Station #5 **Statisticulation**

Read the following joke:

A man goes to a roadside diner where the special is "Rabbit Stew." He asks the waiter whether it really is rabbit in the stew.
"Well, actually it's 50% rabbit and 50% horse," says the waiter.
"That's not too bad," replies the man. "I'll take it."
When the man begins to eat the stew he encounters chunk after chunk of horse-meat, but no rabbit at all, so he calls the waiter over to complain. "There's no way this is 1/2 rabbit and 1/2 horse," he says.
"Sure it is," replies the waiter. "One rabbit, one horse."

1) Did you laugh? _____
2) Why is the joke "funny"?
_____

Imagine that, in one survey, 3% of people choose a certain answer. When you ask that survey again the next year, 6% of people choose that answer. You want to tell someone about this change in the most astounding way possible. Do you say:

there was an increase of 3 percentage points (3 + 3 = 6)?
there was a 100% increase (100% of 3 is 3, so 3 + 3 = 6)?
200% of the people compared to last year chose this answer (200% of 3 is 6)?

Of course, if you want to impress, you would choose the last one. It's important to see that all three of these are the same, but they leave very different impressions in the mind of the reader. So always be on the lookout for the difference between "percent" and "percent increase". Also beware of people using percent when a number would do.

Practice:

Suppose you make $1000 a week. Your company is in dire straits, and so you have to take a 50% pay cut.

How much money do you make now? _____

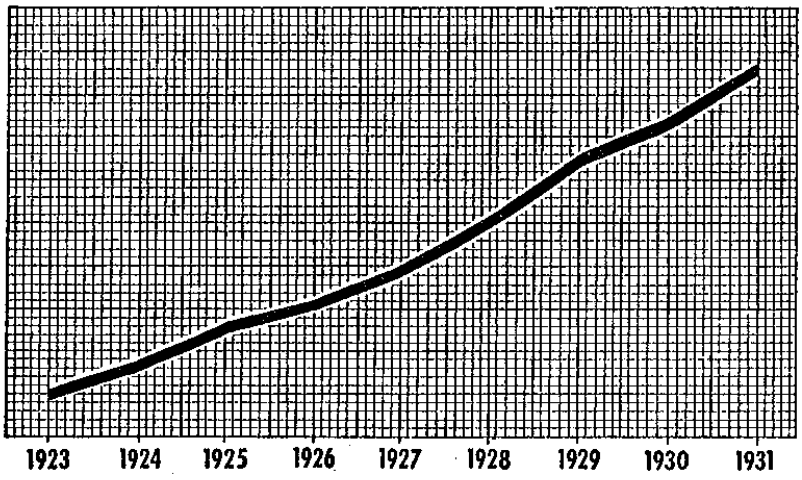
Later on, the company recovers, and so grants you a 50% pay increase.

How much money do you make now? _____

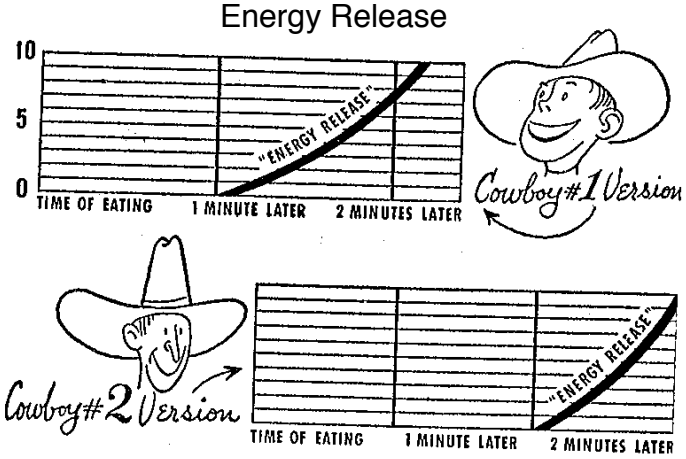
Are you happy with your current salary? _____

Station #1 **The Little Numbers That Are Not There**

Profit over Time



Energy Release



Look at the two graphs. The first one, Profit over Time, is how much more money a certain company made in 1931 compared to 1923. The second one, Energy Release, is about the benefits of eating a certain "healthy" cereal.

1) So, how much more money did the company make?

_____

2) How much "energy" is released by the cereal?

