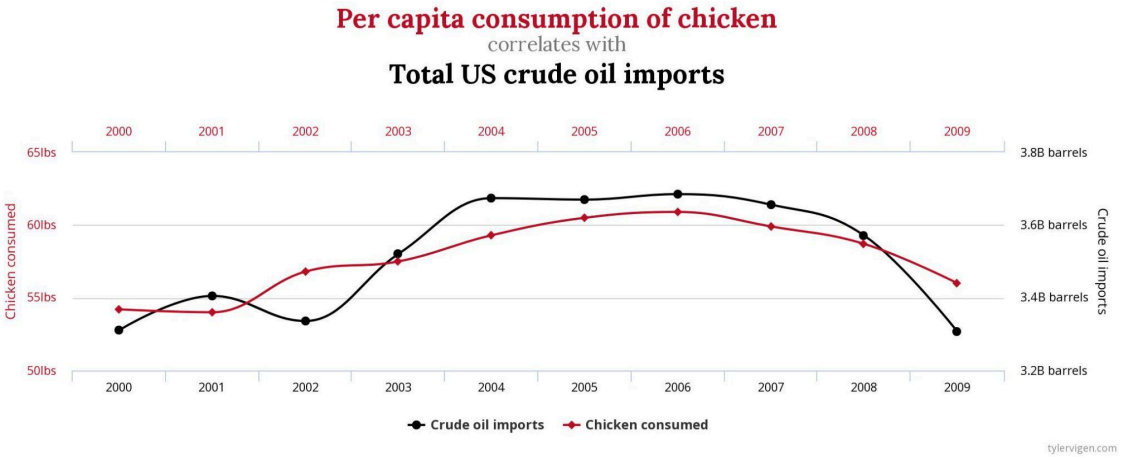
- Define correlation, causation, samples, and populations
- Explain the difference between correlation and causation
- Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.
- Compare college testing and admissions statistics
- Examine the relationship between college cost and graduation rates

