

# **Math 114**

## **Module 7:**

### **Correlation & Causality**



**Prof. Volk**

**Spring 2026**

<https://viz.bible>



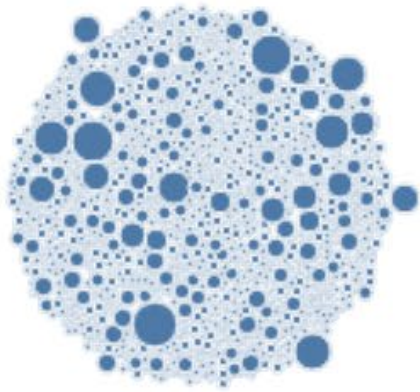
APP | POSTS | DATA | ABOUT | STORE

Images capture attention and ignite emotions. Pictures filled with data engage the mind. They cause us to notice something, ask questions, and search for answers. Viz.Bible showcases data visualizations, infographics, and illustrated diagrams that inspire people to know God more fully.

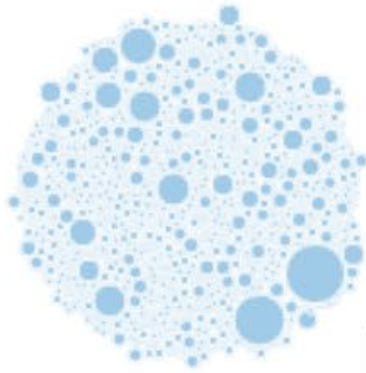
*Gallery*

# Word Usage in Each Book of the Bible

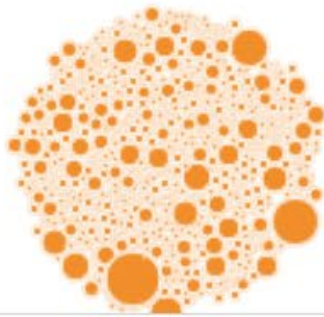
Genesis



Exodus



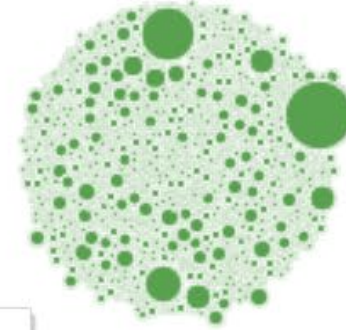
Leviticus



Numbers



Deuteronomy

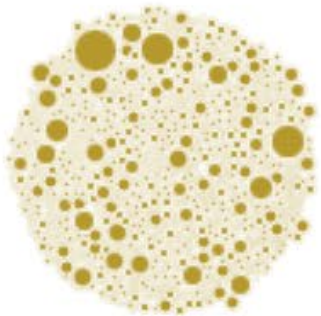


Joshua



The word, **Lord**, appears 414 time(s) in Exodus

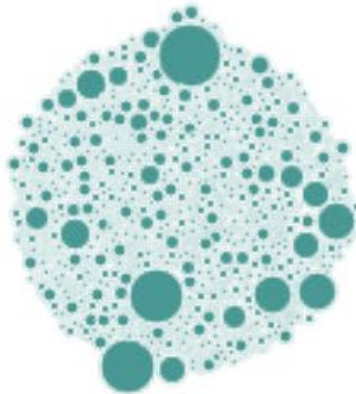
Judges



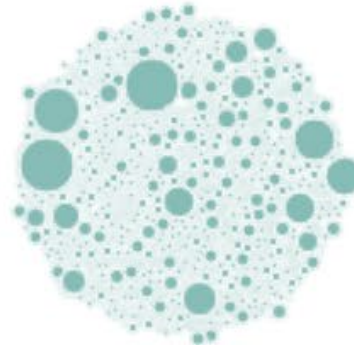
Ruth



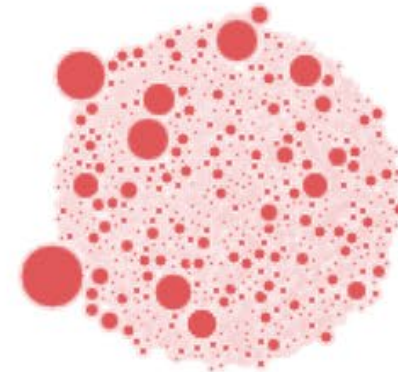
1st Samuel



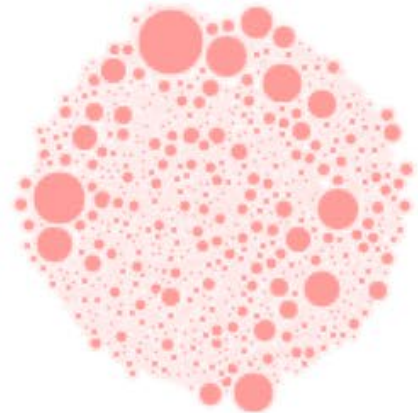
2nd Samuel



1st Chronicles

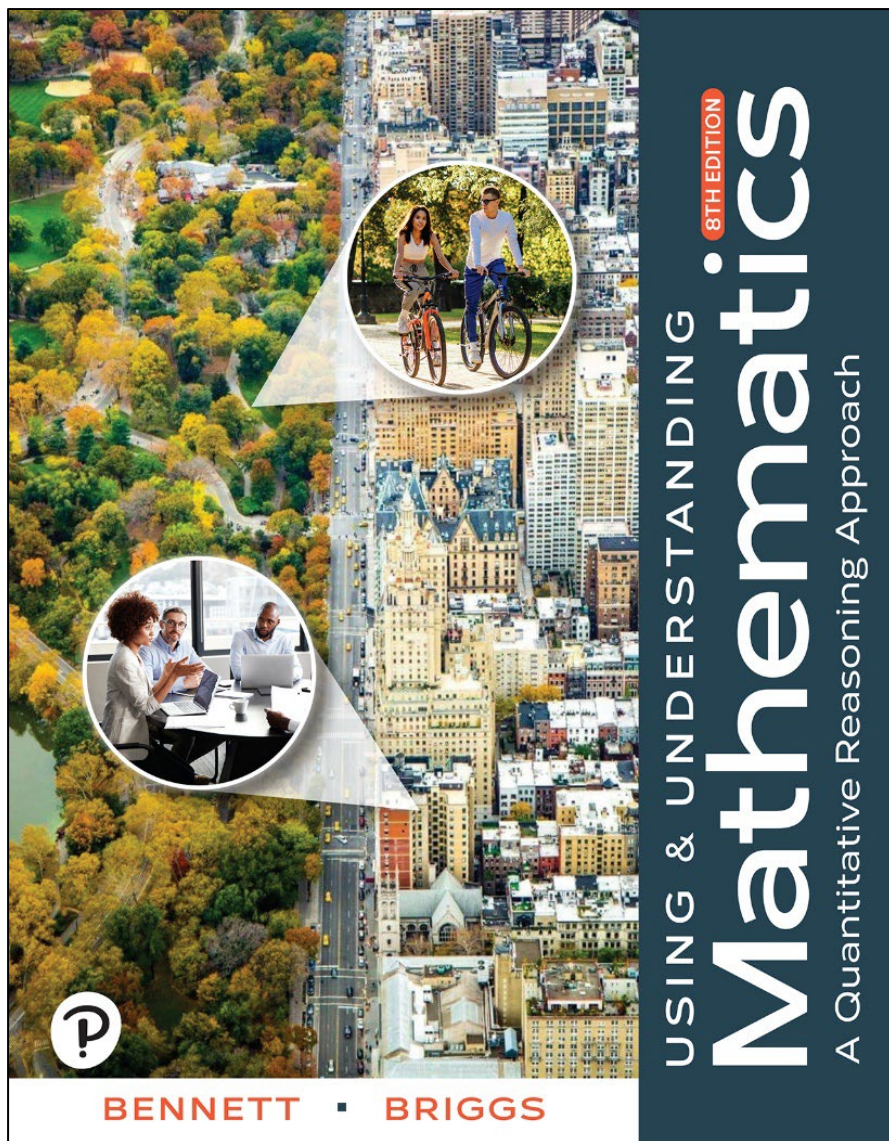


2nd Chronicles



FOR I WILL REFRESH THE  
WEARY SOUL AND  
REPLENISH ALL WHO ARE  
WEAK.”

*- JEREMIAH 31:25*



# This Week's Reading

## Chapter 5

(Sections D & E)

Statistics

# Homework 7: 20 Questions

Due Sunday  
11:59 pm

## Questions 1-5

- Interpret multiple bar graphs, stack plots, contour maps, and other graphical displays.

## Questions 6 - 8

- Identify features of graphs that must be interpreted with caution.

## Question 9

- Interpret exponential scales on graphical displays.

## Questions 10-12

- Construct and interpret graphical displays for given data sets.

## Questions 13-14

- Describe correlations by type and strength.

## Questions 15-16

- Identify possible explanations for a correlation or a causal relationship.

## Questions 17 - 20

- Construct and interpret Scatterplots

# Quiz 7: 10 Questions

Due Monday  
11:59 pm

## Question 1

- Interpret multiple bar graphs, stack plots, contour maps, and other graphical displays.

## Question 2

- Identify features of graphs that must be interpreted with caution.

## Question 3

- Interpret exponential scales on graphical displays.

## Question 4

- Construct and interpret graphical displays for given data sets.

## Question 5

- Evaluate the quality and trustworthiness of media graphics.

## Question 6

- Describe correlations by type and strength.

## Questions 7

- Identify possible explanations for a correlation or a causal relationship.

## Questions 8-10

- Construct and interpret Scatterplots



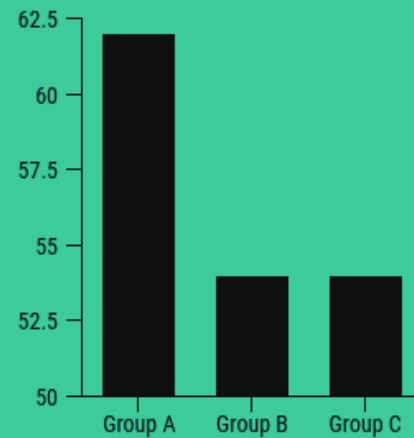
# 5 WAYS WRITERS USE GRAPHS TO MISLEAD YOU

Writers use graphs to make their information seem credible. But graphs should be read with a critical eye. There are ways that writers will misrepresent and skew data to support their narratives. Here are 5 of the most common ways writers use graphs to mislead readers.

1

## OMITTING THE BASELINE

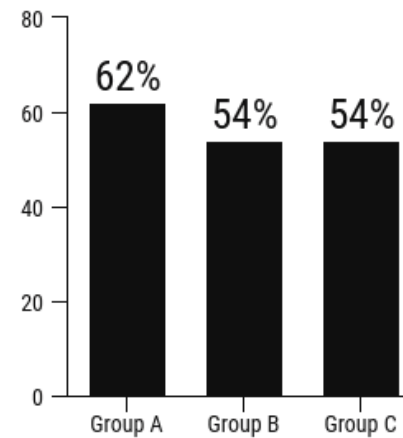
In most cases, the baseline for a graph is 0. But writers can skew how data is perceived by making the baseline a different number. This is known as a "truncated graph".



### MISLEADING

- Starting the vertical axis at 50 makes a small difference between groups seem massive
- Group A looks much larger than Groups B and C

VS



### ACCURATE

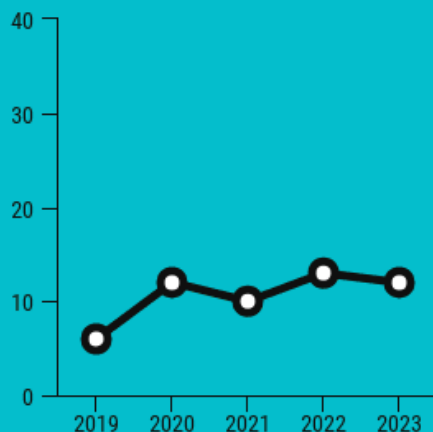


- Starting the vertical axis at 0 offers a more accurate depiction of the data
- The difference between the groups does not seem as dramatic

2

## MANIPULATING THE Y-AXIS

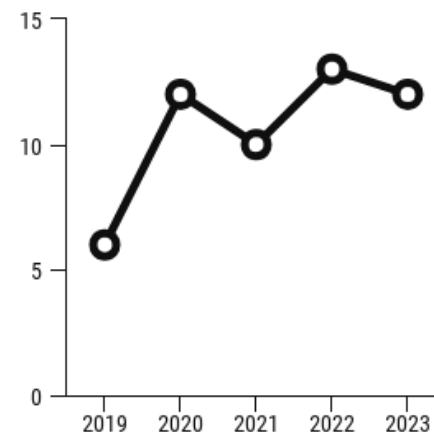
Expanding or compressing the scale on a graph can make changes in data seem more or less significant than they actually are.



**MISLEADING**

- The scale is disproportionate to the data, making the change over time seem small

VS



**ACCURATE**

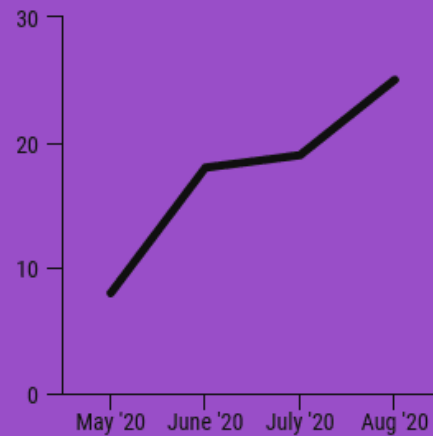


- The scale is proportionate to the data, showing a greater change over time

3

## CHERRY PICKING DATA

Writers may only include certain data points on their graphs to reinforce their narratives. This can create a false impression of the data.



### MISLEADING

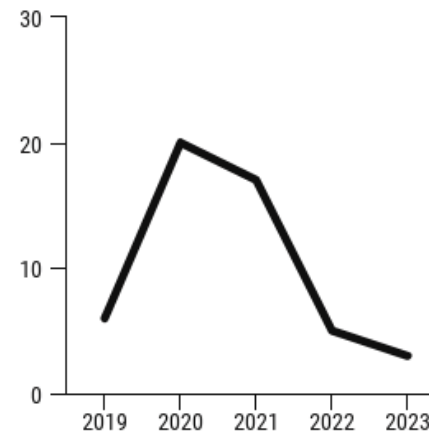
- Only a few months out of the year are graphed, depicting an upward trends

VS

### ACCURATE



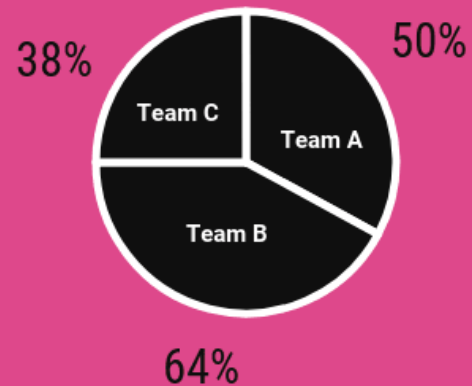
- A much wider date range is graphed, revealing an overall downward trend
- This graphs shows the bigger picture



4

## USING THE WRONG GRAPH

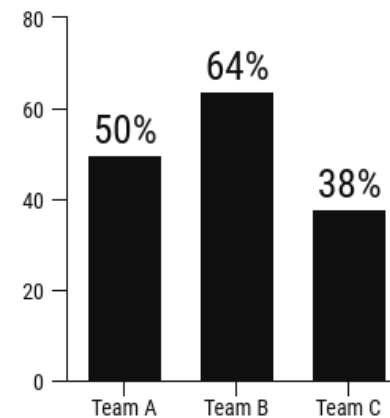
The type of graph you use should depend on the type of data you want to visualize.  
Using the wrong type of graph can skew the data. Writers will sometimes use the wrong type of graph on purpose.



### MISLEADING

- Pie charts are used to compare parts of a whole, not the difference between groups
- A different type of graph should be used to compare the three teams

VS



### ACCURATE

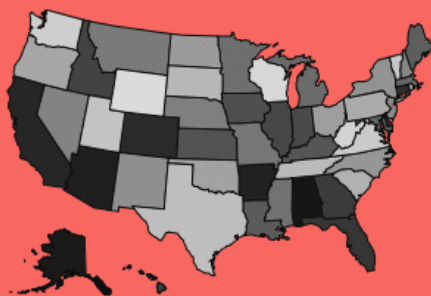


- Bar graphs are better for showing the differences between groups
- This chart is a better visualization of the data

## 5

## GOING AGAINST CONVENTIONS

Over time, we have developed standards for how data is visualized. Flipping those conventions can make a graph confusing or misleading to readers.



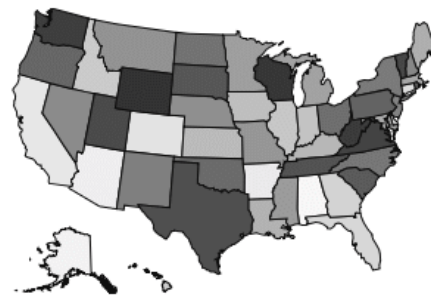
Individuals per km



## MISLEADING

- Normally, darker shades are associated with density on a map but here, dark has been used to depict lower population density
- This graph can confuse and mislead readers, who expect dark to represent a higher population density

VS



Individuals per km

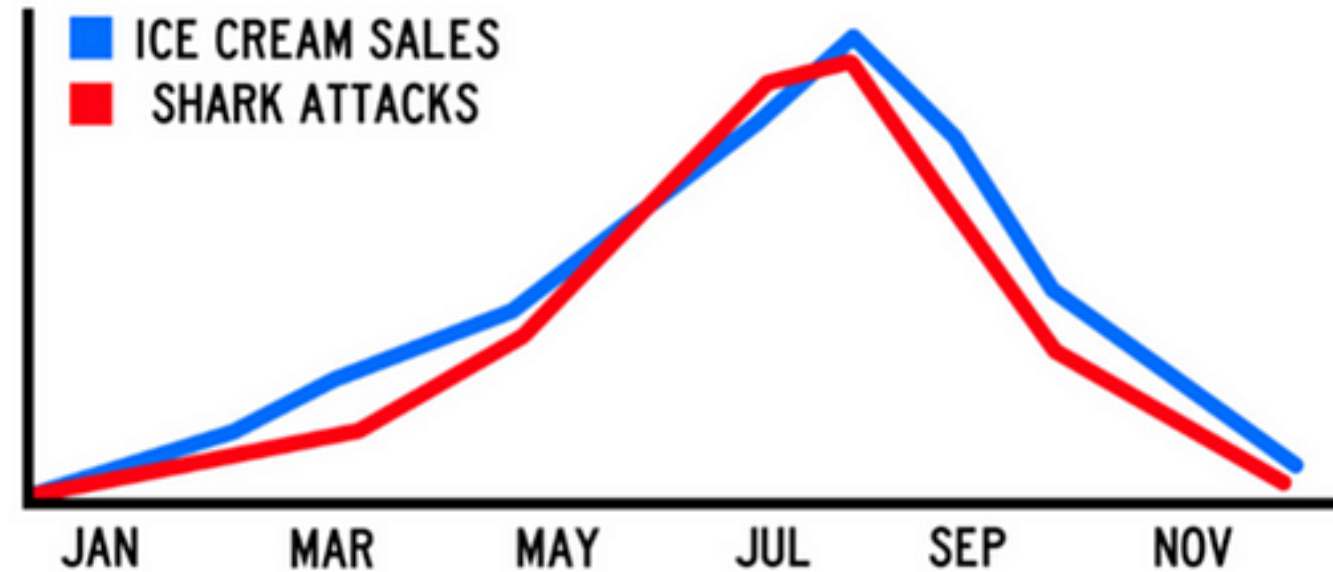


## ACCURATE



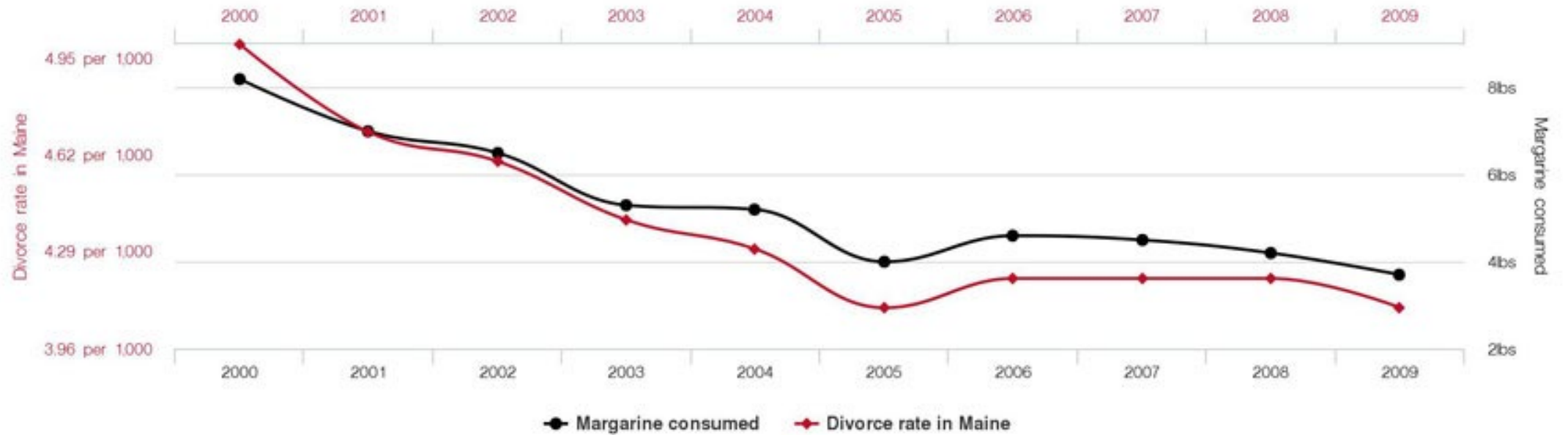
- This map follows the convention of using lighter shades for lighter density and darker shades for higher density
- Readers will intuitively know how to interpret the data

# CORRELATION IS NOT CAUSATION!

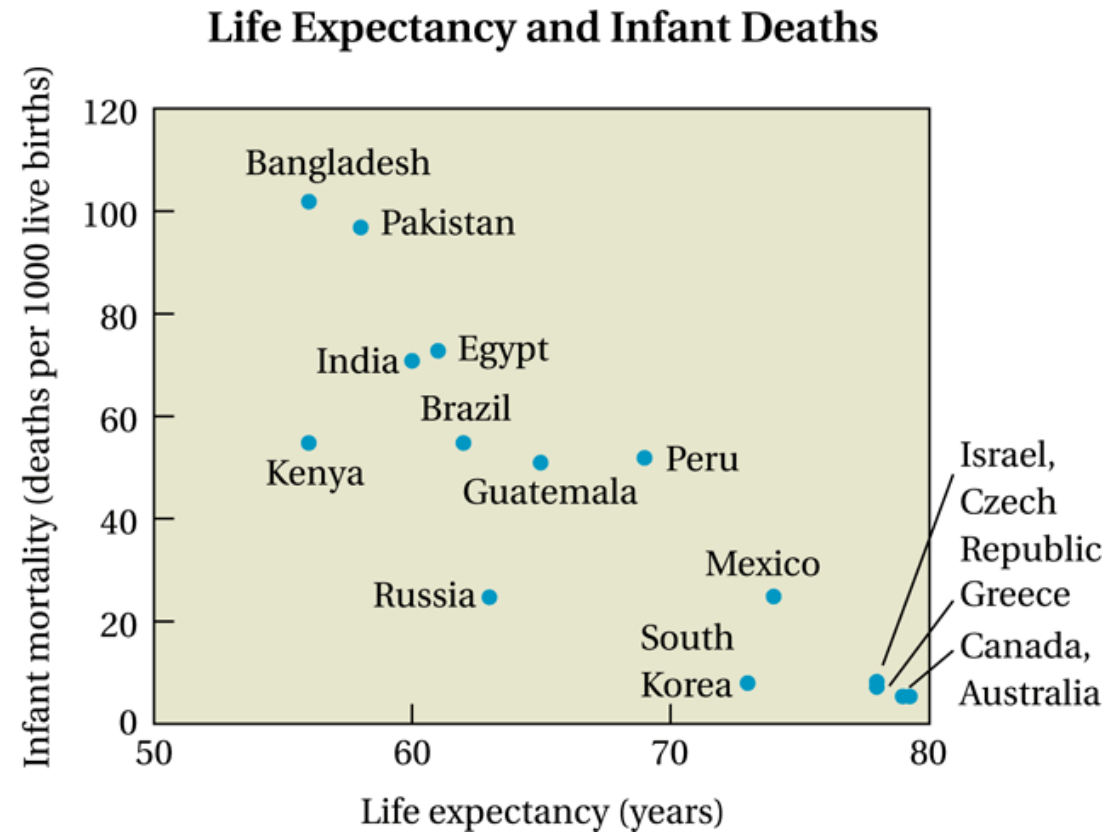


Both ice cream sales and shark attacks increase when the weather is hot and sunny, but they are not caused by each other (they are caused by good weather, with lots of people at the beach, both eating ice cream and having a swim in the sea)

## Divorce rate in Maine correlates with Per capita consumption of margarine

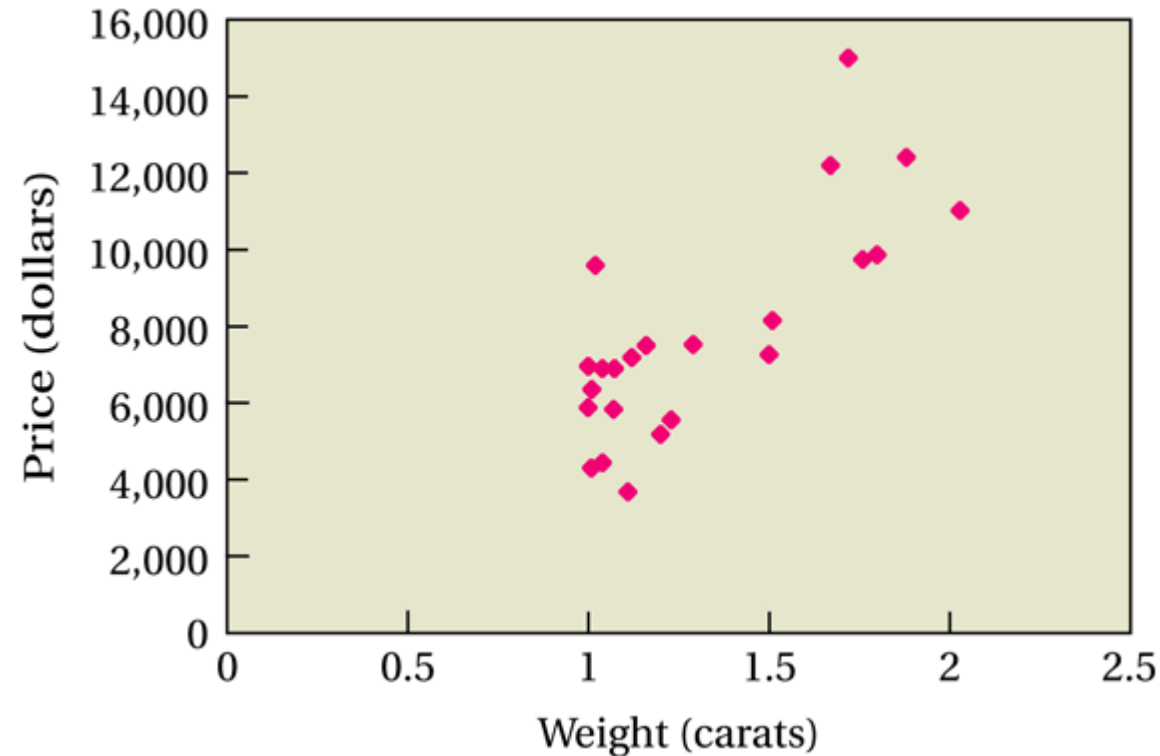


# Negative Correlation



A scatter diagram shows that higher life expectancy generally goes with lower infant mortality.