_____

When we look at a statistical representation, there are often little facts that may be missing. Sometimes they are missing unintentionally, but sometimes not! Your first response should be to look for those numbers. Talk back to the statistics, and ask them:

What is the range?
What is the margin of error?
Who did you ask?
How many people of each demographic did you ask?
Is everything properly labeled?

If those answers are not provided, then everything may not be as it seems.

Also beware when two things seem the same but are not. Take the following example:

When Governer Dewey was elected in 1942, the minimum teacher's salary in some districts was as low at $900 a year. As a result of his work to improve salaries, the minimum salary of teachers in NYC was between $2,500 and $5,325 a year.

Seems like Governer Dewey was a big help...except...first they said "some districts," then they said "NYC." Those aren't the same. Teachers always make more in NYC than in rural districts through the state. Comparing the lowest statewide to the lowest in the city is not a fair comparison.

Practice:

The death rate in the Navy during the Spanish-American War (1898) was .9%.

The death rate in NYC in 1898 was 1.6%.

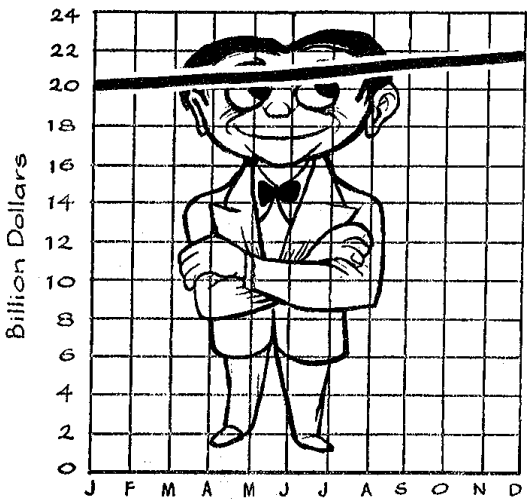
Was it safer to be in the Navy during a war than to live in NYC? Why or why not?

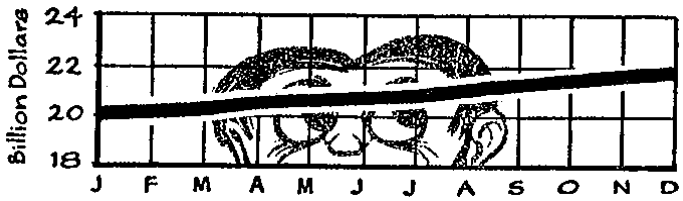
Who's Who - Women	Academic Degrees	Number of Children
Arnott, Mary	2	3
Brighton, Abigail	3	0
Cleveland, Dorothy	3	1
Donaldson, Sarah	3	0
Frank, Louise	2	0
Gilbreth, Lillian	8	12
Gildersleeve, Virginia	12	0
Inez, Claire	2	0
Johnson, Zelda	5	0
Lovejoy, Bea	2	0
Matthews, Rose	4	0
Piper, Estelle	2	0
Smith, Jean	3	0
Sutherland, Joyce	2	2
Thompson, Margaret	4	0
Waldorf, Meredith	3	0

Station #2 **The Gee-Whiz Graph**

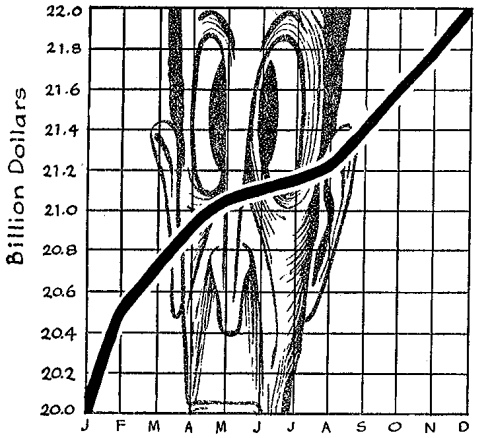
(How you can make data look different by changing the graph not the data)

1. What is the trend in graph 1?
a. There has been no increase in income
b. There has been a slight increase in income
c. There has been a dramatic increase in income





2. What is the trend in graph 2?
a. There has been no increase in income
b. There has been a slight increase in income
c. There has been a dramatic increase in income



3. What is the trend in graph 3?
a. There has been no increase in income
b. There has been a slight increase in income
c. There has been a dramatic increase in income