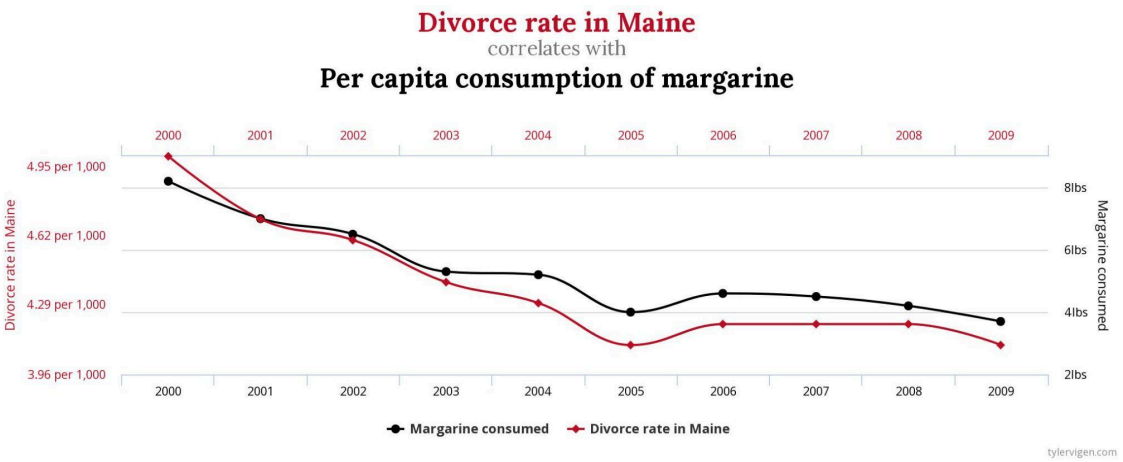
INTRO

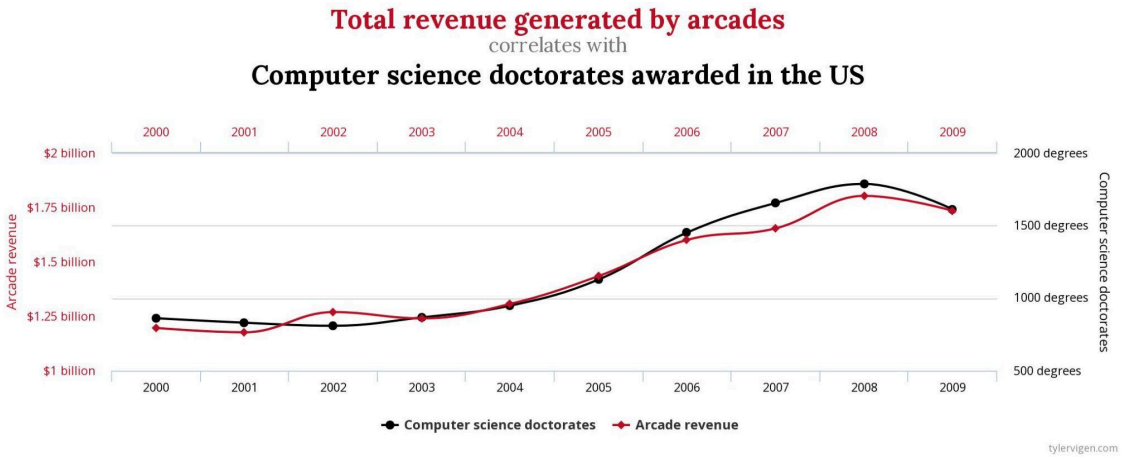
CONSIDER: Drawing Conclusions

Here you see graphs that show some unexpected relationships between seemingly unconnected things. Take some time to analyze each graph, and then answer the questions.









Source

1. **Choose one of these graphs and draw a conclusion about the relationship between the variables**

2. **What is one action you could recommend based on this information?**

LEARN IT

EDPUZZLE: Correlation - The Basic Idea Explained

The previous graphs all showed two different variables that were correlated. Correlation is one of the factors we use when comparing two or more different variables. It is an important factor to measure, but it is also easily misinterpreted if you're not careful. Watch this edpuzzle video, and then answer the questions.

1. **What is an important thing to remember about correlation and causation?**

2. **For each statement below about the INTRO graphs, decide if it implies correlation (the two events are related) or causation (the two events are related and one event caused the other).**
    a. Sociology doctorates and space launches both increased at the same rate from 2007 to 2009.

    b. When consumption of chicken decreases, the U.S. imports less crude oil.

    c. The less margarine that is consumed per capita, the lower the divorce rates in Maine will be.

    d. The rise in arcade revenue corresponds to the increase in computer science doctorates awarded in the U.S.

3. **Give an example of two variables that are correlated, but one variable does not cause the other.**

ARTICLE: What is Considered to Be a "Strong" Correlation?

A correlation shows a relationship (though NOT necessarily a causal one) between variables. Often, the only measure we get of correlation is a graph or a correlation coefficient from an analysis program. But how do you interpret the correlation coefficient in real terms for a set of data? Read the article through the section on technology fields to get an idea of how to interpret the correlation coefficient, and then answer the questions.

1. **What is the typical cutoff for a correlation showing a “strong” linear relationship?**

2. **Below what level of correlation would typically be considered “no relationship” between variables?**

3. **Describing the correlation based on the description given:**
    a. The data are extremely scattered but overall they slope downward very steeply

    b. There is very slight upward slope to the data points which are all in very nearly a line

4. **Why might different fields of study have different interpretations for the same correlation levels?**

PRACTICE IT

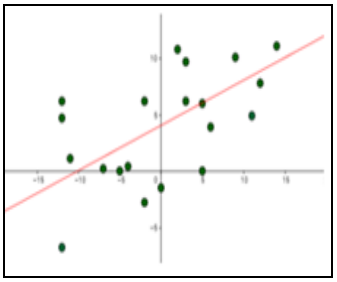
PICK TWO: Correlation
Complete two of the problems below.