# Positive Correlation

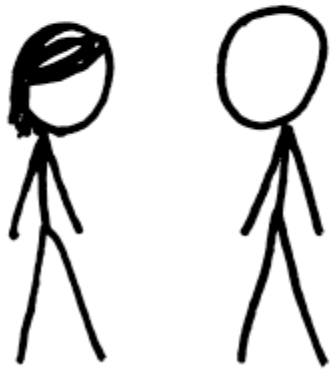


A scatter diagram shows that higher diamond weight generally goes with higher price.

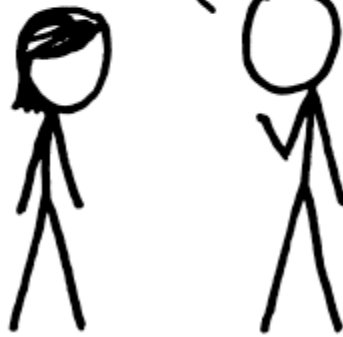
# Possible Explanations for a Correlation

1. The correlation may be a *coincidence*.
2. Both variables might be directly influenced by some *common underlying cause*.
3. One of the correlated variables may actually be a *cause* of the other. Note that, even in this case, it may be only one of several causes.

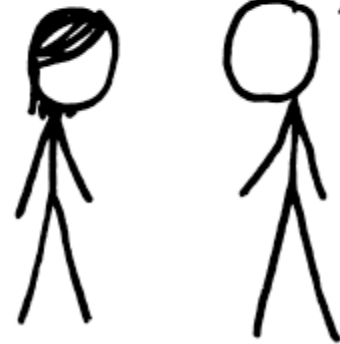
I USED TO THINK  
CORRELATION IMPLIED  
CAUSATION.



THEN I TOOK A  
STATISTICS CLASS.  
NOW I DON'T.



SOUNDS LIKE THE  
CLASS HELPED.  
WELL, MAYBE.



# Example: Explanation for a Correlation

Consider the negative correlation between infant mortality and life expectancy. Which of the three possible explanations for a correlation applies?

The negative correlation is probably due to a common underlying cause – the quality of health care. In countries where health care is better in general, infant mortality is lower and life expectancy is higher.

# Module 7: **Learning Outcomes**



Interpret data given in various graphics and visualizations.

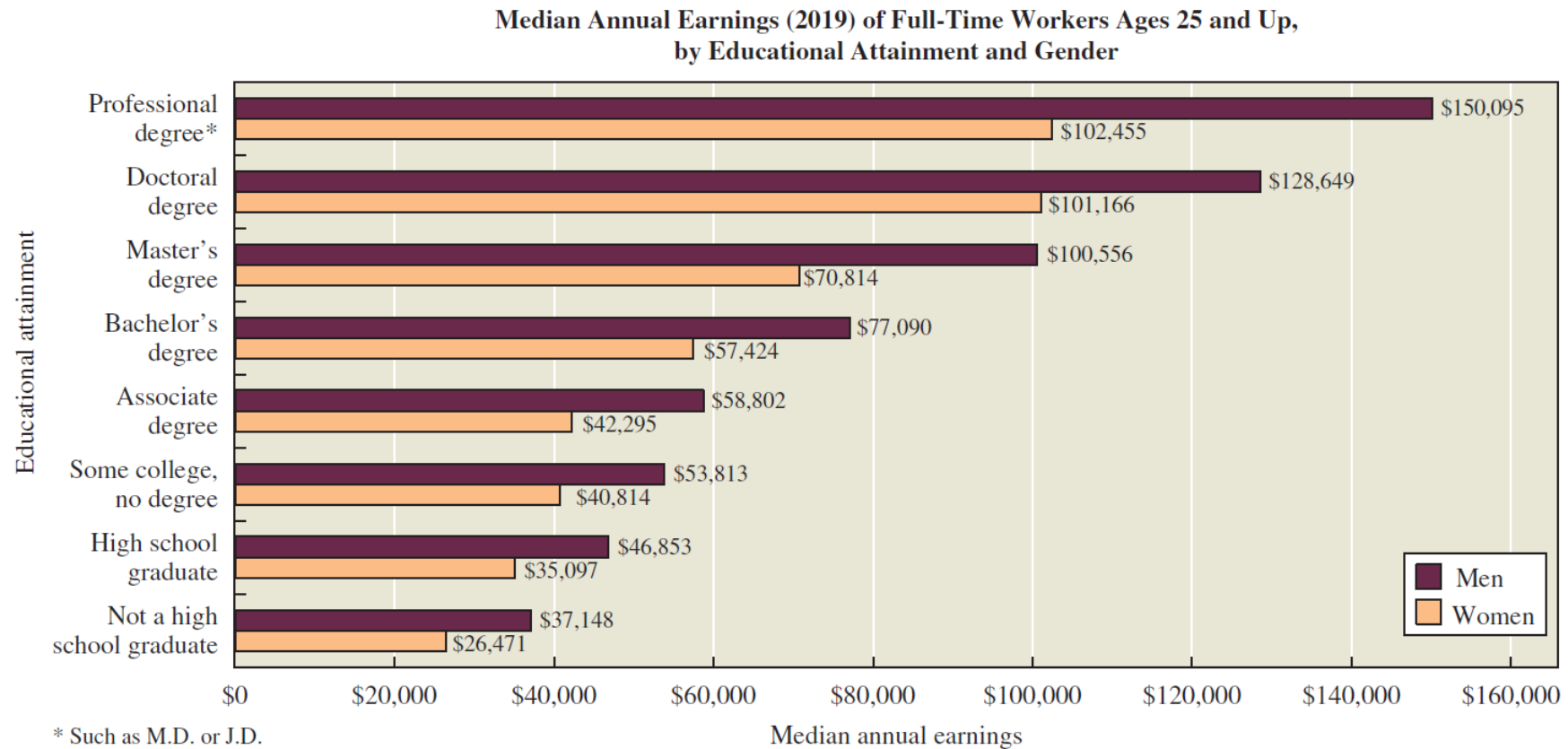


Distinguish between correlation and causation.



Construct and interpret Scatterplots

# Sample Multiple Bar Graph



# Example: Interpreting the Earnings Graph

Identify at least two general messages revealed by the Figure on the previous slide. Comment on how the use of the multiple bar graph makes these messages easy to see.

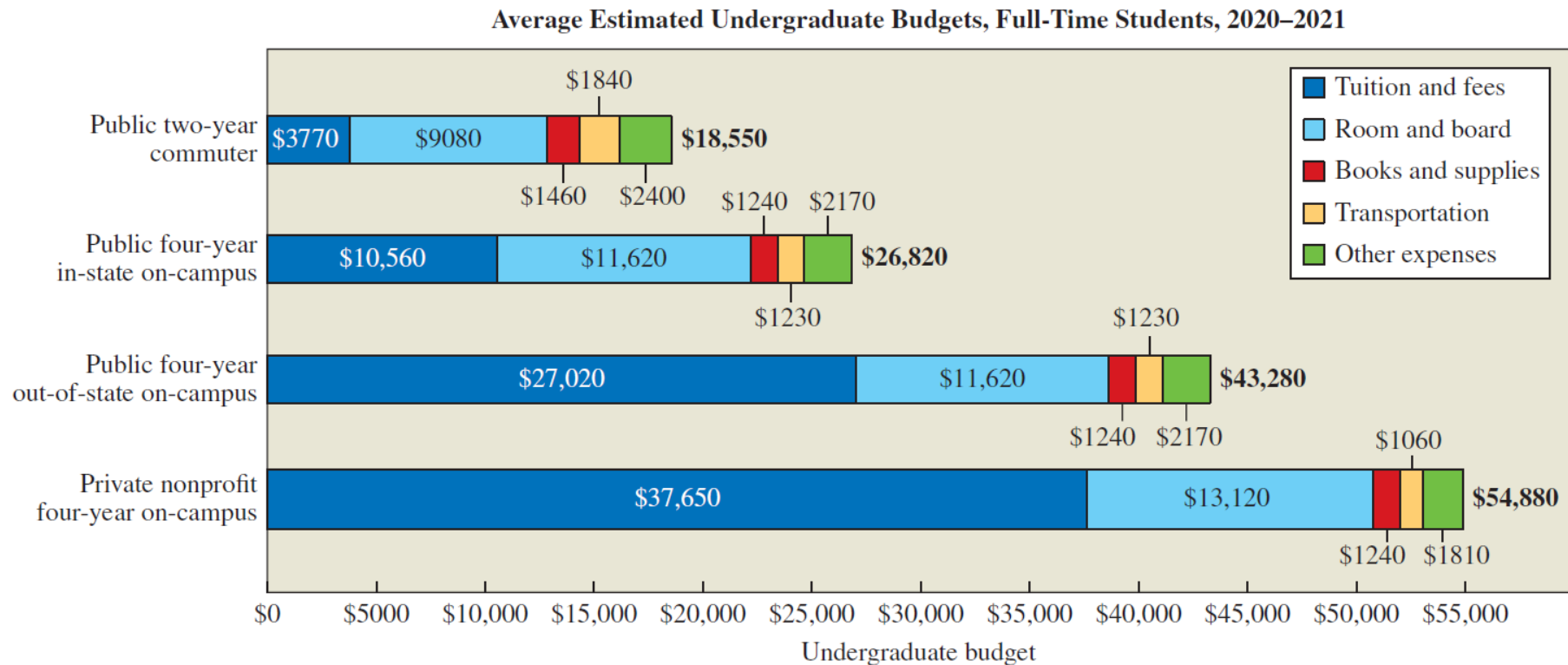
## **Solution**

The bar graph conveys two clear messages.

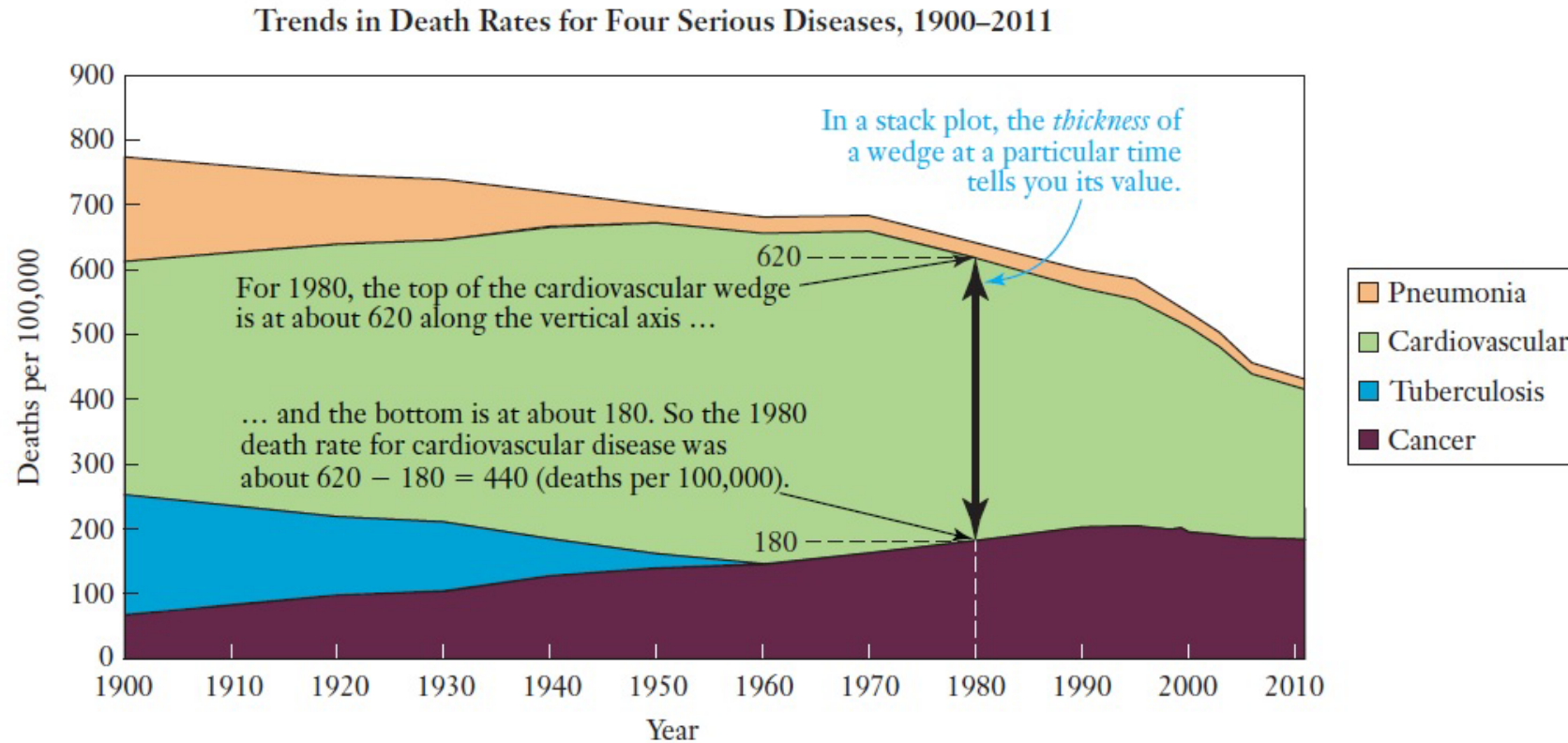
- people with greater education have significantly higher median incomes
- for equivalent levels of educational attainment, women still earn much less than men.

# A Stack Plot

The following stack plot shows the breakdown of average student budgets at different types of institutions.



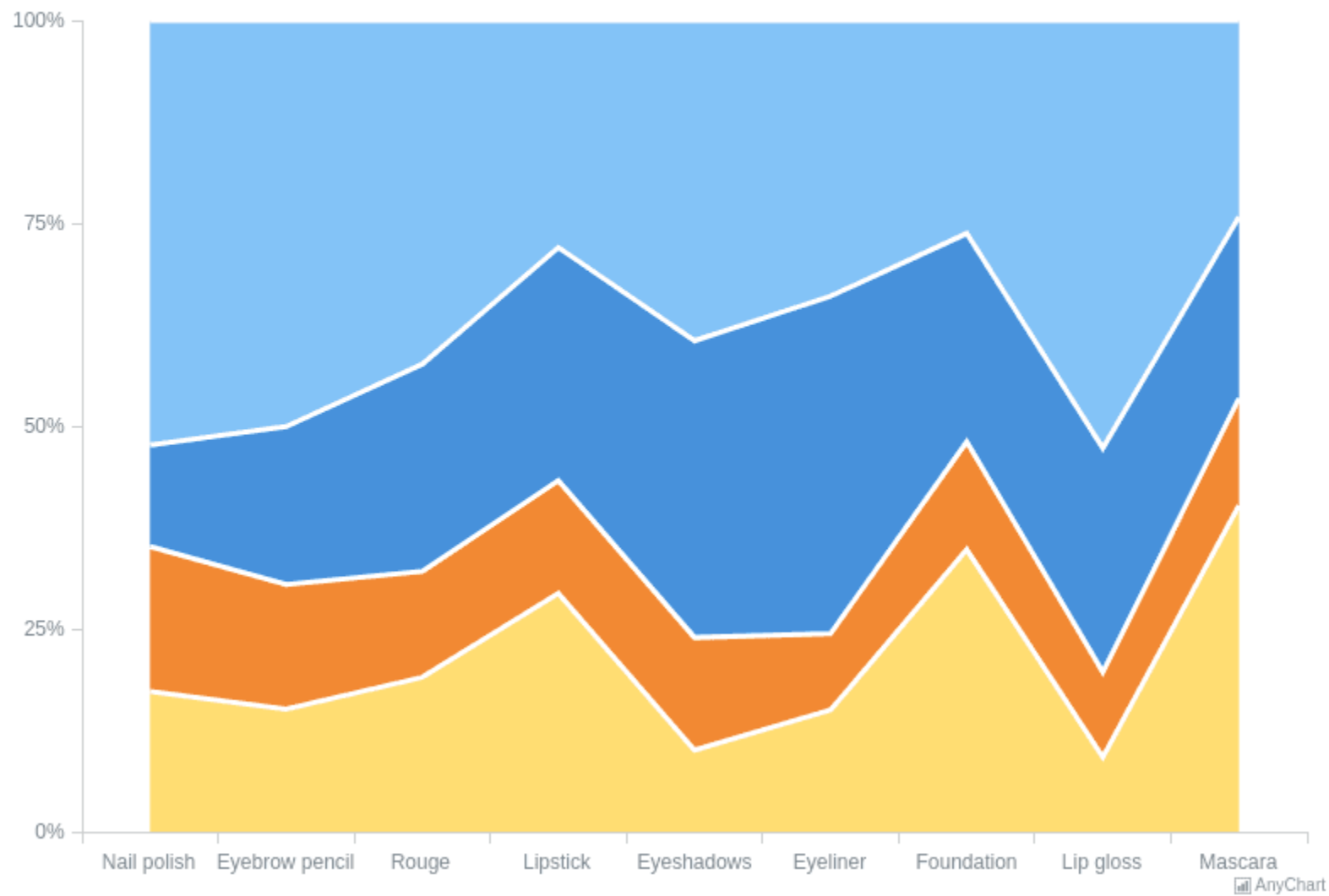
# Example: Trends in Health Data (1 of 3)



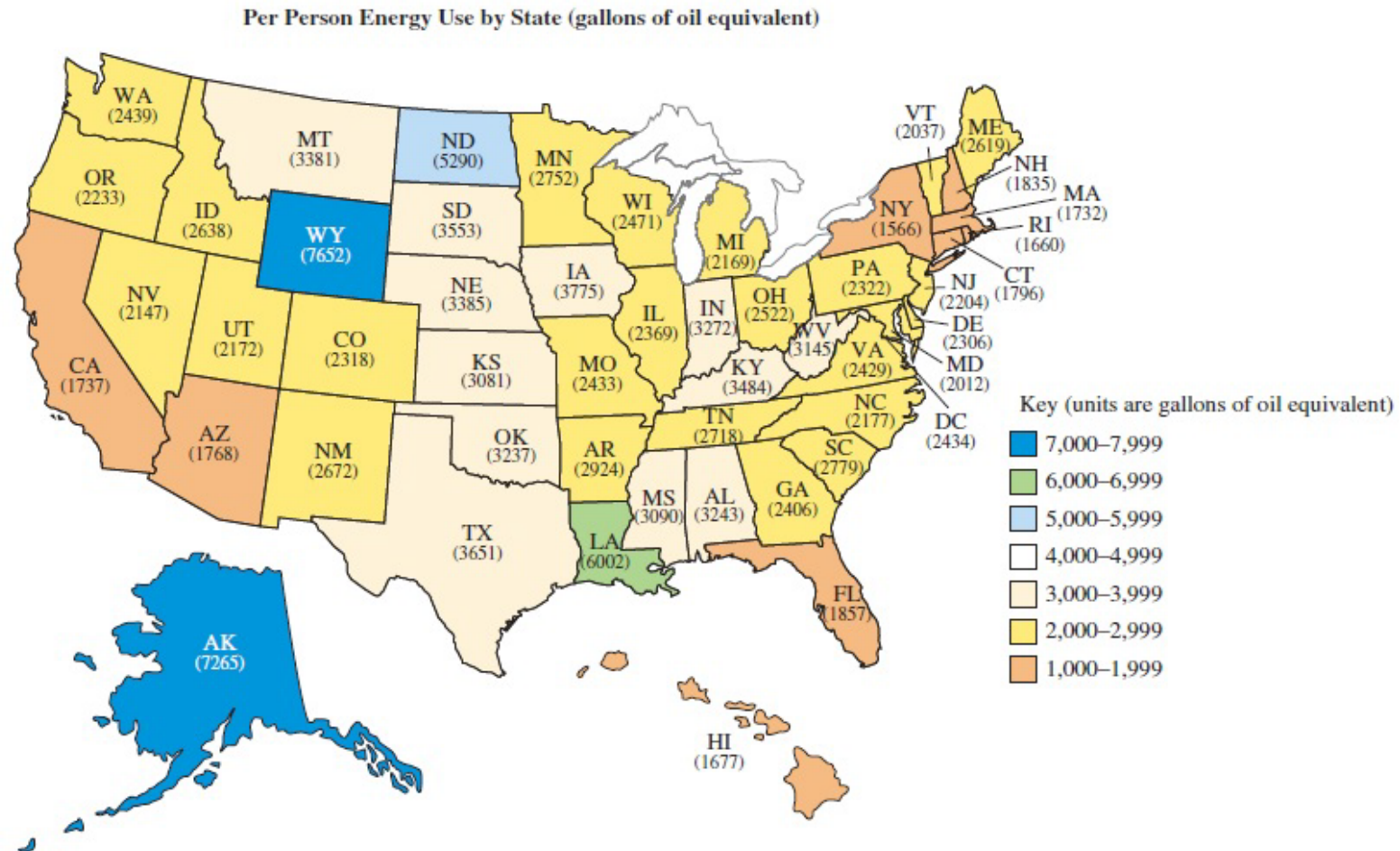
What was the death rate for cardiovascular disease in 1980?  
Discuss the general trends visible on this graph.