4. Now, what do you notice about the data in the graphs? How much has income risen?

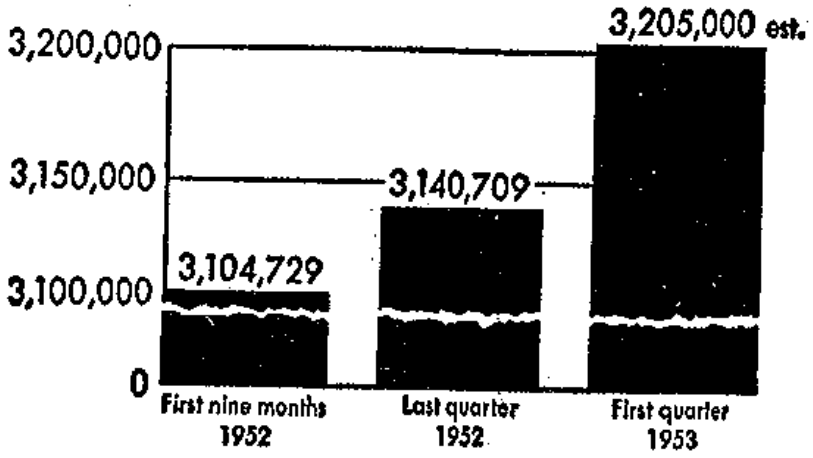
_____

_____

_____

Looking at graphs 1 and 2, you might notice that the data is the same, but the graphs look different. Nothing has been falsified – except the impression that it gives. Instead of starting with 0, the graph starts with 18. Doesn't the increase in income look greater here? It's not – it just looks that way because the bottom has been chopped off. But, why stop there? There is a further trick available to make the data look even more impressive. Simply change the proportions on the y-axis. Let each mark up the

axis stand for only one tenth as many dollars as before. Look at graph 3. Wow! Doesn't it look like a dramatic increase now?



Now for something even trickier . . . Look at graph 4. This graph does start at 0 on the y-axis. It jumps to 3,100,000 so quickly because the middle has been cut out. How much bigger do the other two bars look compared to the first?

_____

How much bigger are the actually?

_____

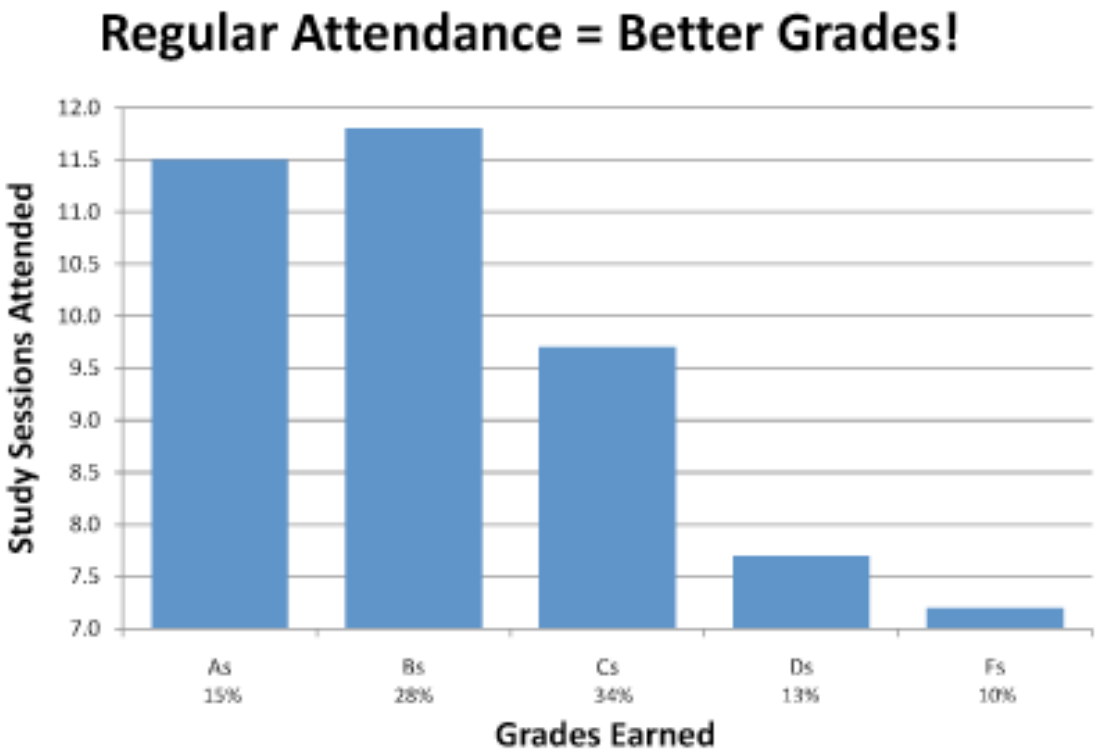
Why do you think someone might use the Gee Whiz Graph?