1. **For each of the following graphs, decide if it is a strong or weak, positive or negative, or no correlation and give an estimate of its correlation coefficient.**

   a. Strong / Weak No Correlation

   Positive / Negative

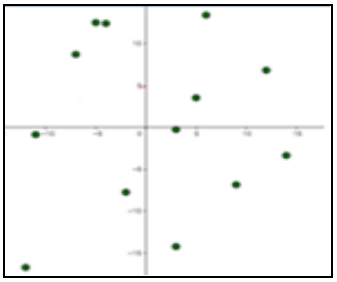
   r ≈ _____



   b. Strong / Weak No Correlation

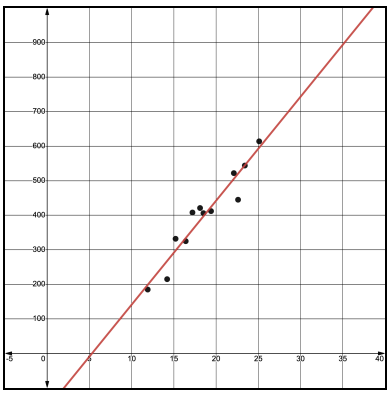
   Positive / Negative

   r ≈ _____



2. **Your friend Derek polls his classmates and finds the coefficient of correlation, r, for hours spent hanging out with friends and GPA is 0.93. "I knew it!" he exclaims. This proves that if I just spend more time with my friends, I'm bound to get an A eventually! What mistake is he making? Give one way he could revise his claim or explain the data differently.**

3. **Use the graph to answer the questions.**
   a. Estimate the r value for this graph and explain your answer.



   b. Come up with two variables that might reasonably have a correlation like this.

LEARN IT

VIDEO: Types Of Studies Explained

We've established that correlation does not imply causation. There are different types of studies that can lead us to different conclusions. Two of these are observational studies and randomized experiments. Watch this video to learn the difference, and then answer the questions.

1. **Fill in the blank with either "correlation" or "causation." Observational studies can only show _____, while experiments can determine _____.**

2. **What is the main difference in design between an observational study and an experiment?**

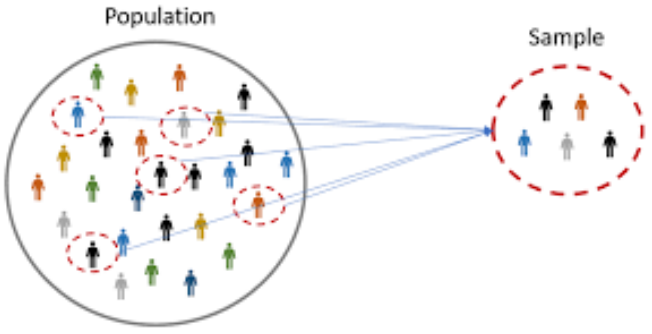
3. **Your classmate, Katarina, says: "Experiments seem WAY better than observational studies. I'm only going to do experiments to collect data from now on!" Give TWO reasons or examples of why her claim might be difficult to keep.**

Samples vs. Populations

Whether you're working with observational studies or experiments, it's important to know the difference between a sample and a population.

A **population** is a set of all items or events which are of interest for some question or experiment. It is generally the group you are trying to make predictions or learn something about. For most studies, it is either impossible or impractical to obtain data on an entire population. This is why you need to use a smaller selection of items.

A **sample** is a selection of observations from a population. We measure data in a known sample to make a prediction, or inference, about the population.



Good and Bad Samples
You want to know the average height of students in your whole grade. To get a good estimate, you measure the average height of students in your class.

> **Population:** Students in your grade
> **Sample:** Students in your class

A sample that would **NOT** fit would be:

> **Sample:** Students from the class younger than you

Since height varies with age for adolescents, a younger student is not likely to have the same height as an older student. Because they are not part of the population, they would not provide an accurate estimate.

But, there are many other samples you could take for that same population. Other samples might be:

- The girls in your grade
- The students in the other class
- Your friend group
- Just you

1. **Which of these samples is likely to be the LEAST accurate estimate for the height of students in your class and why?**

2. **Give one more example of another possible sample that would fit this population**

3. **Give an example of a sample that would NOT fit this population**

APPLY IT

Follow your teacher's directions to complete the Application Problems.

Teachers, you can find the Application problems linked in the Lesson Guide.