Regional ratio of cosmetic products sales

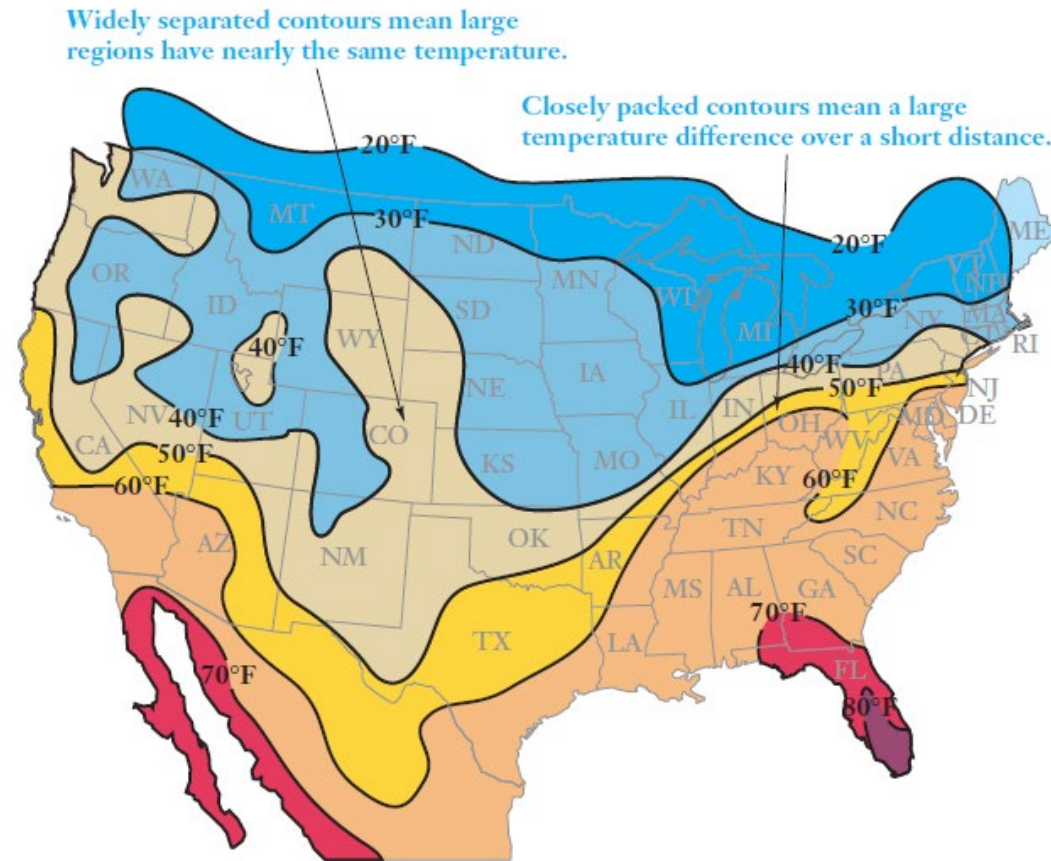
USA China EU Africa



# Geographical Data



# Contour Map



**FIGURE 5.17** A contour map of temperature.

# Example: Interpreting Geographical Data (1 of 2)

Use the figures on the previous two slides to answer the following questions.

a. What geographical characteristics are common to states with the lowest energy usage per person?

The color coding shows that the states in the lowest category of energy use per person are all either warm-weather states (CA, AZ, FL, and HI) or states in the more densely populated regions of the northeast (NY, NH, CT, MA, and RI).

# Example: Interpreting Geographical Data (2 of 2)

b. Were there any temperatures above 80°F in the United States on the date shown in the contour map? If so, where?

The 80° contour passes through southern Florida, so the parts of Florida south of this contour had a temperature above 80°.

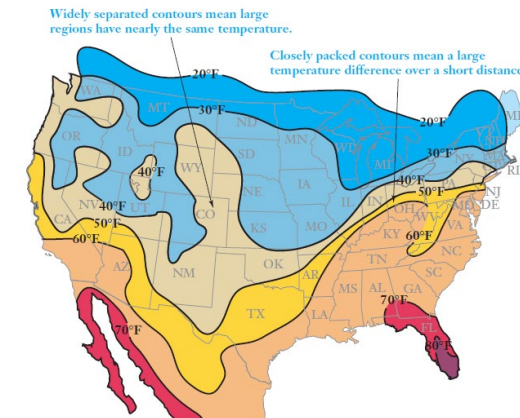


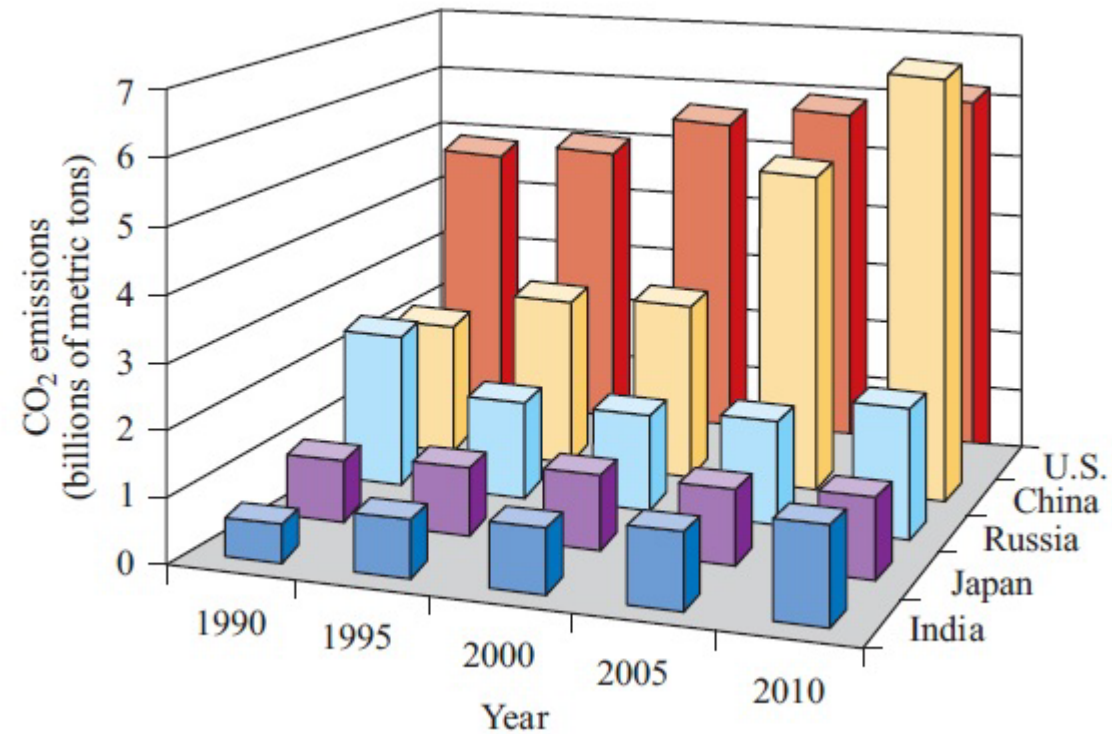
FIGURE 5.17 A contour map of temperature.

# Three-Dimensional Graphics

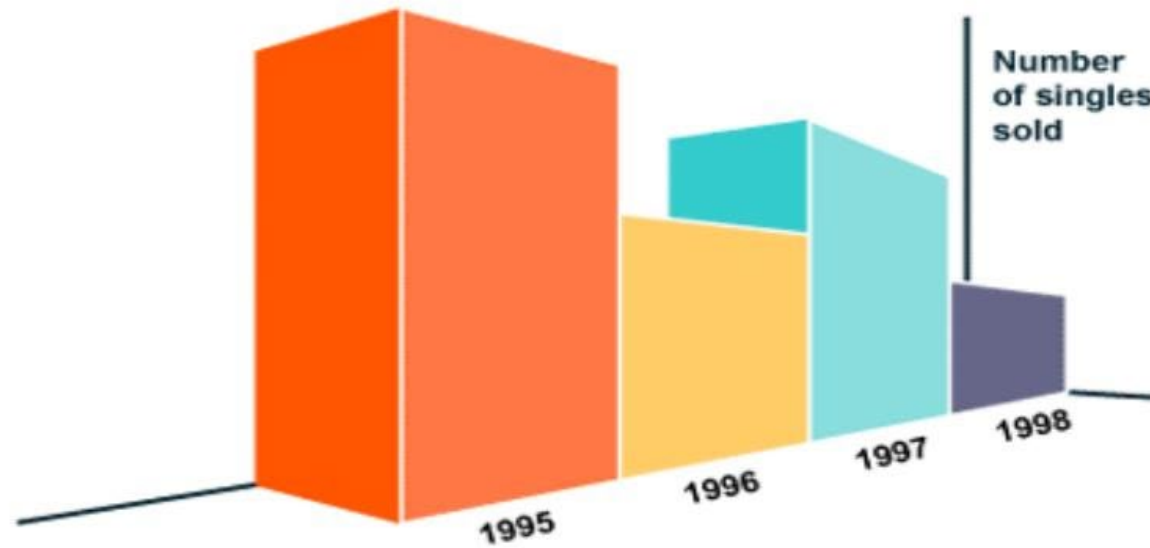
Computer software makes it easy to give almost any graph a three-dimensional appearance.

- Allow us to show richer data sets.
- However, can be difficult to read the data precisely.
- Three-dimensional graphics therefore tend to work best when they are interactive (online), so that figures can be rotated or viewed from different perspectives.

# Example 3-D Graphic

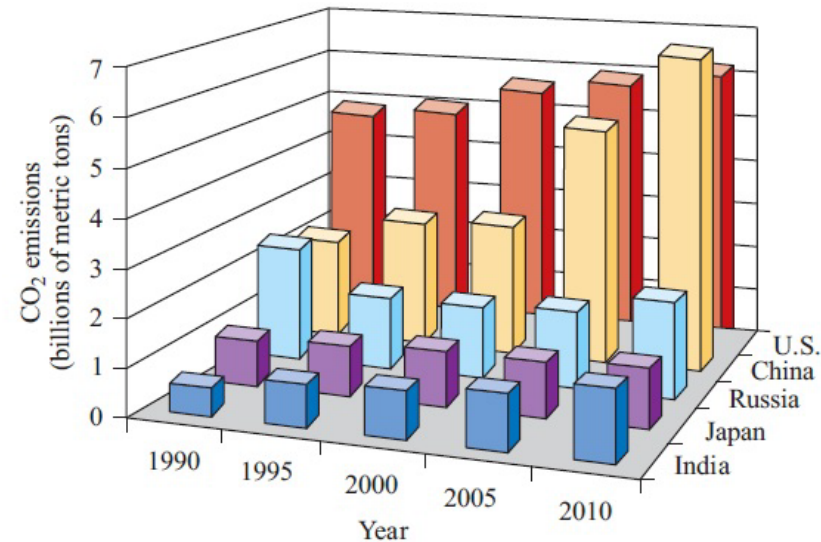


# WHAT IS MISLEADING ABOUT THIS GRAPH?



# Example: Three-Dimensional Carbon Dioxide Emissions

Based on the figure, about when did China surpass Russia in total carbon dioxide emissions?



China surpassed Russia in total emissions sometime between 1990 and 1995.

# A Few Cautions about Graphics

- Perceptual distortions: Many graphics are drawn in a way that distorts our perception of them.
- Watch the scales: It can be visually deceptive if you do not study the scales carefully.
- Percentage change graphs: Graphs that show percentage change can be misleading unless you interpret them with great care.
- Pictographs: Pictographs are graphs embellished with additional artwork. The artwork may make the graph more appealing, but can also distract or mislead.

# Perceptual Distortion

The lengths of the dollars to the right represent the data, but your eyes tend to focus on the area.

1980 = \$1.00

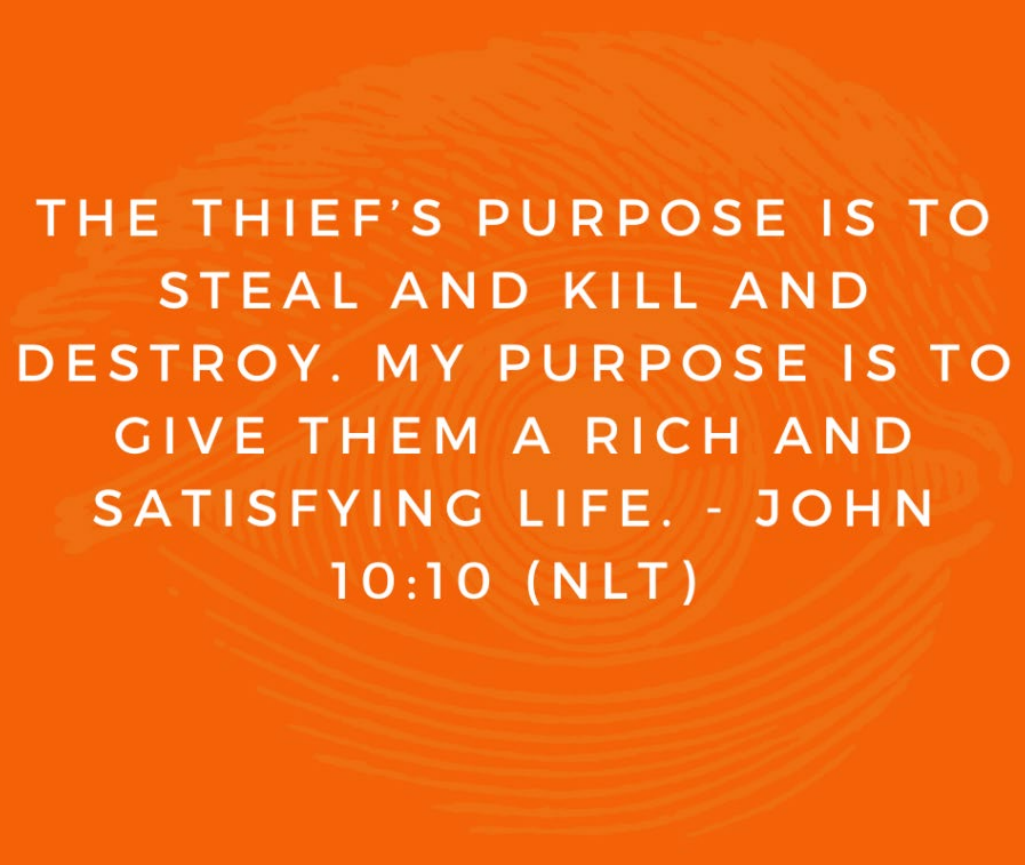


1990 = \$0.63



2005 = \$0.42





THE THIEF'S PURPOSE IS TO  
STEAL AND KILL AND  
DESTROY. MY PURPOSE IS TO  
GIVE THEM A RICH AND  
SATISFYING LIFE. - JOHN  
10:10 (NLT)

STUDENTDEVOS.COM | @STUDENTDEVOS

# VOTELINE

## SATURDAY'S RESULT

Can Julia Gillard win  
the next federal election?

## TODAY'S QUESTION

Do you like the plan to remove  
a car lane of the Princes Bridge  
for sole use by cyclists?

**YES**      **1900 956 434**

**NO**      **1900 956 435**

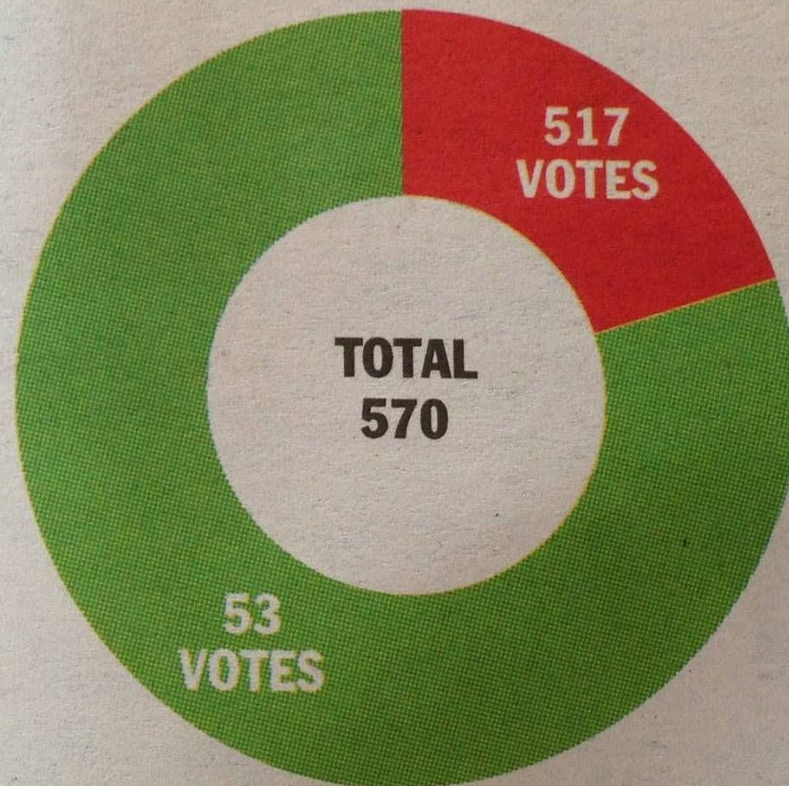
Calls cost 38.5c including GST. You  
can also have your say at  
[heraldsun.com.au](http://heraldsun.com.au) or [facebook.com/heraldsun](https://facebook.com/heraldsun)

**10%**

**YES**

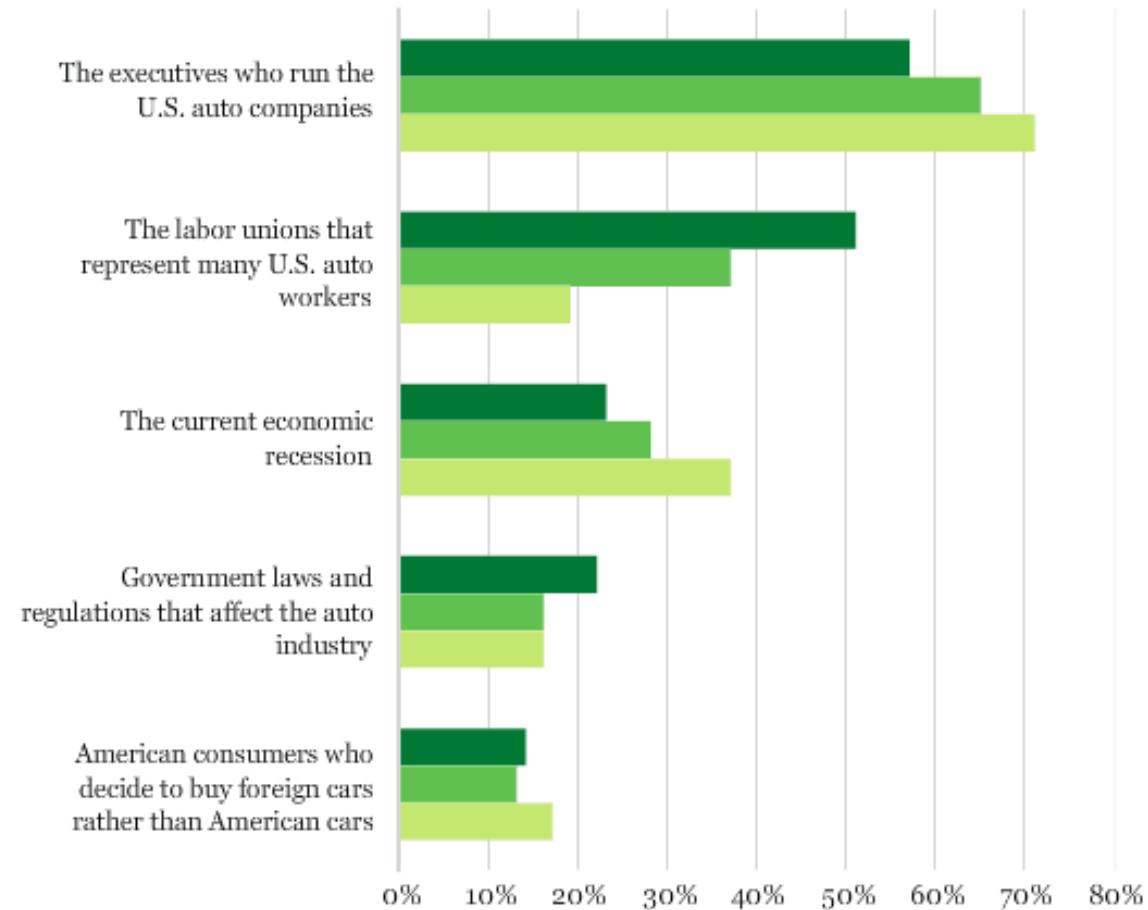
**90%**

**NO**



*Great Deal of Blame for Problems Faced by the Three Major U.S. Auto Companies*

■ Republicans ■ Independents ■ Democrats

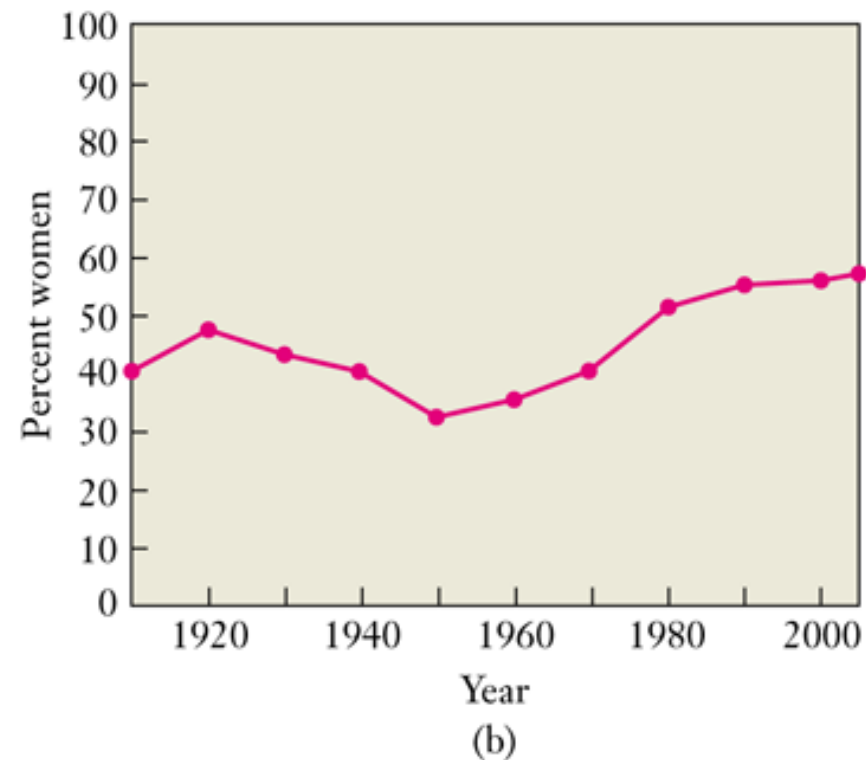
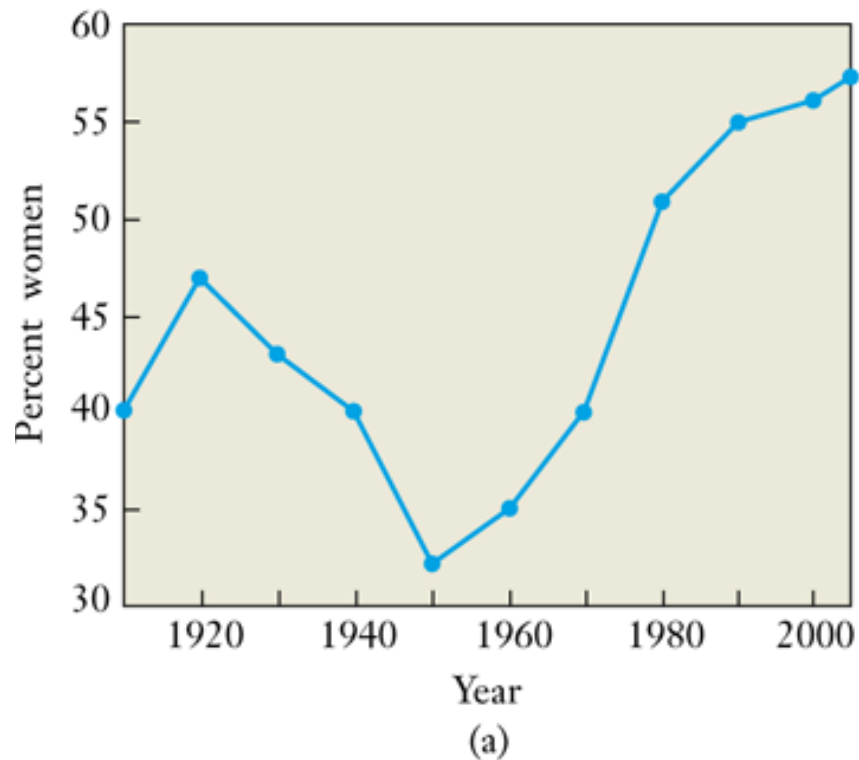


Gallup Poll, Dec. 4-7, 2008

GALLUP POLL

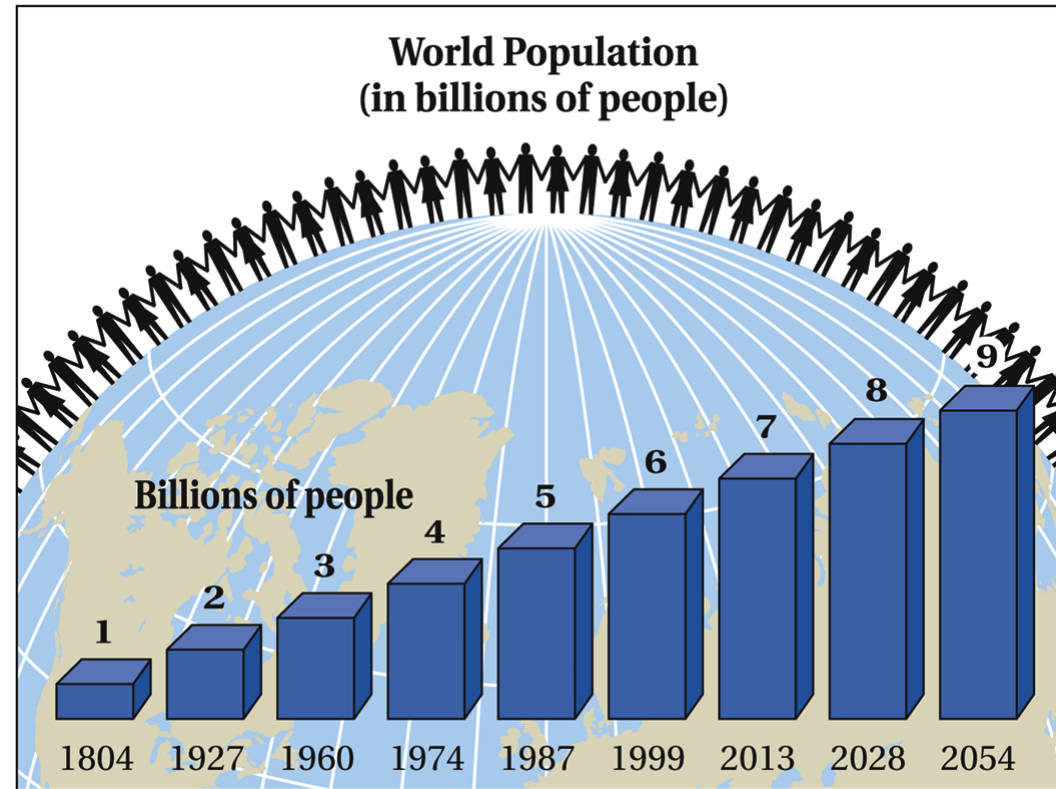
# Different Vertical Scales

Women as a Percentage of All College Students



Both graphs show the same data, but they look very different because their vertical scales have different ranges.