_____

_____

Practice:

Correct this graph so it is not misleading:



Station #4 **The Well Chosen Average**

Who's Who - Women	Academic Degrees	Number of Children
Arnott, Mary	2	3
Brighton, Abigail	3	0
Cleveland, Dorothy	3	1
Donaldson, Sarah	3	0
Frank, Louise	2	0
Gilbreth, Lillian	8	12
Gildersleeve, Virginia	12	0
Inez, Claire	2	0
Johnson, Zelda	5	0
Lovejoy, Bea	2	0
Matthews, Rose	4	0
Piper, Estelle	2	0
Smith, Jean	3	0
Sutherland, Joyce	2	2
Thompson, Margaret	4	0
Waldorf, Meredith	3	0

1. Look at the chart and the statement. How did the statistician calculate the fact that the **average** woman on the Who's Who list has 4 academic degrees and 1 child?

_____

_____

2. Do you think this is misleading? Why or why not?

_____

_____

When someone says the word "average" do you ever wonder what kind of average the person is talking about? The trick of the "Well-Chosen Average" is to use a different kind of average in order to prove what you want. The word "average" often has a very loose meaning. It is a trick commonly used, sometimes in innocence but often in guilt, by fellows wishing to influence public opinion or sell advertising

space. When you are told something is an average you still don't know very much about it unless you can find out which of the common kinds of average it is:

Mean: (sum of total divided by total #)

Median: (middle number, when the numbers are in order)

Mode: (the number that appears the most.

Let's look at our example. In this scenario the author used the mean in order to determine that they had 4 degrees and 1 child. What if she had used the median or the mode. How would the statement change? What would be different about it?

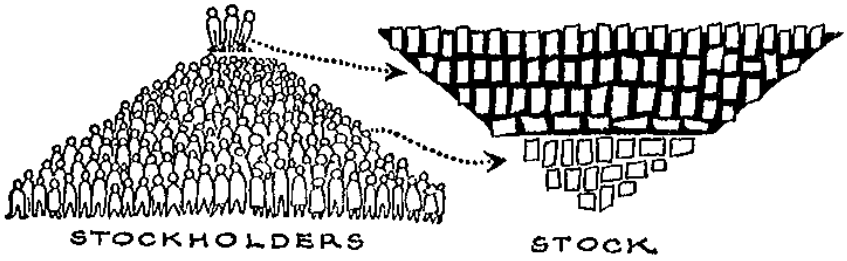
_____

_____

_____

_____

Practice:



This picture shows a certain company. There are 2,000,000 shares of stock in this company. The top three man own 1,500,000 shares between them. The other 3,000 stockholders own the rest.

1) If you were one of the three men, what would you say the "average" stockholder in the company owned?

2) If you were part of the Wall Street protest, what would you say the "average" was?

Station #3 **The One Dimensional Picture**

1. How many blocks are in the first square? _____
2. How many blocks are in the second square? _____
3. How many blocks are in the third square? _____
4. The second square is twice as tall as the first square. Is it twice as big? Why or why not? _____
5. How many times bigger is the third square than the first square?

_____

The "One-Dimensional Picture" method is all about an exaggerated image. Let's take the example of the money bags in images 1 and 2. What are the pictures trying to tell you? Well obviously it's saying that the man in picture 2 has twice as much money as the man in picture 1 because the bag is twice as tall . . . but wait a minute! Because the second bag is twice as high as the first, it is also twice as wide. It occupies not twice, but four times as much area on the page. The numbers still say two to one, but the visual impression says the ratio is four to one. Or worse. Since these are pictures of objects that have three dimensions in reality, the second must also be twice as thick as the first. Now it is giving me the impression that the second bag is eight times as large as the first, not twice as big. This is very misleading!

What would be a more accurate way to represent that the man in the second picture has twice as much money as the man in picture one? Explain or draw.

_____

_____

_____

Practice:

If there were a fourth square in the sequence, how many blocks would it have?

If all the squares were cubes, how many blocks would each one have?