# Different Horizontal Scales



It appears that the world population has been rising linearly. However, the time intervals on the horizontal axis are not uniform in size.

# Correlation

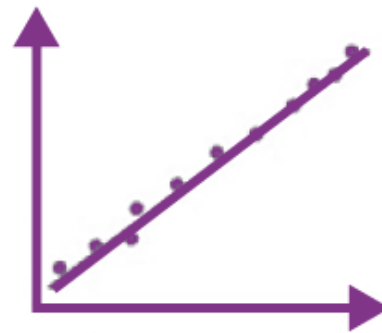
- A **correlation** exists between two variables when higher values of one variable consistently go with higher values of another variable or when higher values of one variable consistently go with lower values of another variable.

# Scatterplot

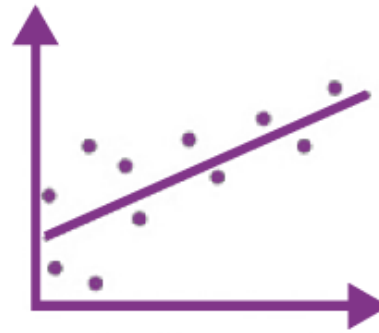
- A **scatterplot** is a graph in which each point represents the values of two variables.

# Relationships Between Two Data Variables

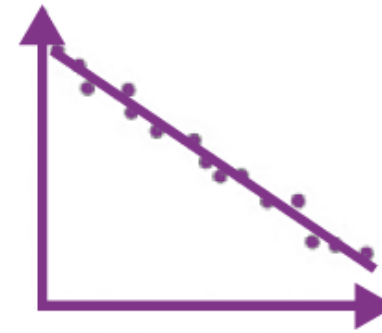
- **No correlation:** There is no apparent relationship between the two variables.
- **Positive correlation:** Both variables tend to increase (or decrease) together.
- **Negative correlation:** One variable increases while the other decreases.
- **Strength of a correlation:** The more closely two variables follow the general trend, the stronger the correlation. In a perfect correlation, all data points lie on a straight line.



**Strong positive correlation**



**Weak positive correlation**



**Strong negative correlation**



**Weak negative correlation**



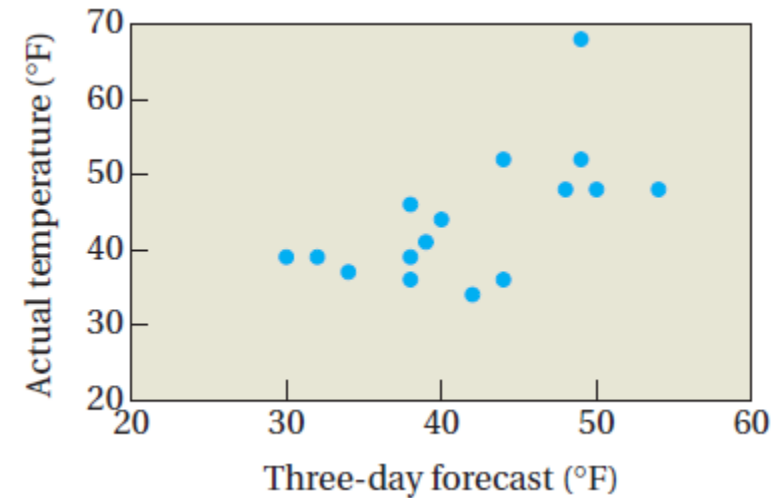
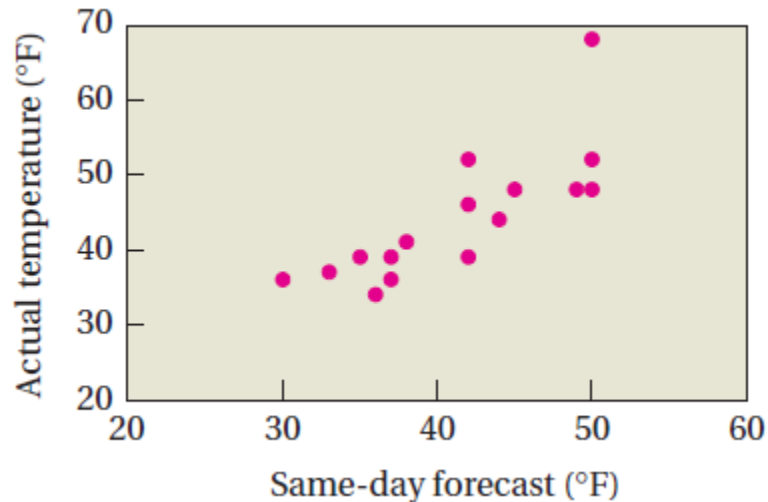
**Moderate negative correlation**



**No correlation**

# Example: Accuracy of Weather Forecasts (1 of 2)

The scatterplots shown show two weeks of data comparing the actual high temperature for the day with the same-day forecast (left diagram) and the three-day forecast (right diagram). Discuss the types of correlation on each diagram.



# Example: Accuracy of Weather Forecasts (2 of 2)

Both scatterplots show a general trend in which higher predicted temperatures mean higher actual temperatures. That is, both show positive correlations.

The points in the left diagram lie more nearly on a straight line, indicating a stronger correlation than in the right diagram. This makes sense, because we expect weather forecasts to be more accurate on the same day than three days in advance.



QUESTIONS?



# Guidelines for Establishing Causality (1 of 2)

If you suspect that a particular variable (the suspected cause) is causing some effect:

1. Look for situations in which the effect is correlated with the suspected cause even while other factors vary.
2. Among groups that differ only in the presence or absence of the suspected cause, check that the effect is similarly present or absent.
3. Look for evidence that larger amounts of the suspected cause produce larger amounts of the effect.
4. If the effect might be produced by other potential causes (besides the suspected cause), make sure that the effect still remains after accounting for these other potential causes.

# Guidelines for Establishing Causality (2 of 2)

- 5.** If possible, test the suspected cause with an experiment.  
If the experiment cannot be performed with humans for ethical reasons, consider doing the experiment with animals, cell cultures, or computer models.
- 6.** Try to determine the physical mechanism by which the suspected cause produces the effect.

# Case Study: Air Bags and Children (1 of 3)

By the mid-1990s, passenger-side air bags had become commonplace in cars. Statistical studies showed that the air bags saved many lives in moderate- to high-speed collisions. But a disturbing pattern also appeared. In at least some cases, young children, especially infants and toddlers in child car seats, were killed by air bags in low-speed collisions.

# Case Study: Air Bags and Children (2 of 3)

At first, many safety advocates found it difficult to believe that air bags could be the cause of the deaths. But the observational evidence became stronger, meeting the first four guidelines for establishing causality. For example, the greater risk to infants in child car seats fit Guideline 3, because it indicated that being closer to the air bags increased the risk of death. (A child car seat sits on top of the built-in seat, thereby putting a child closer to the air bags than the child would be otherwise.)

# Case Study: Air Bags and Children (3 of 3)

To seal the case, safety experts undertook experiments using dummies. They found that children, because of their small size, often sit where they could be easily hurt by the explosive opening of an air bag. The experiments also showed that an air bag could impact a child car seat hard enough to cause death, thereby revealing the physical mechanism by which the deaths occurred.

# Confidence in Causality (1 of 2)

**Possible cause:** We have discovered a correlation, but cannot yet determine whether the correlation implies causality. In the legal system, possible cause (such as thinking that a particular suspect possibly caused a particular crime) is often the reason for starting an investigation.

**Probable cause:** We have good reason to suspect that the correlation involves cause, perhaps because some of the guidelines for establishing causality are satisfied. In the legal system, probable cause is the general standard for getting a judge to grant a warrant for a search or wiretap.

## Confidence in Causality (2 of 2)

**Cause beyond reasonable doubt:** We have found a physical model that is so successful in explaining how one thing causes another that it seems unreasonable to doubt the causality. In the legal system, cause beyond reasonable doubt is the usual standard for conviction. It generally demands that the prosecution show how and why (essentially the physical model) the suspect committed the crime. Note that beyond *reasonable* doubt does *not* mean beyond *all* doubt.

Rejoice always, pray continually,  
give thanks in all circumstances;  
for this is God's will for you in Christ Jesus.

**1 Thessalonians 5:16-18**





## Volk, Andrew Harrison (General Math and Science)

Booking Page



### Choose a meeting type



#### Meeting with Volk in Office!

25 MIN

I am keeping aside some time in the day for listening, sharing, and helping each other with our questions, queries, or concerns. Feel free to book time with me!



#### Speed Meeting with Volk in Office

10 MIN

Quick question or need some advice? Schedule a 10-minute meeting.

# What to do in lecture?



**Show up**



**Take notes**

Key formulas

New words

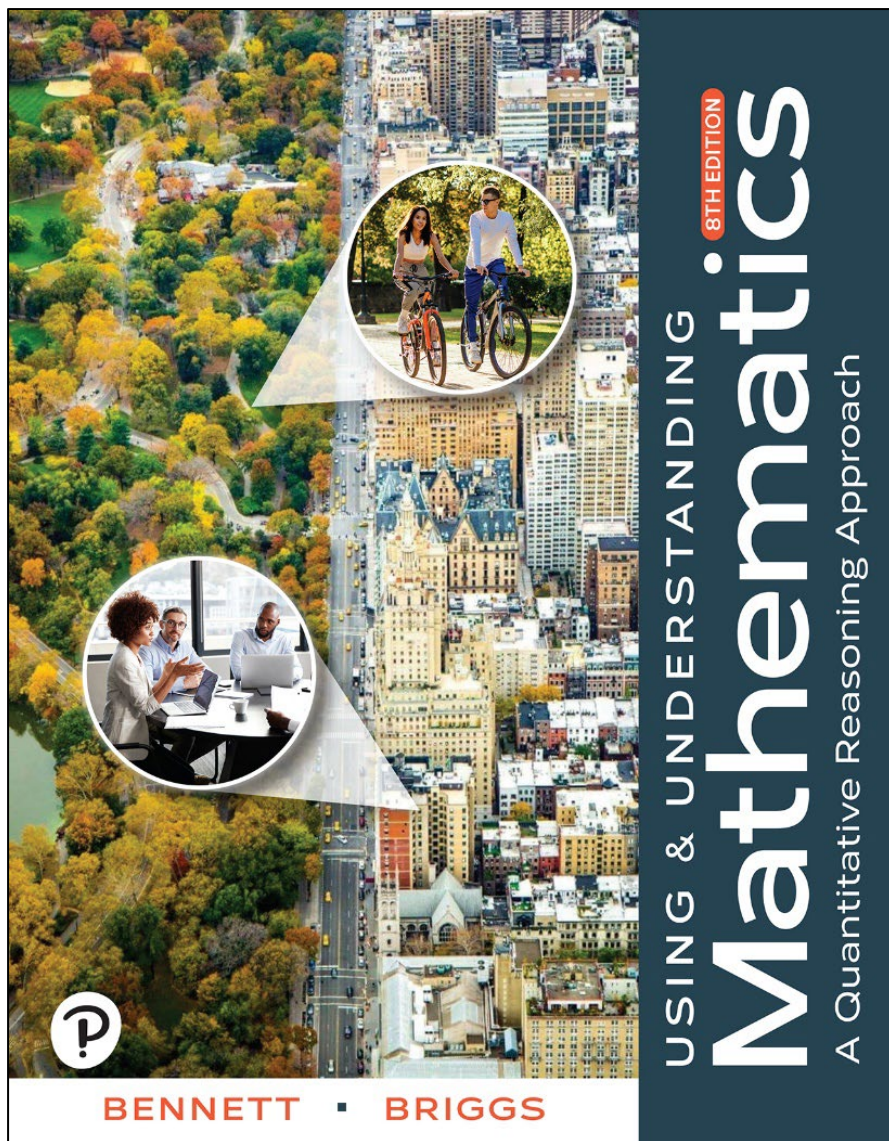
Hints and shortcuts



**Answer questions**



**Make Progress**



# This Week's Reading

## Chapter 5

(Sections D & E)

Statistics

# Homework 7: 20 Questions

Due Sunday  
11:59 pm

## Questions 1-5

- Interpret multiple bar graphs, stack plots, contour maps, and other graphical displays.

## Questions 6 - 8

- Identify features of graphs that must be interpreted with caution.

## Question 9

- Interpret exponential scales on graphical displays.

## Questions 10-12

- Construct and interpret graphical displays for given data sets.

## Questions 13-14

- Describe correlations by type and strength.

## Questions 15-16

- Identify possible explanations for a correlation or a causal relationship.

## Questions 17 - 20

- Construct and interpret Scatterplots

# Quiz 7: 10 Questions

Due Monday  
11:59 pm

## Question 1

- Interpret multiple bar graphs, stack plots, contour maps, and other graphical displays.

## Question 2

- Identify features of graphs that must be interpreted with caution.

## Question 3

- Interpret exponential scales on graphical displays.

## Question 4

- Construct and interpret graphical displays for given data sets.

## Question 5

- Evaluate the quality and trustworthiness of media graphics.

## Question 6

- Describe correlations by type and strength.

## Questions 7

- Identify possible explanations for a correlation or a causal relationship.

## Questions 8-10

- Construct and interpret Scatterplots

# Module 7: **Learning Outcomes**



Interpret data given in various graphics and visualizations.

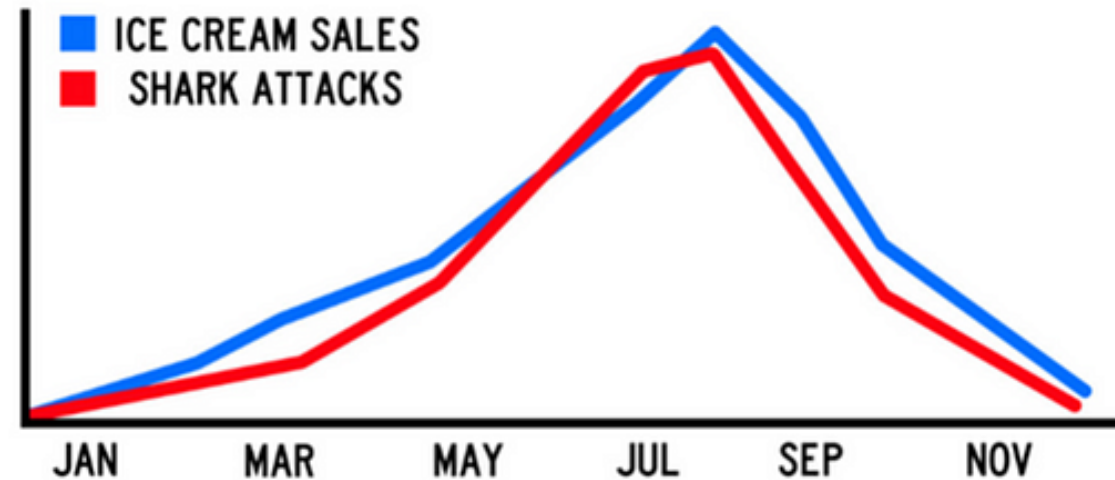


Distinguish between correlation and causation.



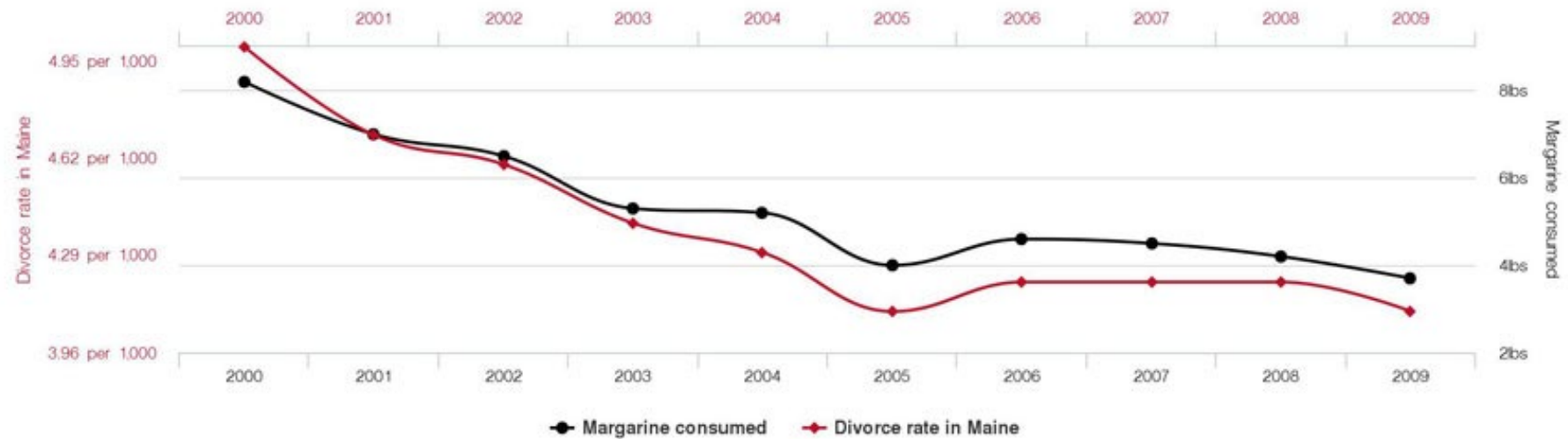
Construct and interpret Scatterplots

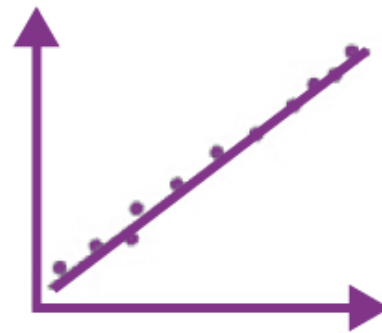
## CORRELATION IS NOT CAUSATION!



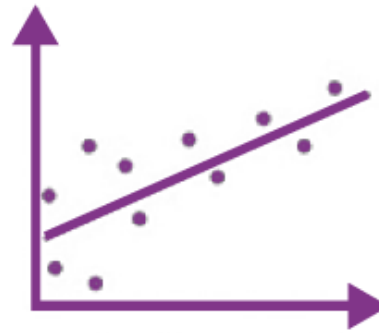
Both ice cream sales and shark attacks increase when the weather is hot and sunny, but they are not caused by each other (they are caused by good weather, with lots of people at the beach, both eating ice cream and having a swim in the sea)

**Divorce rate in Maine**  
correlates with  
**Per capita consumption of margarine**

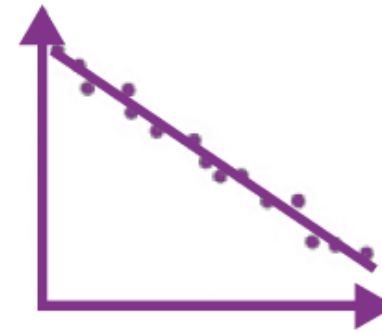




**Strong positive correlation**



**Weak positive correlation**



**Strong negative correlation**



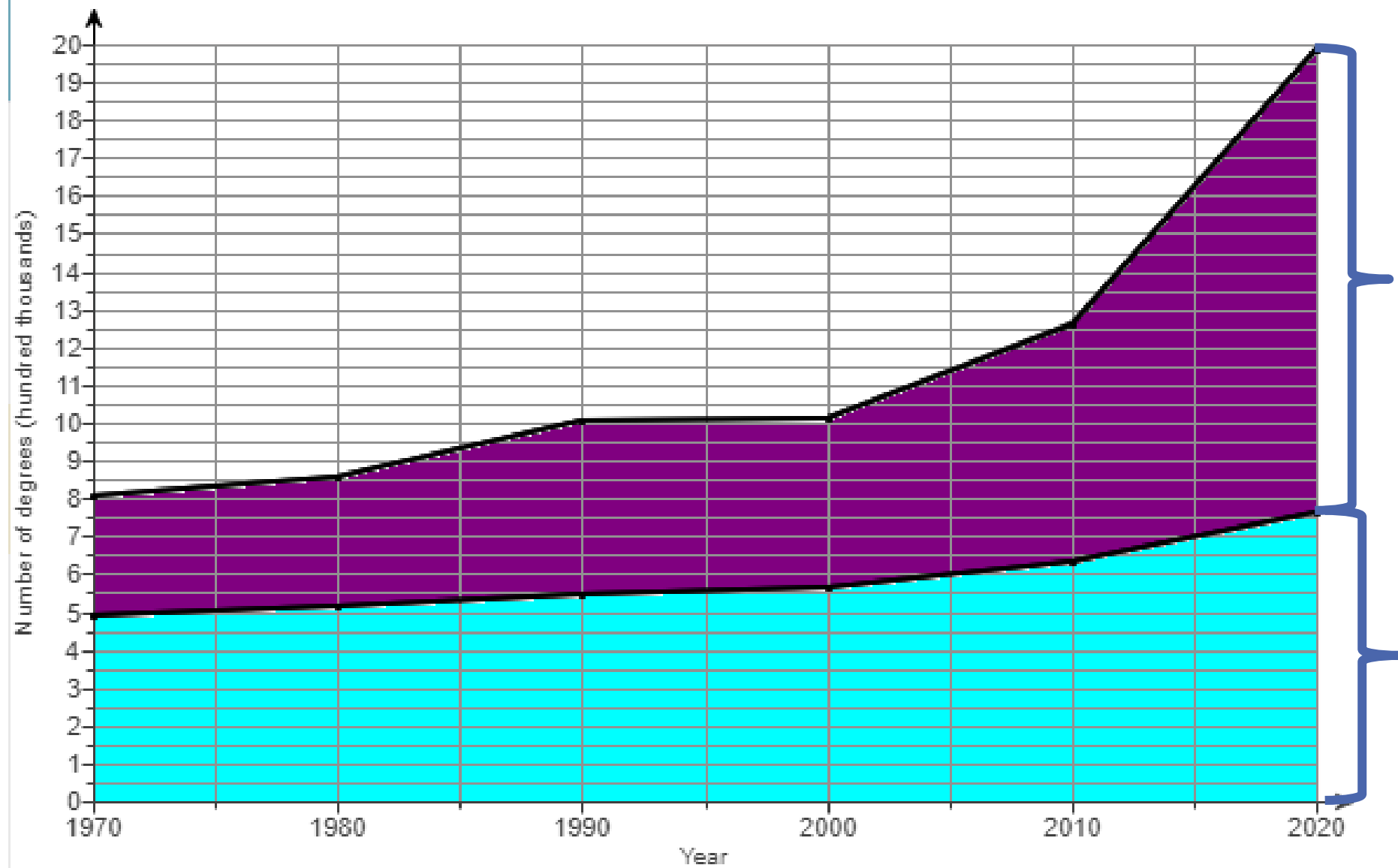
**Weak negative correlation**



**Moderate negative correlation**



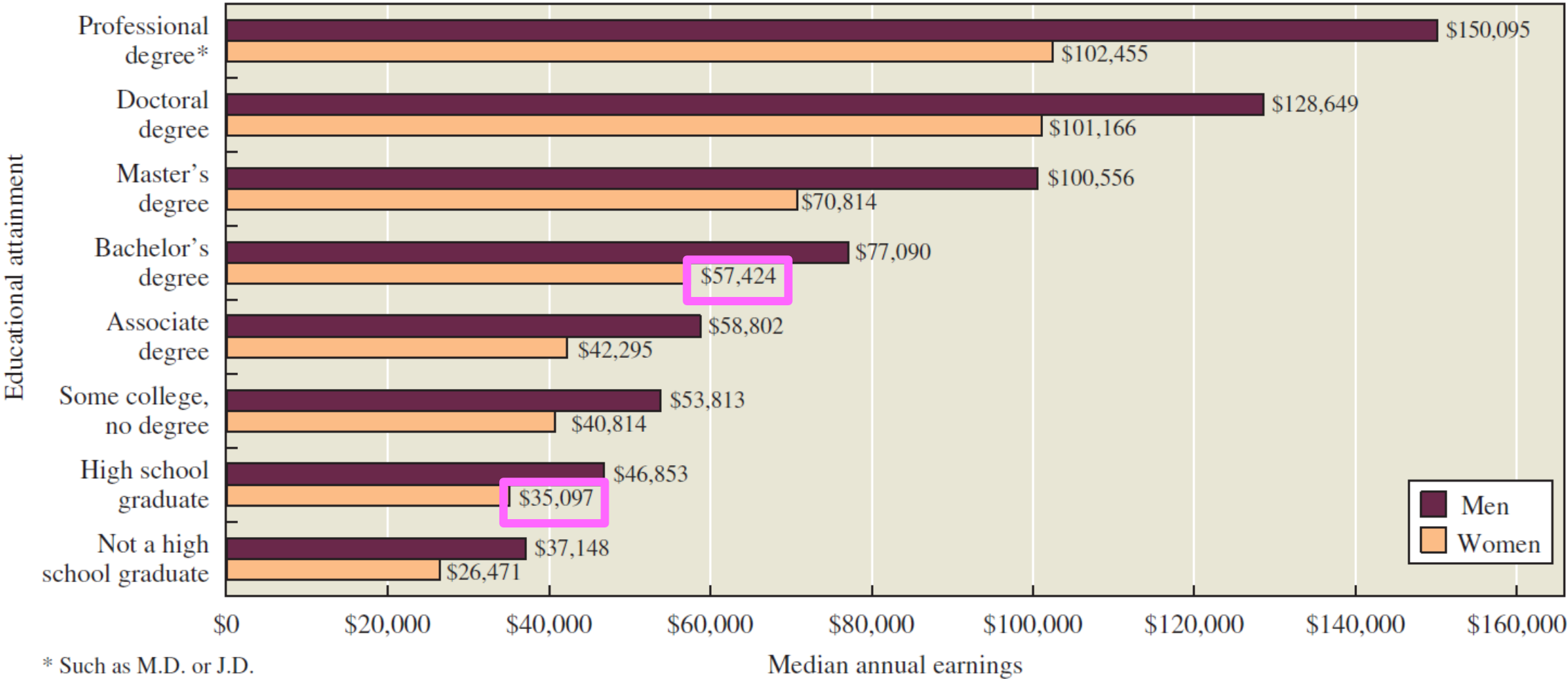
**No correlation**



How much more would the average female college graduate (bachelor's degree) earn during these 45 years than the average female high school graduate?

$(57424 - 35097) \times 45$

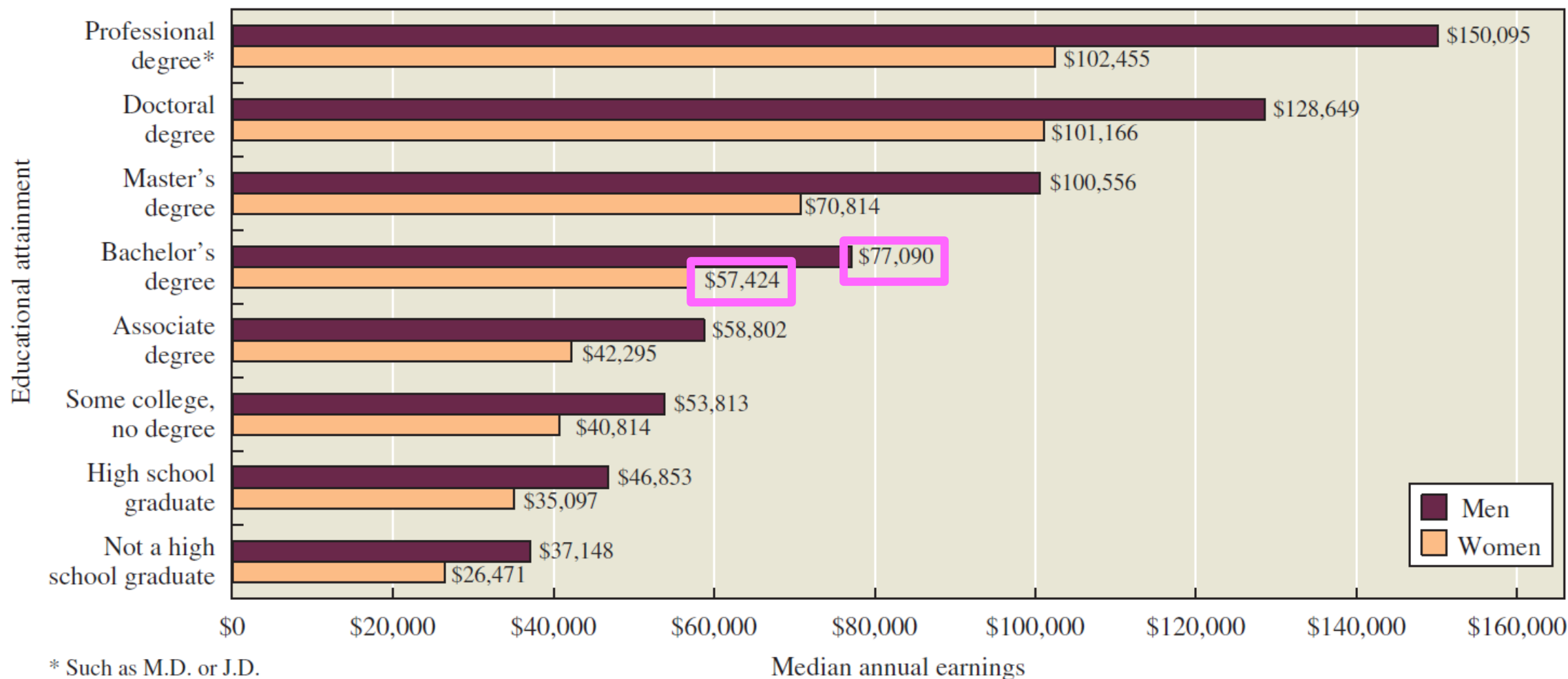
Median Annual Earnings (2019) of Full-Time Workers Ages 25 and Up,  
by Educational Attainment and Gender



What is the percentage difference in earnings for men with a bachelor's degree compared to women with a bachelor's degree?

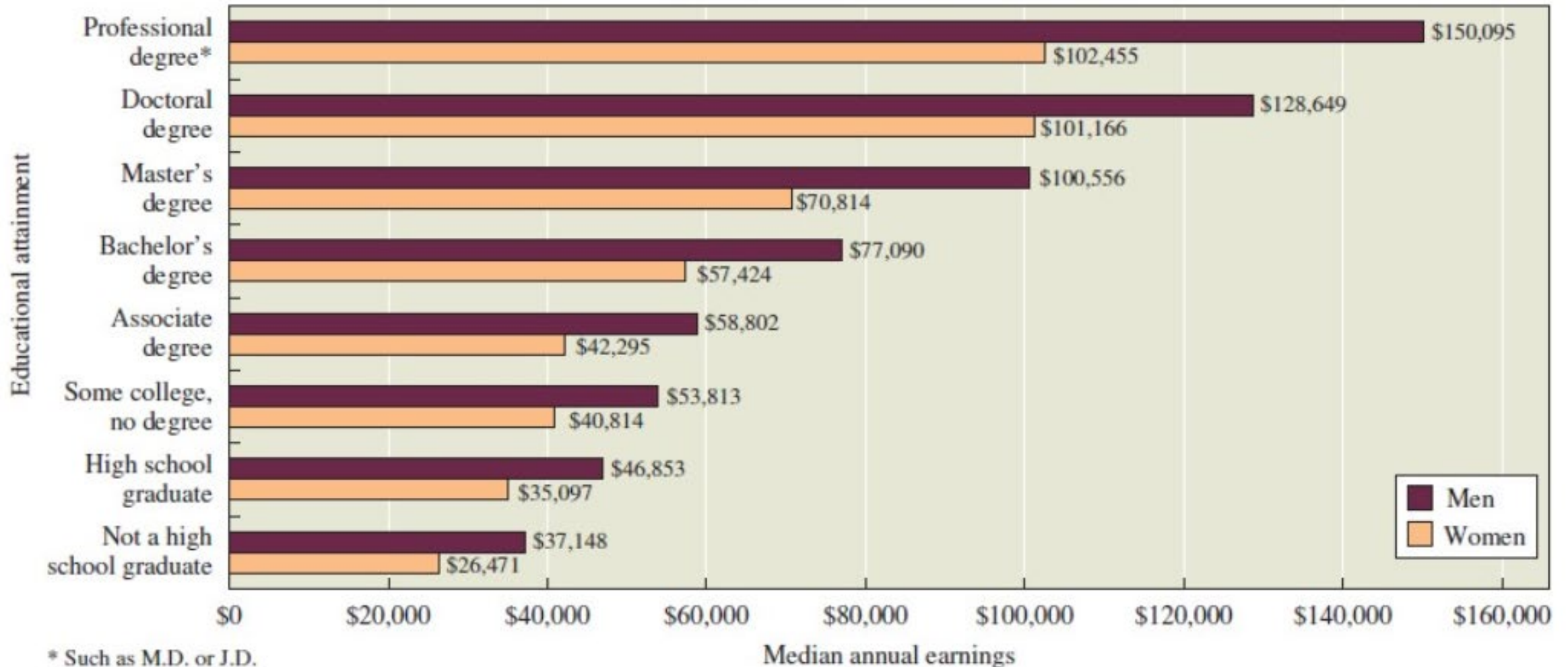
$$\frac{\text{men} - \text{women}}{\text{women}} \times 100\%$$

Median Annual Earnings (2019) of Full-Time Workers Ages 25 and Up,  
by Educational Attainment and Gender



How much more would the average male college graduate (bachelor's degree) earn during 30 years than the average male high school graduate?

Median Annual Earnings (2019) of Full-Time Workers Ages 25 and Up,  
by Educational Attainment and Gender



# Math 114

## Quantitative Reasoning

Causes of Death in  
1980 and 2016

Project 2



## PROJECT 2 INSTRUCTIONS

Please also pay close attention to any additional specifications provided by your professor. Professors often will clarify their expectations regarding the format and presentation of your submission.

### Topic – Causes of Death in 1980 and 2016

According to the 1980 Census, the United States population was approximately 226,540,000 in 1980. It grew to approximately 323,120,000 at the beginning of 2016. Using Census data for 1980 and estimates derived from mortality data for 2016, we arrive at the population estimates given in the table below:

| Year | Total Population | Ages 15–24 | Ages 25–44 | Ages 45–64 |
|------|------------------|------------|------------|------------|
| 1980 | 226,540,000      | 42,475,000 | 62,707,000 | 44,497,000 |
| 2016 | 323,120,000      | 43,500,000 | 85,150,000 | 84,300,000 |

The National Center for Health Statistics published a document entitled “Health, United States, 2015: With Special Feature on Racial and Ethnic Health Disparities” that includes a table listing the leading causes of death in 1980 by age bracket. The CDC further produced a National Vital Statistics Reports that provided similar information for the year 2016. Under the Project Instructions link in Canvas, you’ll find **Project 2: Data**, a spreadsheet showing the leading causes of death in both 1980 and 2016 for these 3 age categories. Each of the first 3 questions has both a computational part and a discussion part. To get full credit for each of the discussion parts, please cite a reference to support your claims. This should not be an excessively difficult task: you can easily find information online for most of the illnesses or other causes listed in the report. All you need to do is provide the website you used (though other resources are also permitted if you prefer to use one of those).

1. Assuming that the population numbers in the above table are relatively accurate, use the Project 2: Data spreadsheet to compute the deaths per 1000 people for each age group in both 1980 and 2016. Deaths per 1000 people is computed using the formula  $\text{Deaths per 1000} = (\# \text{ of deaths}) / (\text{total population}) \times 1000$ . Do not round your answer to the nearest whole number, provide at least 2 decimal places (but no more than 4). Give these 6 values (e.g. deaths per 1000 people for ages 15–24 in 1980) and then cite a reference to discuss what might account for the changes between the deaths per 1000 in 1 of these 3 age categories between 1980 and 2016. Your discussion should be at least 50 words.
2. Besides the changes in the overall death rate in the past 3 decades, the leading causes of death vary somewhat between 1980 and 2016. Choose 1 of the 3 age ranges and select 1 cause of death from the Project 2: Data spreadsheet that strikes you as noteworthy and that appears in both the 1980 and 2016 lists. For the cause of death that you selected, compute the number of deaths per 1000 in both 1980 and 2016 for your chosen age group. Do not round your answer to the nearest whole number, provide at least 2

## Two Documents Needed



| 1980                                  |             | 2016                                        |             |
|---------------------------------------|-------------|---------------------------------------------|-------------|
| Population                            | 226,540,000 | Population                                  | 323,120,000 |
| Deaths                                |             | Deaths                                      |             |
| All causes                            | 1,989,841   | All causes                                  | 2,744,248   |
| Diseases of heart                     | 761,085     | Diseases of heart                           | 635,260     |
| Malignant neoplasms                   | 416,509     | Malignant neoplasms                         | 598,038     |
| Cerebrovascular diseases              | 170,225     | Unintentional injuries                      | 161,374     |
| Unintentional injuries                | 105,718     | Chronic lower respiratory diseases          | 154,596     |
| Chronic obstructive pulmonary disease | 56,050      | Cerebrovascular diseases                    | 142,142     |
| Pneumonia and influenza               | 54,619      | Alzheimer's disease                         | 116,103     |
| Diabetes mellitus                     | 34,851      | Diabetes mellitus                           | 80,058      |
| Chronic liver disease and cirrhosis   | 30,583      | Influenza and pneumonia                     | 51,537      |
| Atherosclerosis                       | 29,449      | Nephritis, nephrotic syndrome and nephrosis | 50,046      |
| Suicide                               | 26,869      | Suicide                                     | 44,965      |
| Ages 15 - 24                          |             | Ages 15 - 24                                |             |
| Population                            | 42,475,000  | Population                                  | 43,500,000  |
| Deaths                                |             | Deaths                                      |             |
| All causes                            | 49,027      | All causes                                  | 32,575      |
| Unintentional injuries                | 26,206      | Unintentional injuries                      | 13,895      |
| Homicide                              | 6,537       | Suicide                                     | 5,723       |
| Suicide                               | 5,239       | Homicide                                    | 5,172       |
| Malignant neoplasms                   | 2,683       | Malignant neoplasms                         | 1,431       |
| Diseases of heart                     | 1,223       | Diseases of heart                           | 949         |
| Congenital anomalies                  | 600         | Congenital malformations/abnormalities      | 388         |
| Cerebrovascular diseases              | 418         | Diabetes mellitus                           | 211         |
| Pneumonia and influenza               | 348         | Chronic lower respiratory disease           | 206         |
| Chronic obstructive pulmonary disease | 141         | Influenza and pneumonia                     | 189         |
| Anemias                               | 133         | Complicated Pregnancy                       | 184         |
| Ages 25 - 44                          |             | Ages 25 - 44                                |             |
| Population                            | 62,707,000  | Population                                  | 85,150,000  |
| Deaths                                |             | Deaths                                      |             |
| All causes                            | 108,658     | All causes                                  | 135,408     |
| Unintentional injuries                | 26,722      | Unintentional injuries                      | 44,959      |
| Malignant neoplasms                   | 17,551      | Malignant neoplasms                         | 14,694      |
| Diseases of heart                     | 14,513      | Suicide                                     | 14,396      |
| Homicide                              | 10,963      | Diseases of heart                           | 13,922      |
| Suicide                               | 9,855       | Homicide                                    | 8,745       |
| Chronic liver disease and cirrhosis   | 4,782       | Chronic liver disease and cirrhosis         | 3,776       |
| Cerebrovascular diseases              | 3,154       | Diabetes mellitus                           | 2,841       |
| Diabetes mellitus                     | 1,472       | Cerebrovascular diseases                    | 2,426       |
| Pneumonia and influenza               | 1,467       | HIV disease                                 | 1,517       |
| Congenital anomalies                  | 817         | Septicemia                                  | 1,316       |
| Ages 45 - 64                          |             | Ages 45 - 64                                |             |
| Population                            | 44,497,000  | Population                                  | 84,300,000  |
| Deaths                                |             | Deaths                                      |             |
| All causes                            | 425,338     | All causes                                  | 539,961     |
| Diseases of heart                     | 148,322     | Malignant neoplasms                         | 157,655     |
| Malignant neoplasms                   | 135,675     | Diseases of heart                           | 112,637     |
| Cerebrovascular diseases              | 19,909      | Unintentional injuries                      | 45,237      |
| Unintentional injuries                | 18,140      | Chronic liver disease and cirrhosis         | 21,812      |
| Chronic liver disease and cirrhosis   | 16,089      | Chronic lower respiratory diseases          | 22,117      |
| Chronic obstructive pulmonary disease | 11,514      | Diabetes mellitus                           | 20,518      |
| Diabetes mellitus                     | 7,977       | Cerebrovascular diseases                    | 17,663      |
| Suicide                               | 7,079       | Suicide                                     | 16,196      |
| Pneumonia and influenza               | 5,804       | Septicemia                                  | 8,413       |
| Homicide                              | 4,019       | Nephritis, nephrotic syndrome and nephrosis | 7,790       |



|                                             | 2016        |                                        |
|---------------------------------------------|-------------|----------------------------------------|
| Population                                  | 323,120,000 | Death rate (all causes)                |
| Deaths                                      |             | $\frac{2744248}{323120000}$            |
| All causes                                  | 2,744,248   |                                        |
| Diseases of heart                           | 635,260     | = 0.008492968557                       |
| Malignant neoplasms                         | 598,038     | Death per 1000                         |
| Unintentional injuries                      | 161,374     |                                        |
| Chronic lower respiratory diseases          | 154,596     | = 8.492968557                          |
| Cerebrovascular diseases                    | 142,142     |                                        |
| Alzheimer's disease                         | 116,103     | Death rate per 1000<br>(Heart Dis.)    |
| Diabetes mellitus                           | 80,058      |                                        |
| Influenza and pneumonia                     | 51,537      | $\frac{635260}{323120000} \times 1000$ |
| Nephritis, nephrotic syndrome and nephrosis | 50,046      |                                        |
| Suicide                                     | 44,965      | = 1.966018817                          |

|    | A                                     | B           | C | D                                           | E           |
|----|---------------------------------------|-------------|---|---------------------------------------------|-------------|
| 1  | 1980                                  |             |   | 2016                                        |             |
| 2  | Population                            | 226,540,000 |   | Population                                  | 323,120,000 |
| 3  | Deaths                                |             |   | Deaths                                      |             |
| 4  | All causes                            | 1,989,841   |   | All causes                                  | 2,744,240   |
| 5  | Diseases of heart                     | 761,085     |   | Diseases of heart                           | 635,260     |
| 6  | Malignant neoplasms                   | 416,509     |   | Malignant neoplasms                         | 598,030     |
| 7  | Cerebrovascular diseases              | 170,225     |   | Unintentional injuries                      | 161,370     |
| 8  | Unintentional injuries                | 105,718     |   | Chronic lower respiratory diseases          | 154,590     |
| 9  | Chronic obstructive pulmonary disease | 56,050      |   | Cerebrovascular diseases                    | 142,140     |
| 10 | Pneumonia and influenza               | 54,619      |   | Alzheimer's disease                         | 116,100     |
| 11 | Diabetes mellitus                     | 34,851      |   | Diabetes mellitus                           | 80,050      |
| 12 | Chronic liver disease and cirrhosis   | 30,583      |   | Influenza and pneumonia                     | 51,530      |
| 13 | Atherosclerosis                       | 29,449      |   | Nephritis, nephrotic syndrome and nephrosis | 50,040      |
| 14 | Suicide                               | 26,869      |   | Suicide                                     | 44,960      |
| 15 |                                       |             |   |                                             |             |
| 16 | Ages 15 - 24                          |             |   | Ages 15 - 24                                |             |
| 17 | Population                            | 42,475,000  |   | Population                                  | 43,500,000  |
| 18 | Deaths                                |             |   | Deaths                                      |             |
| 19 | All causes                            | 49,027      |   | All causes                                  | 32,570      |
| 20 | Unintentional injuries                | 26,206      |   | Unintentional injuries                      | 13,890      |
| 21 | Homicide                              | 6,537       |   | Suicide                                     | 5,720       |

# US Population (by Age Group) in 1980 and 2016

| Year | Total Population | Ages 15–24 | Ages 25–44 | Ages 45–64 |
|------|------------------|------------|------------|------------|
| 1980 | 226,540,000      | 42,475,000 | 62,707,000 | 44,497,000 |
| 2016 | 323,120,000      | 43,500,000 | 85,150,000 | 84,300,000 |

Part 1: Calculate the deaths per 1000 people (per year) for all 3 groups for the two different years.

Discuss and support with source

Part 2: Select one cause of death and one group, then compare the death rate per 1000 people (per year) for the two different years.

Discuss and support with source

Part 3: Select a cause of death that appears in both the 25–44 and 45–64 age categories, then compare the for the year 2016 only

Discuss and support with source

Part 4: What value might there be in thinking about death? (Consider biblical perspective.)

Discuss and support with Bible Verse



1. Assuming that the population numbers in the above table are relatively accurate, use the Project 2: Data spreadsheet to compute the deaths per 1000 people for each age group in both 1980 and 2016. Deaths per 1000 people is computed using the formula  $\text{Deaths per 1000} = (\# \text{ of deaths}) / (\text{total population}) \times 1000$ . Do not round your answer to the nearest whole number, provide at least 2 decimal places (but no more than 4). Give these 6 values (e.g. deaths per 1000 people for ages 15–24 in 1980) and then cite a reference to discuss what might account for the changes between the deaths per 1000 in 1 of these 3 age categories between 1980 and 2016. Your discussion should be at least 50 words.



2. Besides the changes in the overall death rate in the past 3 decades, the leading causes of death vary somewhat between 1980 and 2016. Choose 1 of the 3 age ranges and select 1 cause of death from the Project 2: Data spreadsheet that strikes you as noteworthy and that appears in both the 1980 and 2016 lists. For the cause of death that you selected, compute the number of deaths per 1000 in both 1980 and 2016 for your chosen age group. Do not round your answer to the nearest whole number, provide at least 2 decimal places. Cite a reference to discuss the possible reasons for any changes in the rates over this period. Your discussion should be at least 50 words.



3. Not only do the leading causes of death vary across time, they vary significantly for different age ranges. Looking only at the 2016 data, choose a cause of death that appears in both the 25–44 and 45–64 age categories and compute the number of deaths per 1000 people for both age categories. Do not round your answer to the nearest whole number, provide at least 2 decimal places. Cite a reference to discuss a possible reason for any differences in these values as people advance in age. Your discussion should be at least 40 words.



4. Contemplating causes of death might strike some people as unpleasant or even morbid. However, the Bible encourages us to give some thought to the fact of our own mortality. Ecclesiastes 7:2–4 says: “It is better to go to the house of mourning than to go to the house of feasting, for this is the end of all mankind, and the living will lay it to heart. Sorrow is better than laughter, for by sadness of face the heart is made glad. The heart of the wise is in the house of mourning, but the heart of fools is in the house of mirth.” It is interesting to consider why the author of Ecclesiastes encourages the wise to go to the house of mourning and the living to lay the end of all mankind to heart. What value might there be in thinking about the, admittedly uncomfortable, subject of the end of all mankind? What comes to your mind when you consider this topic? Please respond with at least 100 words.

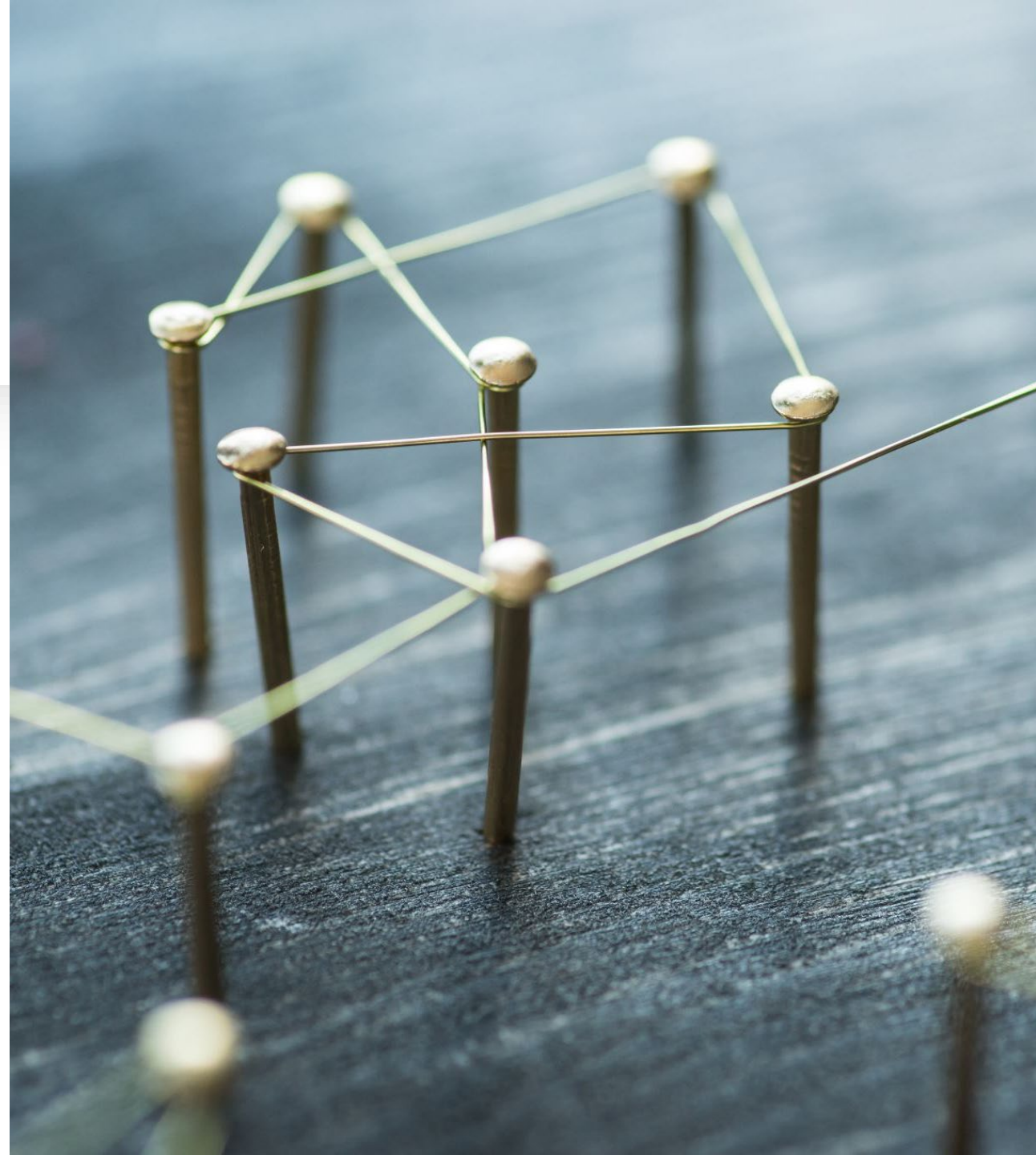


# Living a Life of Quantitative Reasoning



# Introduction

- Definition of Quantitative Reasoning
- Connecting Reasoning to Faith
- Luke 14:28
  - For which of you, desiring to build a tower, does not first sit down and count the cost, whether he has enough to complete it?



# Why is Quantitative Reasoning Important?

- **Informed decision-making:** Whether it's personal finance, evaluating news stories, or understanding scientific claims, quantitative reasoning helps us make sound judgments, aligning with the Proverbs' call for wisdom (Proverbs 1:7, 9:10).
- **Problem-solving:** Many challenges in life, from budgeting to planning a project, require quantitative skills. Jesus often used parables with numerical elements to illustrate spiritual truths (Matthew 13:3-8, 25:14-30).
- **Critical thinking:** Quantitative reasoning encourages us to look beyond the surface and analyze information more deeply, as Paul encourages us to "test everything; hold fast what is good" (1 Thessalonians 5:21).

# Discussion Questions

1. How can quantitative reasoning help us better understand the complexity and order in God's creation?
2. How can we use quantitative reasoning to make ethical decisions that align with biblical values?
3. How can we balance faith and reason when approaching complex issues like poverty, environmental concerns, or medical advancements?
4. What are some examples of how quantitative reasoning can be used to serve others and further God's kingdom?
5. How can we be mindful of the limitations of quantitative reasoning and avoid misusing statistics, recognizing that numbers don't always tell the whole story?



---

# Quantitative Reasoning in Everyday Life

- Budgeting and Financial Stewardship
- Biblical Reference: Proverbs 27:23  
Be sure you know the condition of your flocks,  
give careful attention to your herds;
- Discussion Question: Have you tried budgeting before?



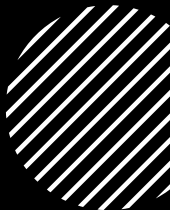
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## Time Management

1. Reflecting on Daily Activities
2. Biblical Reference: Psalm 90:12  
Teach us to number our days, that we may gain a heart of wisdom.
3. Discussion Question: How do you spend your day?



# Quantitative Reasoning in Relationships



Assessing Time Invested in Relationships



Hebrews 10:24-25

Be very careful, then, how you live—not as unwise but as wise, making the most of every opportunity, because the days are evil.



Discussion Question: Can time-tracking improve relationships?



# Data and Decision Making



## Making Evidence-Based Decisions

Biblical Reference: James 1:5

- If any of you lacks wisdom, he should ask God, who gives generously to all without finding fault, and it will be given to him.

Example: Considering Extra Commitments

Discussion Question: Do you consider numbers in decisions?



# Faith and Reason Working Together



Harmonizing Faith and Analytical Thinking



Matthew 22:37

Jesus replied: “Love the Lord your God with all your heart and with all your soul and with all your mind.’



Discussion Question: Where can you use quantitative reasoning?

# How Can We Live a Quantitative Reasoning Life?

- 1.Be curious:** Ask questions about the world around you. How many? How often? What is the trend? Cultivate a spirit of inquiry, as the Bereans did when they "examined the Scriptures daily to see if what Paul said was true" (Acts 17:11).
- 2.Look for data:** Pay attention to numbers, statistics, and graphs in the news, reports, and everyday life. Jesus Himself used statistics to make a point about the likelihood of finding a lost sheep (Luke 15:4-7).
- 3.Develop your skills:** Practice interpreting data, performing calculations, and drawing inferences.
- 4.Apply your skills:** Use quantitative reasoning in your personal, academic, and professional life. Just as the early church kept records and organized their community (Acts 6:1-7), we can use these skills for effective management and service.

# Conclusion



Summary of Key Points



Encouragement to Apply  
Quantitative Reasoning



Final Challenge:  
Pick an Area to Improve

<https://viz.bible>

(viz.)BIBLE

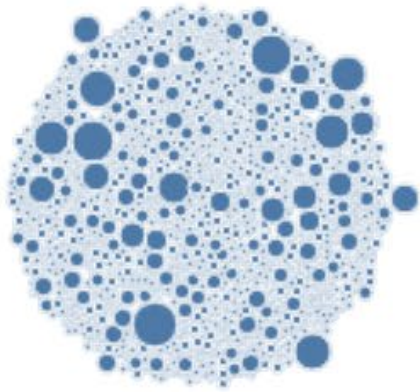
APP | POSTS | DATA | ABOUT | STORE

Images capture attention and ignite emotions. Pictures filled with data engage the mind. They cause us to notice something, ask questions, and search for answers. Viz.Bible showcases data visualizations, infographics, and illustrated diagrams that inspire people to know God more fully.

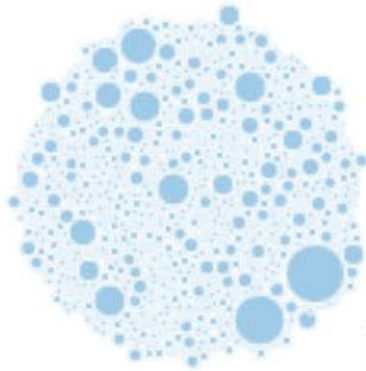
*Gallery*

# Word Usage in Each Book of the Bible

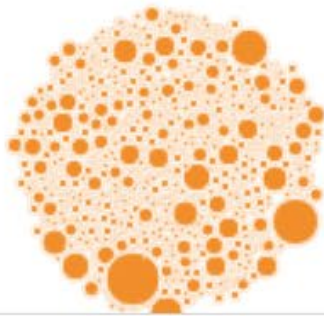
Genesis



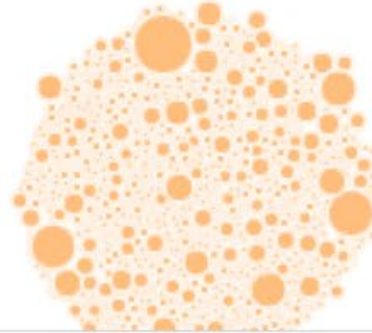
Exodus



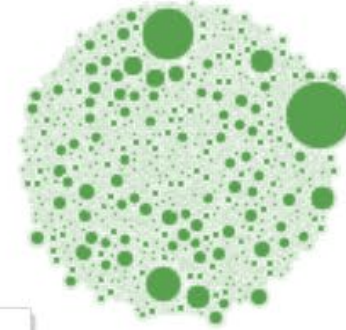
Leviticus



Numbers



Deuteronomy

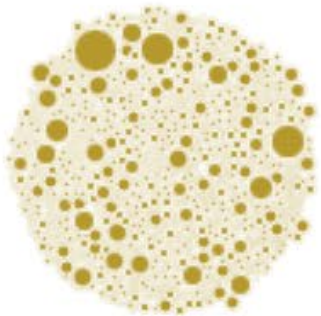


Joshua



The word, **Lord**, appears 414 time(s) in Exodus

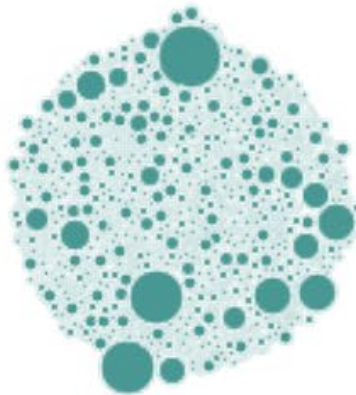
Judges



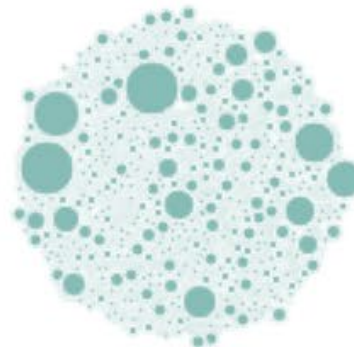
Ruth



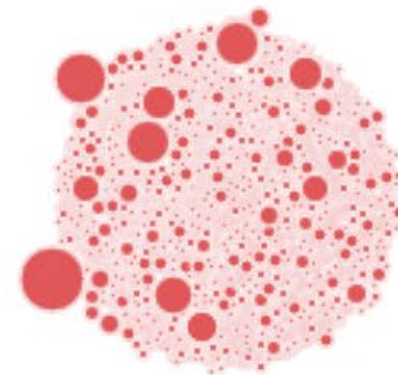
1st Samuel



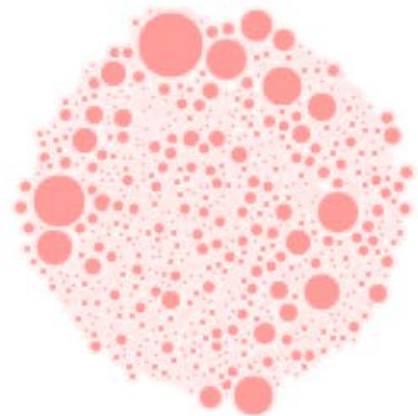
2nd Samuel



1st Chronicles



2nd Chronicles



# Frequency Distribution Calculator

Frequency Distribution Calculator is a tool to help you calculate and analyze word and character frequency distribution in text. You can use it to calculate word rank, word count, character count, and letter count. Or to find and analyze Zipfian distributions (text that follows [Zipf's law](#)). You can even use it to calculate the entropy of text, or locate hapax legomena in text.

Enter or paste text to analyze...

Analyze Words ▼

- ☒ Remove punctuation
- ☒ Remove spaces
- ☒ Ignore case
- ☒ Show Zipf line
- ☒ Sort descending

DEMO

ANALYZE

1. Pull up a book of the bible.
2. Choose three words that summarize the book.
3. Now use a word frequency tool to analyze the book by copying the text without verse numbers.

<https://frequencydistributioncalculator.com/>

FREE Trial ▶

Bible  
Gateway 

For less than \$5/mo. gain access to \$3,100 worth of premium resources to enhance your study of Scripture. Start your

Habakkuk 1-3

New International Version (NI

Bible Book List ▼



Resources

He

Habakkuk 1-3 ▼ New International Version ▼

**1** The prophecy that Habakkuk the prophet received.

### Habakkuk's Complaint

- 2** How long, LORD, must I call for help,  
but you do not listen?  
Or cry out to you, "Violence!"  
but you do not save?
- 3** Why do you make me look at injustice?  
Why do you tolerate wrongdoing?  
Destruction and violence are before me

**PLUS** Do your E  
worth of prem  
**Bible Gateway**  
Bible study.

Start 14-day

Resources for Hal

 All

 Stud

 Commentaries

READ  
THE BIBLESTUDY  
TOOLSBIBLE GATEWAY  
PLUSEXPLORE  
MORE

STORE

Habakkuk 1-3

New International Version (NIV)

Bible Book List ▾



Resources

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☐ Reverse Interlinear PLUS

Habakkuk 1-3 New International Version (NIV)

The prophet received.

Call for help,

but you do not listen?

Or cry out to you, "Violence!"

but you do not save?

Why do you make me look at injustice?

Why do you tolerate wrongdoing?

Destruction and violence are before me;

there is strife, and conflict abounds.

Therefore the law is paralyzed,

and justice never prevails.

The wicked hem in the righteous,

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## Frequency Distribution Calculator

Frequency Distribution Calculator is a tool to help you calculate and analyze word and character frequency distribution in text. You can use it to calculate word rank, word count, character count, and letter count. Or to find and analyze Zipfian distributions (text that follows [Zipf's law](#)). You can even use it to calculate the entropy of text, or locate hapax legomena in text.

The prophecy that Habakkuk the prophet received.

How long, Lord, must I call for help,  
but you do not listen?  
Or cry out to you, "Violence!"  
but you do not save?  
Why do you make me look at injustice?  
Why do you tolerate wrongdoing?  
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there is strife, and conflict abounds.  
Therefore the law is paralyzed,  
and justice never prevails.  
The wicked hem in the righteous,  
so that justice is perverted

Analyze Words ▾

- ☒ Remove punctuation
- ☒ Remove spaces
- ☒ Ignore case
- ☒ Show Zipf line
- ☒ Sort descending

DEMO

ANALYZE

The prophecy that Habakkuk the prophet received.

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DEMO

ANALYZE

ENTROPY  
NONE

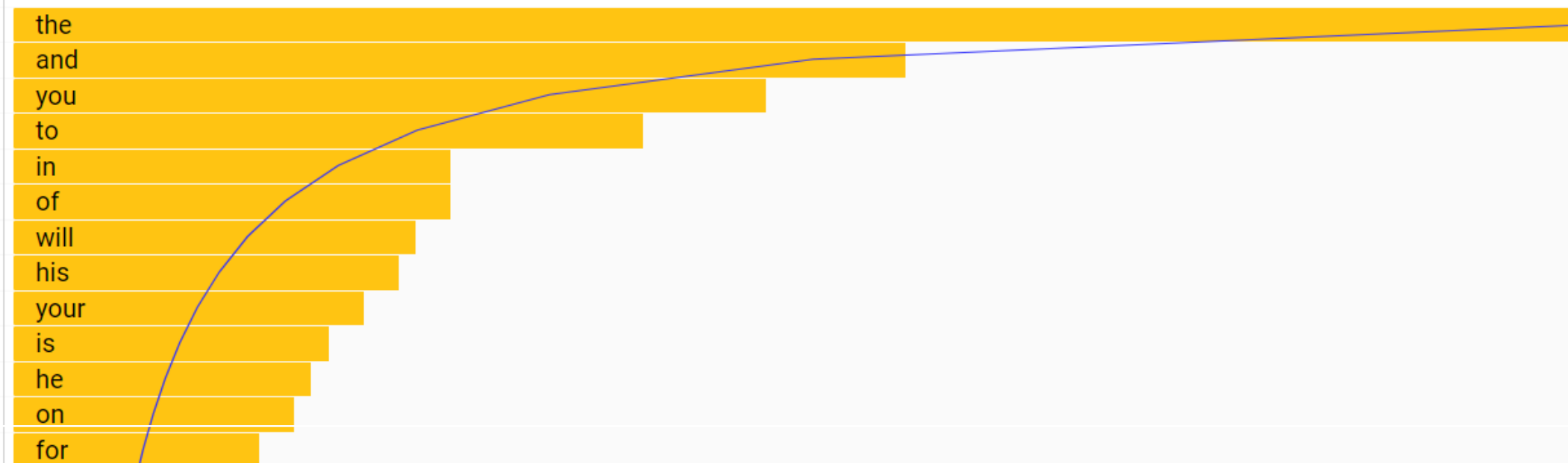
CONTENT GUESS  
SOMETHING BORING

HL PERCENT  
69%

ZIPFIAN  
NO

WORDS  
1323

CHARACTERS  
7559

| FREQUENCY | OCCURANCES | WORD |  |  |
|-----------|------------|------|-------------------------------------------------------------------------------------|--|
| 1st       | 91         | the  |                                                                                     |  |
| 2nd       | 51         | and  |                                                                                     |  |
| 3rd       | 43         | you  |                                                                                     |  |
| 4th       | 36         | to   |                                                                                     |  |
| 5th       | 25         | in   |                                                                                     |  |
| 6th       | 25         | of   |                                                                                     |  |
| 7th       | 23         | will |                                                                                     |  |
| 8th       | 22         | his  |                                                                                     |  |
| 9th       | 20         | your |                                                                                     |  |
| 10th      | 18         | is   |                                                                                     |  |
| 11th      | 17         | he   |                                                                                     |  |
| 12th      | 16         | on   |                                                                                     |  |
| 13th      | 14         | for  |                                                                                     |  |

 SAVE

# Frequency Distribution Calculator

|      |    |         |
|------|----|---------|
| 13th | 14 | for     |
| 14th | 13 | lord    |
| 15th | 13 | i       |
| 16th | 13 | not     |
| 17th | 13 | it      |
| 18th | 12 | are     |
| 19th | 12 | my      |
| 20th | 12 | have    |
| 21st | 11 | that    |
| 22nd | 11 | them    |
| 23rd | 11 | with    |
| 24th | 10 | at      |
| 25th | 10 | they    |
| 26th | 10 | him     |
| 27th | 9  | who     |
| 28th | 9  | their   |
| 29th | 9  | a       |
| 30th | 9  | like    |
| 31st | 8  | up      |
| 32nd | 8  | from    |
| 33rd | 8  | by      |
| 34th | 7  | nations |
| 35th | 7  | earth   |
| 36th | 7  | all     |
| 37th | 6  | do      |
| 38th | 6  | be      |
| 39th | 6  | people  |
| 40th | 6  | own     |
| 41st | 6  | no      |
| 42nd | 5  | come    |
| 43rd | 5  | sea     |

|      |   |            |
|------|---|------------|
| 44th | 5 | though     |
| 45th | 5 | woe        |
| 46th | 4 | but        |
| 47th | 4 | out        |
| 48th | 4 | violence   |
| 49th | 4 | why        |
| 50th | 4 | make       |
| 51st | 4 | me         |
| 52nd | 4 | look       |
| 53rd | 4 | there      |
| 54th | 4 | never      |
| 55th | 4 | so         |
| 56th | 4 | an         |
| 57th | 4 | then       |
| 58th | 4 | god        |
| 59th | 4 | one        |
| 60th | 4 | net        |
| 61st | 4 | as         |
| 62nd | 4 | makes      |
| 63rd | 4 | glory      |
| 64th | 3 | or         |
| 65th | 3 | tolerate   |
| 66th | 3 | before     |
| 67th | 3 | wicked     |
| 68th | 3 | righteous  |
| 69th | 3 | am         |
| 70th | 3 | were       |
| 71st | 3 | themselves |
| 72nd | 3 | horses     |
| 73rd | 3 | than       |

The prophecy that Habakkuk the prophet received.

How long, Lord, must I call for help,  
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Or cry out to you, "Violence!"  
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Analyze **Words** ▾

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- ☒ Show Zipf line
- ☒ Sort descending

DEMO

ANALYZE

ENTROPY  
NONE

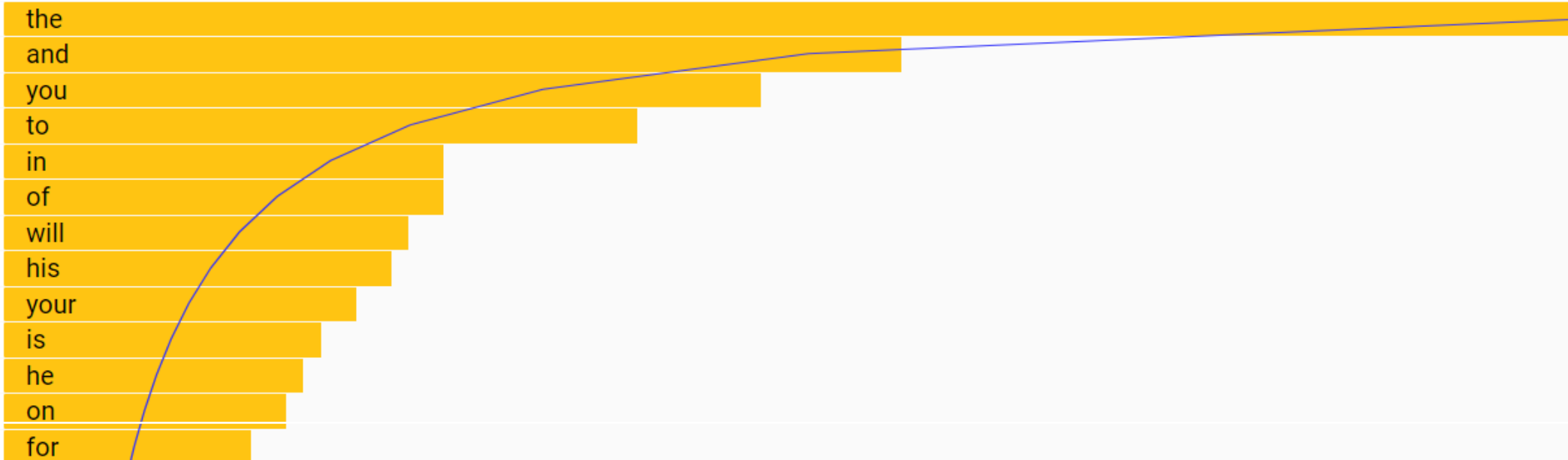
CONTENT GUESS  
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HL PERCENT  
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ZIPFIAN  
NO

WORDS  
1323

CHARACTERS  
7559

| FREQUENCY | OCCURANCES | WORD |  A line graph showing the relationship between word frequency and occurrence. The x-axis represents the rank of the word (1st, 2nd, 3rd, etc.), and the y-axis represents the number of occurrences. A blue line starts at the top left and curves downwards to the right, passing through the data points represented by the yellow bars. The line is labeled 'Zipf's Law'. |  | SAVE |
|-----------|------------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|------|
| 1st       | 91         | the  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  |      |
| 2nd       | 51         | and  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  |      |
| 3rd       | 43         | you  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  |      |
| 4th       | 36         | to   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  |      |
| 5th       | 25         | in   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  |      |
| 6th       | 25         | of   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  |      |
| 7th       | 23         | will |                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  |      |
| 8th       | 22         | his  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  |      |
| 9th       | 20         | your |                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  |      |
| 10th      | 18         | is   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  |      |
| 11th      | 17         | he   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  |      |
| 12th      | 16         | on   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  |      |
| 13th      | 14         | for  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  |      |

|             |            |              |             |           |            |            |          |             |
|-------------|------------|--------------|-------------|-----------|------------|------------|----------|-------------|
| abounds     | cavalry    | dreaded      | gain        | into      | nest       | raising    | speak    | treacherous |
| about       | certainly  | drunk        | gallops     | invading  | nothing    | ramparts   | speaks   | tread       |
| across      | chariots   | dusk         | gather      | its       | now        | ramps      | splendor | tree        |
| advance     | choicest   | eagle        | gaze        | joyful    | old        | rays       | split    | trembled    |
| afar        | churning   | earthen      | gives       | judgment  | olive      | received   | stalls   | trusts      |
| age         | city       | echo         | glad        | keep      | only       | rejoice    | station  | turn        |
| almighty    | clutches   | emptying     | glint       | kings     | ordained   | rejoices   | steps    | uncovered   |
| amazed      | collapsed  | enables      | gloating    | knowledge | overwhelm  | remember   | still    | unjust      |
| ancient     | coming     | end          | going       | known     | paralyzed  | repeat     | stolen   | upright     |
| anger       | complaint  | enemy        | gold        | labor     | paran      | replied    | stone    | utterly     |
| angry       | conflict   | enjoys       | goods       | land      | past       | rest       | stones   | value       |
| anguish     | craftsman  | escape       | grapes      | laugh     | patiently  | ridicule   | stormed  | victory     |
| animals     | creation   | establishes  | grave       | leader    | pen        | right      | streams  | vines       |
| anointed    | creatures  | even         | great       | lebanon   | person     | roared     | strife   | wall        |
| answer      | creditors  | everlasting  | greedy      | left      | perverted  | rock       | stringed | warriors    |
| arise       | crept      | evil         | guidance    | legs      | pestilence | rode       | stripped | water       |
| around      | crop       | execute      | guilty      | leopards  | pierced    | ruler      | strode   | waves       |
| arrogant    | crumbled   | exhaust      | has         | lies      | piles      | rulers     | suddenly | wealthy     |
| awaits      | crushed    | exposed      | headlong    | lifeless  | plague     | run        | sun      | went        |
| awe         | cup        | extortion    | heart       | lifted    | plain      | ruthless   | sunrise  | where       |
| babylonians | cushan     | eyes         | heights     | lightning | plotted    | sacrifices | swallow  | while       |
| beams       | days       | fails        | help        | linger    | plunder    | sand       | swept    | whole       |
| become      | death      | faithfulness | hem         | lips      | plundered  | satisfied  | swifter  | whose       |
| believe     | decay      | fame         | herald      | listen    | pounded    | savior     | swooping | wickedness  |
| betrays     | deeds      | feared       | hidden      | live      | pouring    | say        | tablets  | wine        |
| bloodshed   | deep       | fields       | hiding      | lives     | power      | saying     | takes    | wineskin    |
| bodies      | deer       | fiercer      | hills       | looked    | praise     | says       | taunt    | without     |
| bones       | delay      | fig          | honor       | luxury    | prayer     | scatter    | teaches  | wolves      |
| bow         | deliver    | fire         | hooks       | marches   | prevails   | scoff      | teman    | wood        |
| breath      | desert     | fish         | hordes      | may       | prey       | scorn      | temple   | woodwork    |
| bud         | desires    | flashed      | horsemen    | midian    | prisoners  | seize      | tents    | would       |
| building    | destroying | flashing     | idol        | mock      | produce    | setting    | terrify  | wretched    |
| burns       | determined | fly          | idols       | moon      | promote    | shame      | those    | write       |
| calamity    | did        | flying       | if          | more      | prophecy   | shaming    | threshed | writhed     |
| call        | die        | foe          | image       | mount     | prove      | sheep      | through  |             |
| called      | director   | followed     | impetuous   | music     | puffed     | shigionoth | till     |             |
| captive     | disgrace   | foot         | incense     | myself    | pulls      | shook      | told     |             |
| capture     | distress   | forever      | indeed      | naked     | punish     | silver     | too      |             |
| carved      | does       | forfeiting   | instead     | nakedness | pure       | something  | torrents |             |
| catches     | done       | fortified    | instruments | nation    | quivered   | sound      | town     |             |

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The prophecy that Habakkuk the prophet received.

How long, Lord, must I call for help,

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The prophecy that habakkuk the prophet received. How long, Lord, must I call for help, but you do not listen? Or cry out to you, "Violence!" but you do not save? Why do you make me look at injustice? Why do you tolerate wrongdoing? Destruction and violence are before me; there is strife, and conflict abounds. Therefore the law is paralyzed, and justice never prevails. The wicked hem in the righteous, so that justice is perverted. "Look at the nations and watch—and be utterly amazed. For I am going to do something in your days that you would not believe, even if you were told. I am raising up the Babylonians, that ruthless and impetuous people, who sweep across the whole earth to seize dwellings not their own. They are a feared and dreaded people; they are a law to themselves and promote their own honor. Their horses are swifter than leopards, fiercer than wolves at dusk. Their cavalry gallops headlong; their horsemen come from afar. They fly like an eagle swooping to devour; they all come intent on violence. Their hordes advance like a desert wind and gather prisoners like sand. They mock kings and scoff at rulers. They laugh at all fortified cities; by building earthen ramps they capture them. Then they sweep past like the wind and go on—guilty people, whose own strength is their god." Lord, are you not from everlasting? My God, my Holy One, you will never die. You, Lord, have appointed them to execute judgment; you, my Rock, have ordained them to punish. Your eyes are too pure to look on evil; you cannot tolerate wrongdoing. Why then do you tolerate the treacherous? Why are you silent while the wicked swallow up those more righteous than themselves? You have made people like the fish in the sea, like the sea creatures that have no ruler. The wicked foe pulls all of them up with hooks, he catches them in his net, he gathers them up in his dragnet; an

**dwellings not their feared and  
dreaded justice is perverted  
ordained them to punish have no  
ruler mock kings tolerate the  
treacherous tolerate wrongdoing  
fortified cities ruthless and  
impetuous wicked ruthless  
paralyzed mock guilty dreaded  
evil treacherous scoff  
impetuous**

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QUESTIONS?



# **Math 114**

## **Module 7:**

### **Correlation & Causality**



**Prof. Volk**

**Spring 2024**

# Math 114

## Quantitative Reasoning

Causes of Death in  
1980 and 2016

Project 2



## PROJECT 2 INSTRUCTIONS

Please also pay close attention to any additional specifications provided by your professor. Professors often will clarify their expectations regarding the format and presentation of your submission.

### Topic – Causes of Death in 1980 and 2016

According to the 1980 Census, the United States population was approximately 226,540,000 in 1980. It grew to approximately 323,120,000 at the beginning of 2016. Using Census data for 1980 and estimates derived from mortality data for 2016, we arrive at the population estimates given in the table below:

| Year | Total Population | Ages 15–24 | Ages 25–44 | Ages 45–64 |
|------|------------------|------------|------------|------------|
| 1980 | 226,540,000      | 42,475,000 | 62,707,000 | 44,497,000 |
| 2016 | 323,120,000      | 43,500,000 | 85,150,000 | 84,300,000 |

The National Center for Health Statistics published a document entitled “Health, United States, 2015: With Special Feature on Racial and Ethnic Health Disparities” that includes a table listing the leading causes of death in 1980 by age bracket. The CDC further produced a National Vital Statistics Reports that provided similar information for the year 2016. Under the Project Instructions link in Canvas, you’ll find **Project 2: Data**, a spreadsheet showing the leading causes of death in both 1980 and 2016 for these 3 age categories. Each of the first 3 questions has both a computational part and a discussion part. To get full credit for each of the discussion parts, please cite a reference to support your claims. This should not be an excessively difficult task: you can easily find information online for most of the illnesses or other causes listed in the report. All you need to do is provide the website you used (though other resources are also permitted if you prefer to use one of those).

1. Assuming that the population numbers in the above table are relatively accurate, use the Project 2: Data spreadsheet to compute the deaths per 1000 people for each age group in both 1980 and 2016. Deaths per 1000 people is computed using the formula  $\text{Deaths per 1000} = (\# \text{ of deaths}) / (\text{total population}) \times 1000$ . Do not round your answer to the nearest whole number, provide at least 2 decimal places (but no more than 4). Give these 6 values (e.g. deaths per 1000 people for ages 15–24 in 1980) and then cite a reference to discuss what might account for the changes between the deaths per 1000 in 1 of these 3 age categories between 1980 and 2016. Your discussion should be at least 50 words.
2. Besides the changes in the overall death rate in the past 3 decades, the leading causes of death vary somewhat between 1980 and 2016. Choose 1 of the 3 age ranges and select 1 cause of death from the Project 2: Data spreadsheet that strikes you as noteworthy and that appears in both the 1980 and 2016 lists. For the cause of death that you selected, compute the number of deaths per 1000 in both 1980 and 2016 for your chosen age group. Do not round your answer to the nearest whole number, provide at least 2

## Two Documents Needed



| 1980                                  |             | 2016                                        |             |
|---------------------------------------|-------------|---------------------------------------------|-------------|
| Population                            | 226,540,000 | Population                                  | 323,120,000 |
| Deaths                                |             | Deaths                                      |             |
| All causes                            | 1,989,841   | All causes                                  | 2,744,248   |
| Diseases of heart                     | 761,085     | Diseases of heart                           | 635,260     |
| Malignant neoplasms                   | 416,509     | Malignant neoplasms                         | 598,038     |
| Cerebrovascular diseases              | 170,225     | Unintentional injuries                      | 161,374     |
| Unintentional injuries                | 105,718     | Chronic lower respiratory diseases          | 154,596     |
| Chronic obstructive pulmonary disease | 56,050      | Cerebrovascular diseases                    | 142,142     |
| Pneumonia and influenza               | 54,619      | Alzheimer's disease                         | 116,103     |
| Diabetes mellitus                     | 34,851      | Diabetes mellitus                           | 80,058      |
| Chronic liver disease and cirrhosis   | 30,583      | Influenza and pneumonia                     | 51,537      |
| Atherosclerosis                       | 29,449      | Nephritis, nephrotic syndrome and nephrosis | 50,046      |
| Suicide                               | 26,869      | Suicide                                     | 44,965      |
| Ages 15 - 24                          |             | Ages 15 - 24                                |             |
| Population                            | 42,475,000  | Population                                  | 43,500,000  |
| Deaths                                |             | Deaths                                      |             |
| All causes                            | 49,027      | All causes                                  | 32,575      |
| Unintentional injuries                | 26,206      | Unintentional injuries                      | 13,895      |
| Homicide                              | 6,537       | Suicide                                     | 5,723       |
| Suicide                               | 5,239       | Homicide                                    | 5,172       |
| Malignant neoplasms                   | 2,683       | Malignant neoplasms                         | 1,431       |
| Diseases of heart                     | 1,223       | Diseases of heart                           | 949         |
| Congenital anomalies                  | 600         | Congenital malformations/abnormalities      | 388         |
| Cerebrovascular diseases              | 418         | Diabetes mellitus                           | 211         |
| Pneumonia and influenza               | 348         | Chronic lower respiratory disease           | 206         |
| Chronic obstructive pulmonary disease | 141         | Influenza and pneumonia                     | 189         |
| Anemias                               | 133         | Complicated Pregnancy                       | 184         |
| Ages 25 - 44                          |             | Ages 25 - 44                                |             |
| Population                            | 62,707,000  | Population                                  | 85,150,000  |
| Deaths                                |             | Deaths                                      |             |
| All causes                            | 108,658     | All causes                                  | 135,408     |
| Unintentional injuries                | 26,722      | Unintentional injuries                      | 44,959      |
| Malignant neoplasms                   | 17,551      | Malignant neoplasms                         | 14,694      |
| Diseases of heart                     | 14,513      | Suicide                                     | 14,396      |
| Homicide                              | 10,963      | Diseases of heart                           | 13,922      |
| Suicide                               | 9,855       | Homicide                                    | 8,745       |
| Chronic liver disease and cirrhosis   | 4,782       | Chronic liver disease and cirrhosis         | 3,776       |
| Cerebrovascular diseases              | 3,154       | Diabetes mellitus                           | 2,841       |
| Diabetes mellitus                     | 1,472       | Cerebrovascular diseases                    | 2,426       |
| Pneumonia and influenza               | 1,467       | HIV disease                                 | 1,517       |
| Congenital anomalies                  | 817         | Septicemia                                  | 1,316       |
| Ages 45 - 64                          |             | Ages 45 - 64                                |             |
| Population                            | 44,497,000  | Population                                  | 84,300,000  |
| Deaths                                |             | Deaths                                      |             |
| All causes                            | 425,338     | All causes                                  | 539,961     |
| Diseases of heart                     | 148,322     | Malignant neoplasms                         | 157,655     |
| Malignant neoplasms                   | 135,675     | Diseases of heart                           | 112,637     |
| Cerebrovascular diseases              | 19,909      | Unintentional injuries                      | 45,237      |
| Unintentional injuries                | 18,140      | Chronic liver disease and cirrhosis         | 21,812      |
| Chronic liver disease and cirrhosis   | 16,089      | Chronic lower respiratory diseases          | 22,117      |
| Chronic obstructive pulmonary disease | 11,514      | Diabetes mellitus                           | 20,518      |
| Diabetes mellitus                     | 7,977       | Cerebrovascular diseases                    | 17,663      |
| Suicide                               | 7,079       | Suicide                                     | 16,196      |
| Pneumonia and influenza               | 5,804       | Septicemia                                  | 8,413       |
| Homicide                              | 4,019       | Nephritis, nephrotic syndrome and nephrosis | 7,790       |

# US Population (by Age Group) in 1980 and 2016

| Year | Total Population | Ages 15–24 | Ages 25–44 | Ages 45–64 |
|------|------------------|------------|------------|------------|
| 1980 | 226,540,000      | 42,475,000 | 62,707,000 | 44,497,000 |
| 2016 | 323,120,000      | 43,500,000 | 85,150,000 | 84,300,000 |

Part 1: Calculate the deaths per 1000 people (per year) for all 3 groups for the two different years.

Discuss and support with source

Part 2: Select one cause of death and one group, then compare the death rate per 1000 people (per year) for the two different years.

Discuss and support with source

Part 3: Select a cause of death that appears in both the 25–44 and 45–64 age categories, then compare the for the year 2016 only

Discuss and support with source

Part 4: What value might there be in thinking about death? (Consider biblical perspective.)

Discuss and support with Bible Verse



# All Causes

## 6 answers

1. Assuming that the population numbers in the above table are relatively accurate, use the Project 2: Data spreadsheet to compute the deaths per 1000 people for each age group in both 1980 and 2016. Deaths per 1000 people is computed using the formula  $\text{Deaths per 1000} = (\# \text{ of deaths}) / (\text{total population}) \times 1000$ . Do not round your answer to the nearest whole number, provide at least 2 decimal places (but no more than 4). Give these 6 values (e.g. deaths per 1000 people for ages 15–24 in 1980) and then cite a reference to discuss what might account for the changes between the deaths per 1000 in 1 of these 3 age categories between 1980 and 2016. Your discussion should be at least 50 words.



# Choose a cause

## 2 answers

2. Besides the changes in the overall death rate in the past 3 decades, the leading causes of death vary somewhat between 1980 and 2016. Choose 1 of the 3 age ranges and select 1 cause of death from the Project 2: Data spreadsheet that strikes you as noteworthy and that appears in both the 1980 and 2016 lists. For the cause of death that you selected, compute the number of deaths per 1000 in both 1980 and 2016 for your chosen age group. Do not round your answer to the nearest whole number, provide at least 2 decimal places. Cite a reference to discuss the possible reasons for any changes in the rates over this period. Your discussion should be at least 50 words.



# Choose a cause

2 answers

3. Not only do the leading causes of death vary across time, they vary significantly for different age ranges. Looking only at the 2016 data, choose a cause of death that appears in both the 25–44 and 45–64 age categories and compute the number of deaths per 1000 people for both age categories. Do not round your answer to the nearest whole number, provide at least 2 decimal places. Cite a reference to discuss a possible reason for any differences in these values as people advance in age. Your discussion should be at least 40 words.



# No Math

# 100 words

4. Contemplating causes of death might strike some people as unpleasant or even morbid. However, the Bible encourages us to give some thought to the fact of our own mortality. Ecclesiastes 7:2–4 says: “It is better to go to the house of mourning than to go to the house of feasting, for this is the end of all mankind, and the living will lay it to heart. Sorrow is better than laughter, for by sadness of face the heart is made glad. The heart of the wise is in the house of mourning, but the heart of fools is in the house of mirth.” It is interesting to consider why the author of Ecclesiastes encourages the wise to go to the house of mourning and the living to lay the end of all mankind to heart. What value might there be in thinking about the, admittedly uncomfortable, subject of the end of all mankind? What comes to your mind when you consider this topic? Please respond with at least 100 words.



# Homework 7: 20 Questions

Due Sunday  
11:59 pm

## Questions 1-5

- Interpret multiple bar graphs, stack plots, contour maps, and other graphical displays.

## Questions 6 - 8

- Identify features of graphs that must be interpreted with caution.

## Question 9

- Interpret exponential scales on graphical displays.

## Questions 10-12

- Construct and interpret graphical displays for given data sets.

## Questions 13-14

- Describe correlations by type and strength.

## Questions 15-16

- Identify possible explanations for a correlation or a causal relationship.

## Questions 17 - 20

- Construct and interpret Scatterplots

# Quiz 7: 10 Questions

Due Monday  
11:59 pm

## Question 1

- Interpret multiple bar graphs, stack plots, contour maps, and other graphical displays.

## Question 2

- Identify features of graphs that must be interpreted with caution.

## Question 3

- Interpret exponential scales on graphical displays.

## Question 4

- Construct and interpret graphical displays for given data sets.

## Question 5

- Evaluate the quality and trustworthiness of media graphics.

## Question 6

- Describe correlations by type and strength.

## Questions 7

- Identify possible explanations for a correlation or a causal relationship.

## Questions 8-10

- Construct and interpret Scatterplots

# TYPES OF DATA



# A Few Cautions about Graphics

- Perceptual distortions: Many graphics are drawn in a way that distorts our perception of them.
- Watch the scales: It can be visually deceptive if you do not study the scales carefully.
- Percentage change graphs: Graphs that show percentage change can be misleading unless you interpret them with great care.
- Pictographs: Pictographs are graphs embellished with additional artwork. The artwork may make the graph more appealing, but can also distract or mislead.

# Perceptual Distortion

The lengths of the dollars to the right represent the data, but your eyes tend to focus on the area.

1980 = \$1.00



1990 = \$0.63

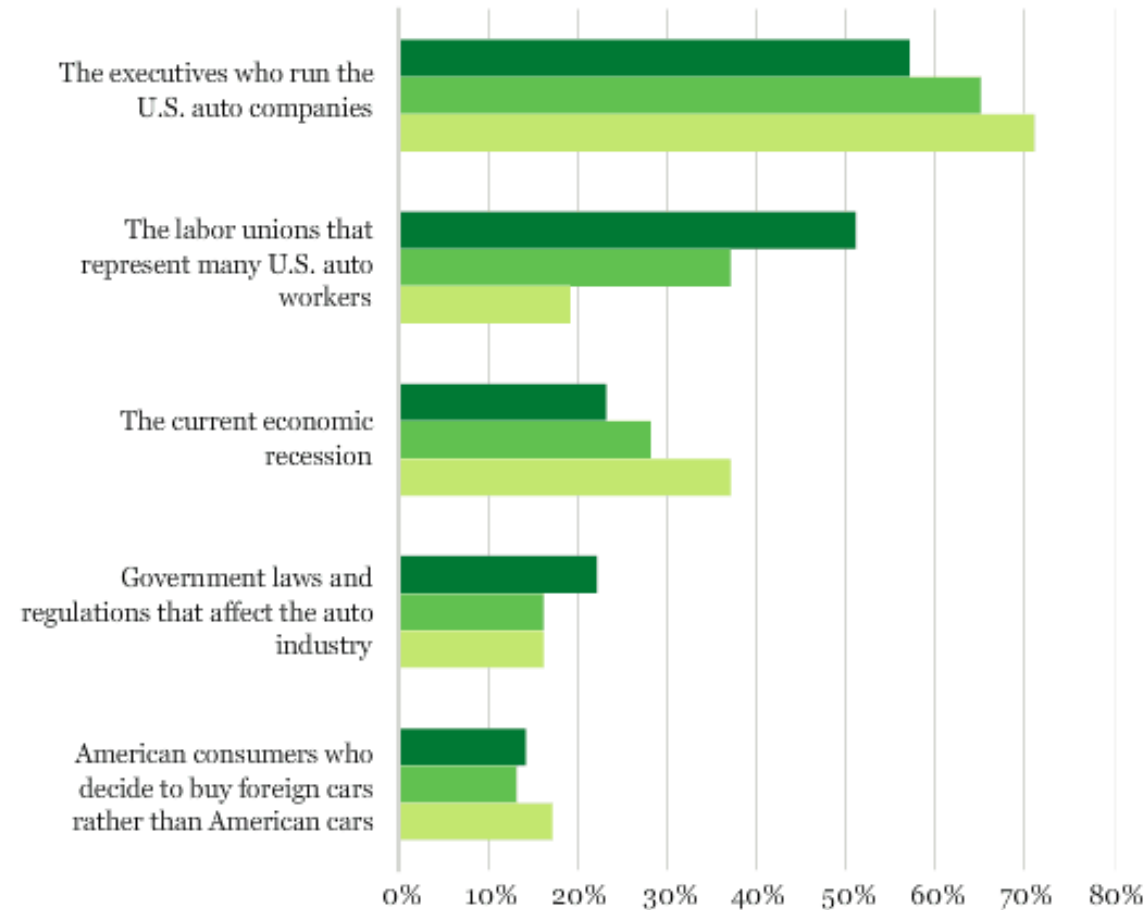


2005 = \$0.42



*Great Deal of Blame for Problems Faced by the Three Major U.S. Auto Companies*

■ Republicans ■ Independents ■ Democrats

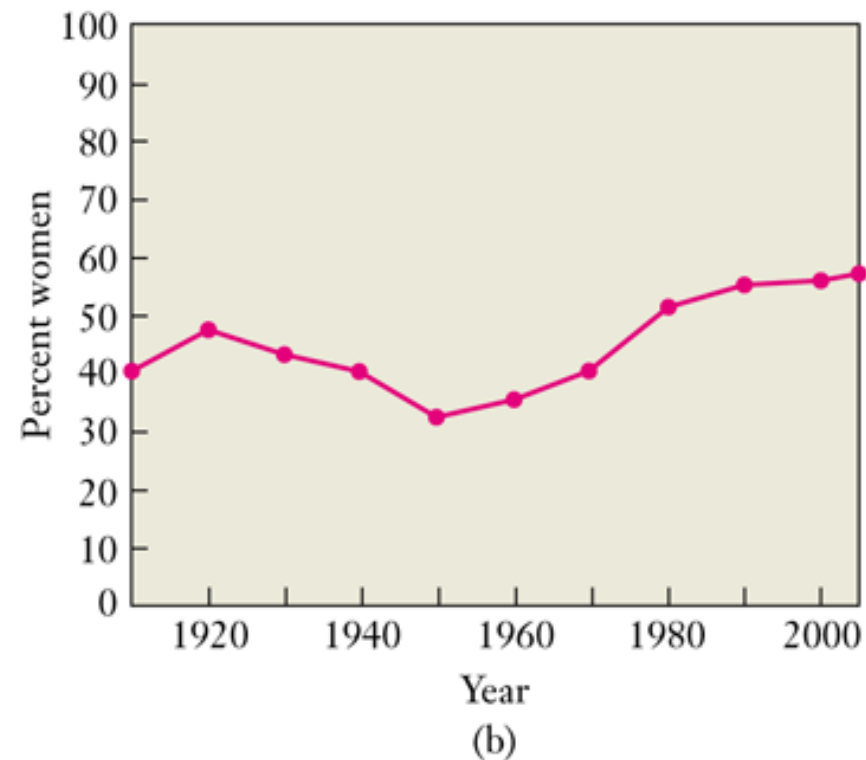
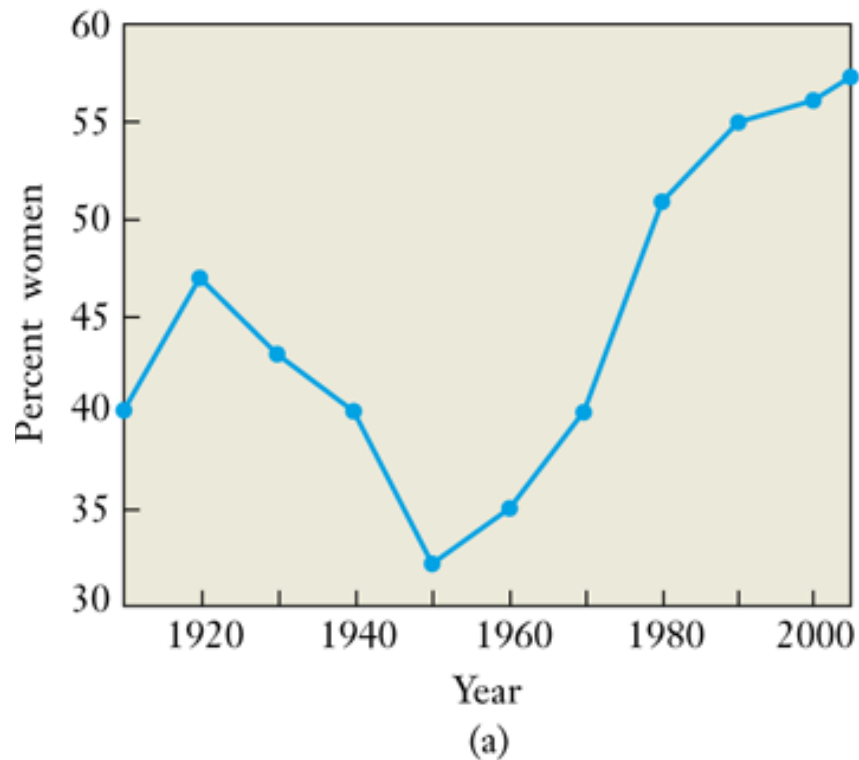


Gallup Poll, Dec. 4-7, 2008

GALLUP POLL

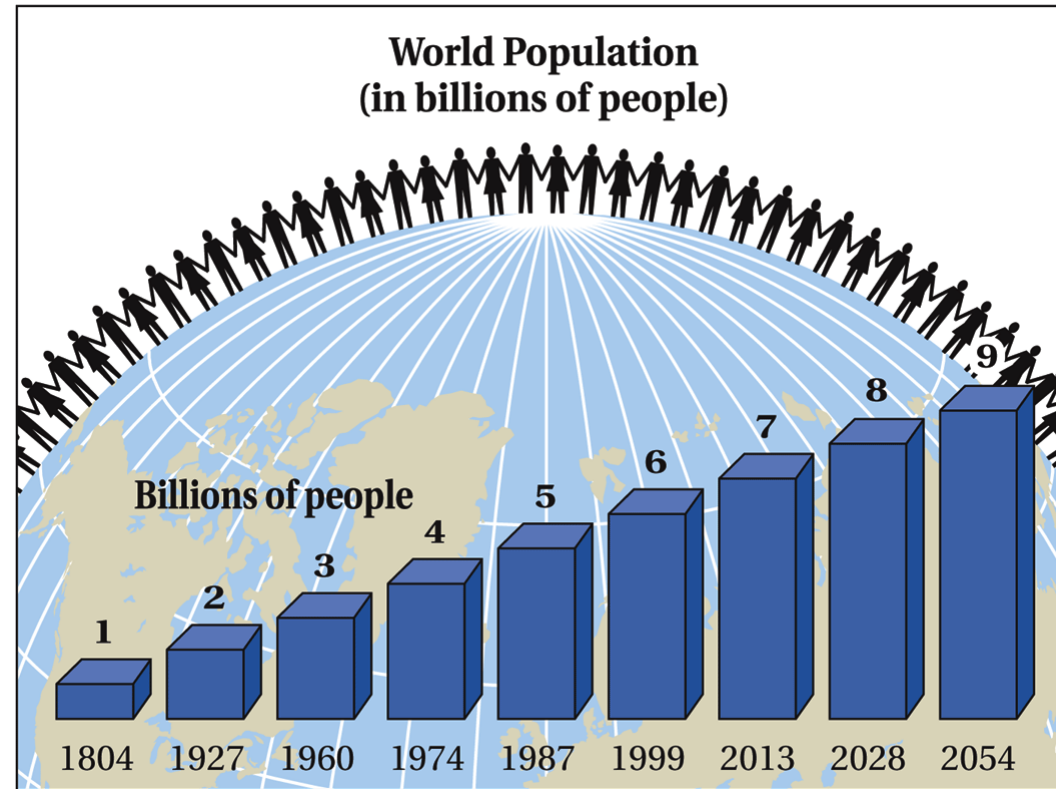
# Different Vertical Scales

Women as a Percentage of All College Students



Both graphs show the same data, but they look very different because their vertical scales have different ranges.

# Different Horizontal Scales



It appears that the world population has been rising linearly. However, the time intervals on the horizontal axis are not uniform in size.

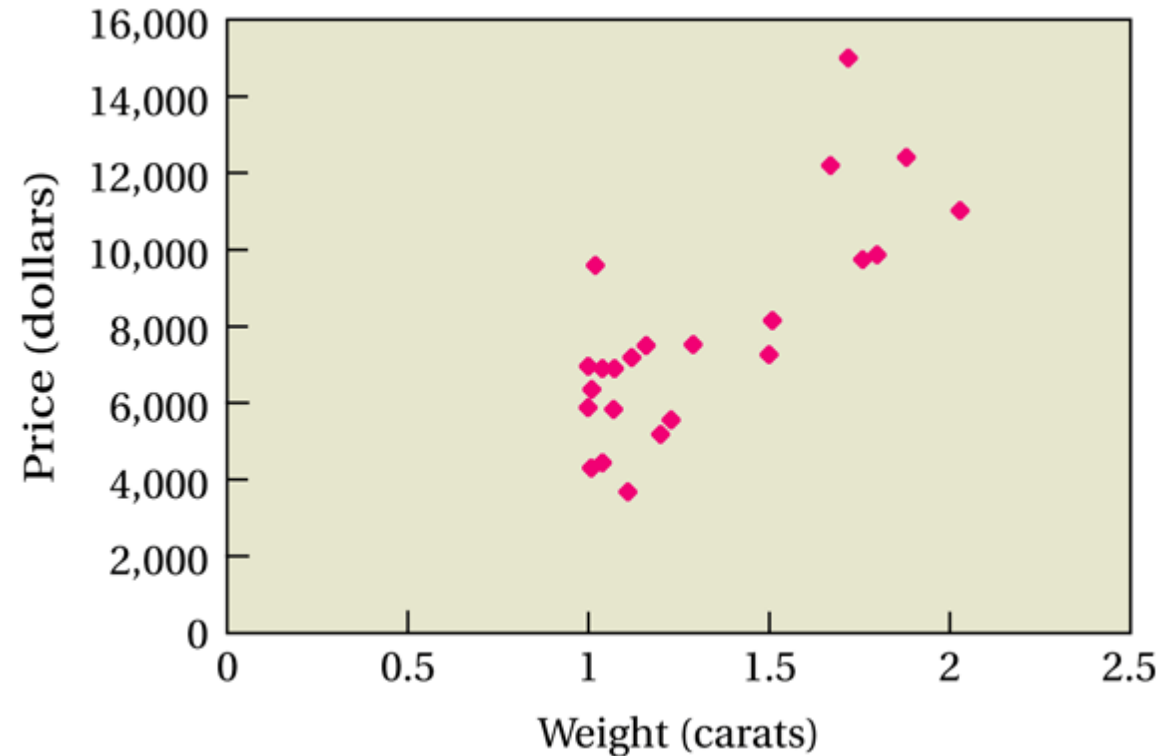
# Scatterplot

- A **scatterplot** is a graph in which each point represents the values of two variables.

# Relationships Between Two Data Variables

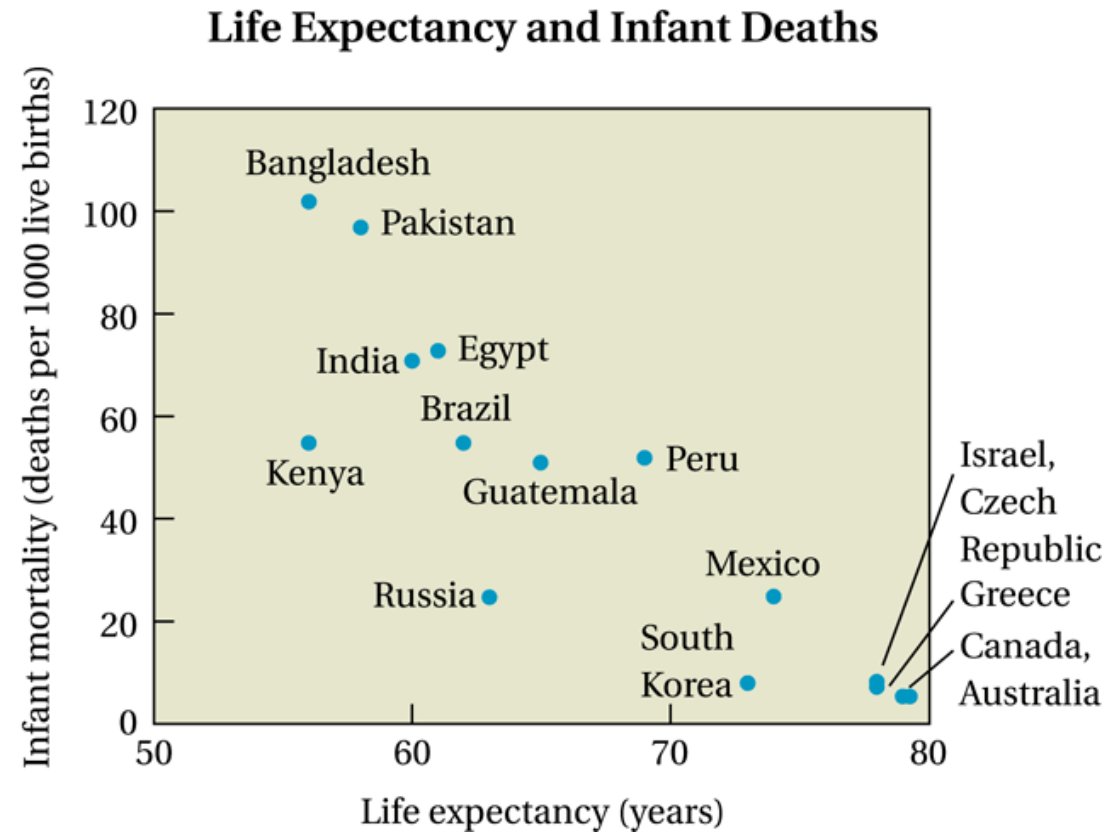
- **No correlation:** There is no apparent relationship between the two variables.
- **Positive correlation:** Both variables tend to increase (or decrease) together.
- **Negative correlation:** One variable increases while the other decreases.
- **Strength of a correlation:** The more closely two variables follow the general trend, the stronger the correlation. In a perfect correlation, all data points lie on a straight line.

# Positive Correlation



A scatter diagram shows that higher diamond weight generally goes with higher price.

# Negative Correlation



A scatter diagram shows that higher life expectancy generally goes with lower infant mortality.

# Example: Explanation for a Correlation

Consider the negative correlation between infant mortality and life expectancy. Which of the three possible explanations for a correlation applies?

The negative correlation is probably due to a common underlying cause – the quality of health care. In countries where health care is better in general, infant mortality is lower and life expectancy is higher.

# Guidelines for Establishing Causality (1 of 2)

If you suspect that a particular variable (the suspected cause) is causing some effect:

1. Look for situations in which the effect is correlated with the suspected cause even while other factors vary.
2. Among groups that differ only in the presence or absence of the suspected cause, check that the effect is similarly present or absent.
3. Look for evidence that larger amounts of the suspected cause produce larger amounts of the effect.
4. If the effect might be produced by other potential causes (besides the suspected cause), make sure that the effect still remains after accounting for these other potential causes.

# Guidelines for Establishing Causality (2 of 2)

- 5.** If possible, test the suspected cause with an experiment.  
If the experiment cannot be performed with humans for ethical reasons, consider doing the experiment with animals, cell cultures, or computer models.
- 6.** Try to determine the physical mechanism by which the suspected cause produces the effect.

# Case Study: Air Bags and Children (1 of 3)

By the mid-1990s, passenger-side air bags had become commonplace in cars. Statistical studies showed that the air bags saved many lives in moderate- to high-speed collisions. But a disturbing pattern also appeared. In at least some cases, young children, especially infants and toddlers in child car seats, were killed by air bags in low-speed collisions.



## DALLAS WILLARD'S SPIRITUAL DISCIPLINES

### Disciplines of Abstinence

Solitude

Silence

Fasting

Frugality

Chastity

Secrecy

Sacrifice

Watching

### Disciplines of Engagement

Study

Worship

Celebration

Service

Prayer

Fellowship

Communion

Submission

*Dallas introduces the topic of Spiritual Disciplines and how we use them to accomplish difficult goals for spiritual growth in The Authentic Leader Series, session 3, on the Dallas Willard Ministries YouTube Channel.*

# 12 SPIRITUAL DISCIPLINES OF THE CHRISTIAN FAITH

to liberate us from self-interest and fear  
and lead us to great spiritual growth.

## The Inward Disciplines:

Avenues for self-reflection, quiet contemplation, growth, and renewal



MEDITATION



PRAYER



FASTING



STUDY

## The Outward Disciplines:

Avenues for making a positive impact on others and the world



SIMPLICITY



SOLITUDE



SUBMISSION



SERVICE

## The Corporate Disciplines:

Avenues for strengthening our relationships with others and God



CONFESSION



WORSHIP



GUIDANCE



CELEBRATION

#### YOUR TEXT INPUT

the king questioned them, he found them ten times better than all the magicians and enchanters in his whole kingdom.

And Daniel remained there until the first year of King Cyrus.

[Edit word list](#) 516 words, of which 234 unique, 0 hidden

#### SETTINGS

Quantity:  51 words

☐ Hide common words in English

☐ Remove all numbers

☐ Convert text to lowercase

#### TYPOGRAPHY

Space between words:  10 %

Nunito

**B**

*I*

#### COLOR SCHEME



Corporate



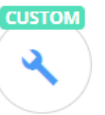
Amethyst



Industry

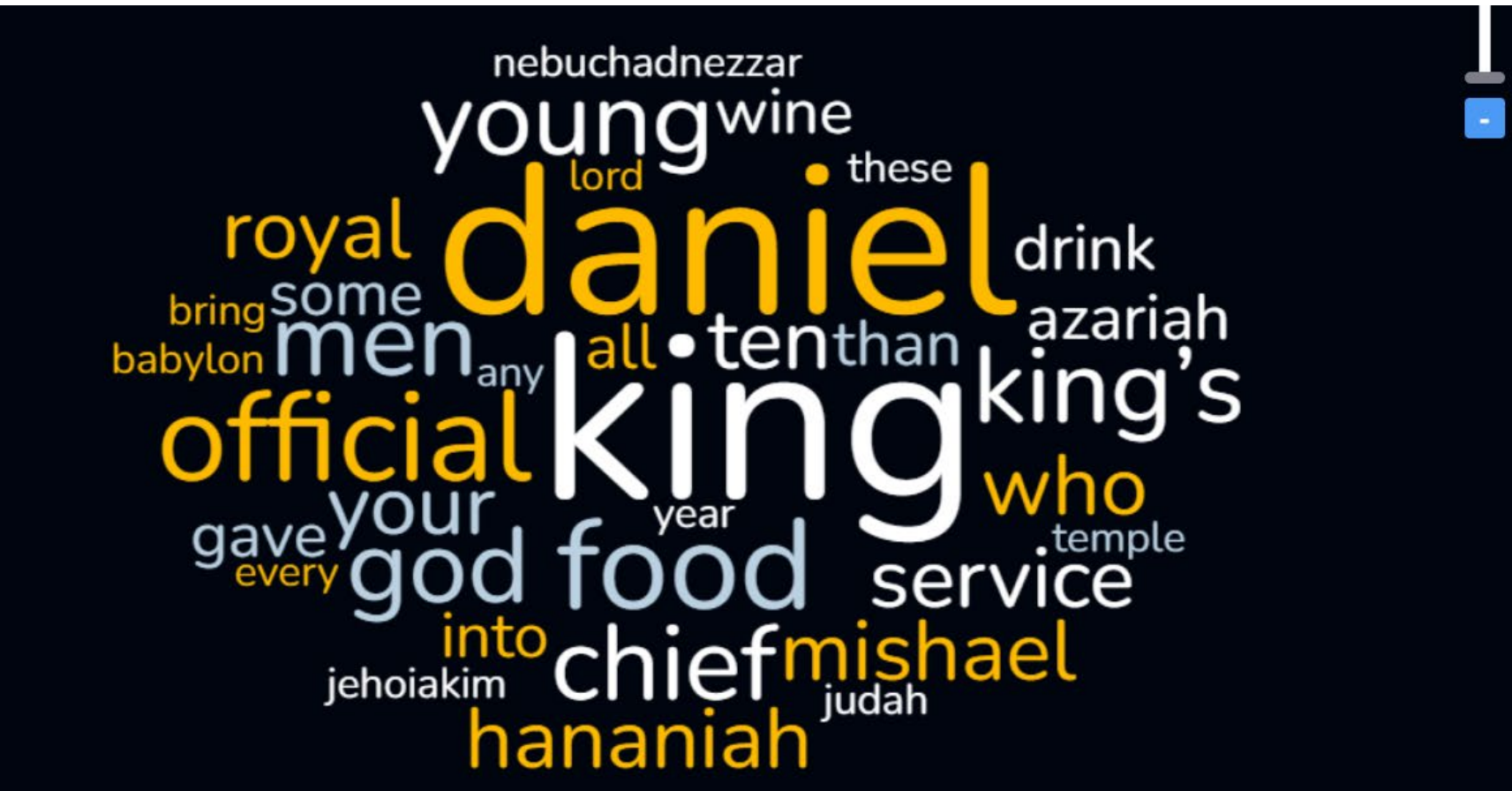


Beach



Edit colors & transparency

and Daniel  
of the to  
king were  
service men who  
Mishael  
Nebuchadnezzar  
every  
chief  
king's  
Then bring  
god  
And into God  
ten in for  
drink  
gave  
The  
official  
Hananiah  
Jehoiakim  
with young  
they  
Azariah  
some  
Judah  
any  
Babylon  
from your  
food  
he  
his  
all  
than  
In  
year  
wine  
temple



[Edit word list](#) 516 words, of which 221 unique, 45 hidden

**SETTINGS**

Quantity:  51 words

☒ Hide common words in English ▾

☒ Remove all numbers

☒ Convert text to lowercase ▾

**TYPOGRAPHY**

Space between words:  10 %

Nunito ▾ **B** *I*

**COLOR SCHEME**



**Andrew Volk** AUTHOR | TEACHER | DESIGNER

Created Oct 2 2:07pm | Posted Oct 2 2:07pm

## Bible Chapter Word Clouds

Step 1: Pick a random bible chapter with:

<https://randombibleizer.spiffy.tech/>

Step 2: Make a word cloud with:

<https://www.simplewordcloud.com/>

Step 3: Clean up word cloud removing numbers, common words and adjusting visually.

Step 4: Download the word cloud you created.

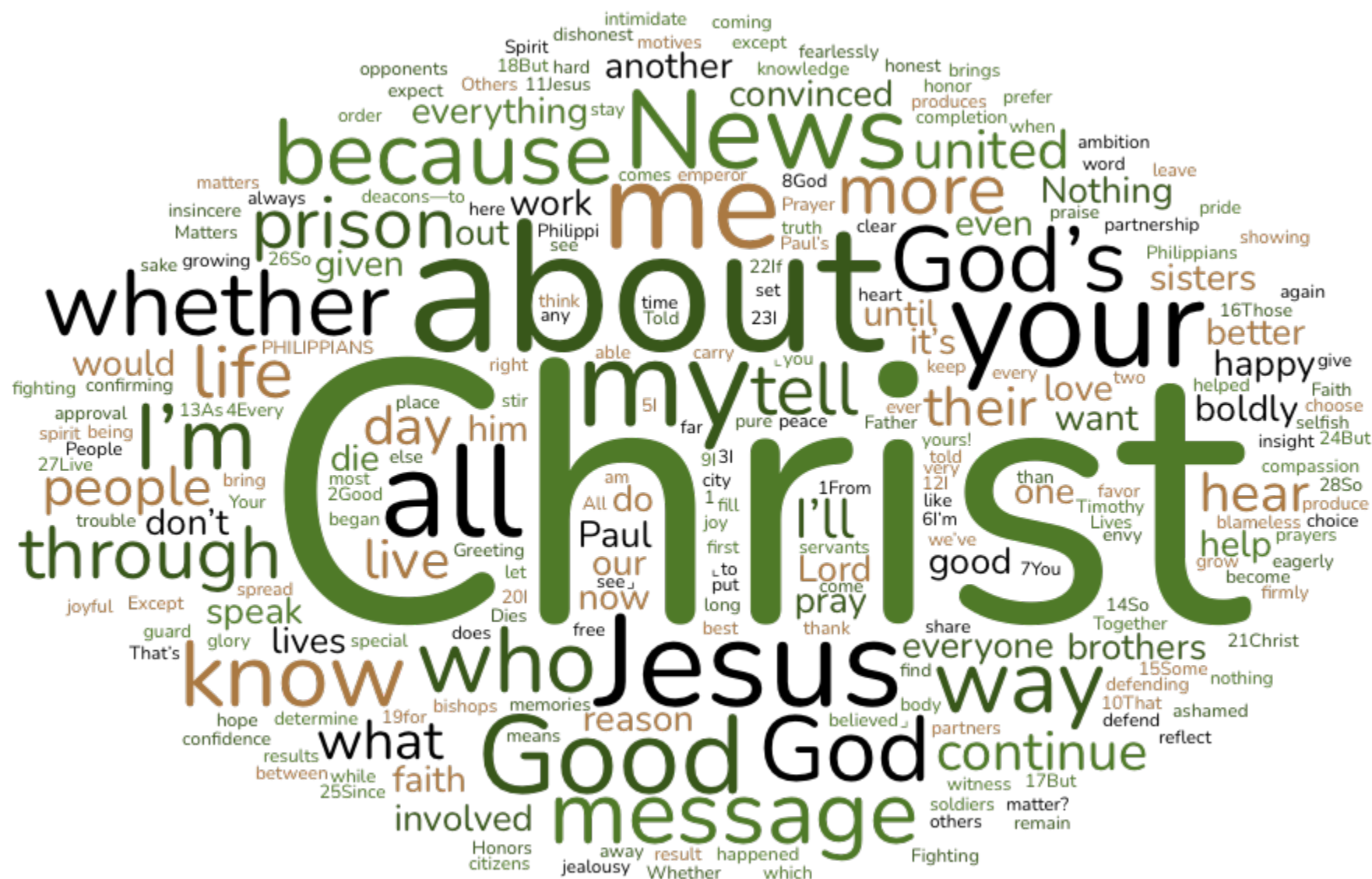
Step 5: Post a word cloud with the name of the book and chapter number as a title.

**Start a Thread**

yourselves  
each  
peace  
forgive  
who  
their  
hearts  
life  
now  
god  
another  
him  
obey  
set  
right  
self  
earthly  
these  
one  
things  
which  
through  
masters  
put  
raised  
seated  
other  
also  
love  
where

olive back  
grain gave won't naked  
make lovers longer  
wine after my into day prostitute  
husband your call like people  
why new me wife lord when  
oil"  
love did  
who







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239097

to join this course

Text **8084** to

(315) 636-0905

to answer via SMS

# HW 7 AND PROJECT 2

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Progress Report

# If not now, when?

- Like specifically...
- But where?
- What will stop me?