MATH 1700

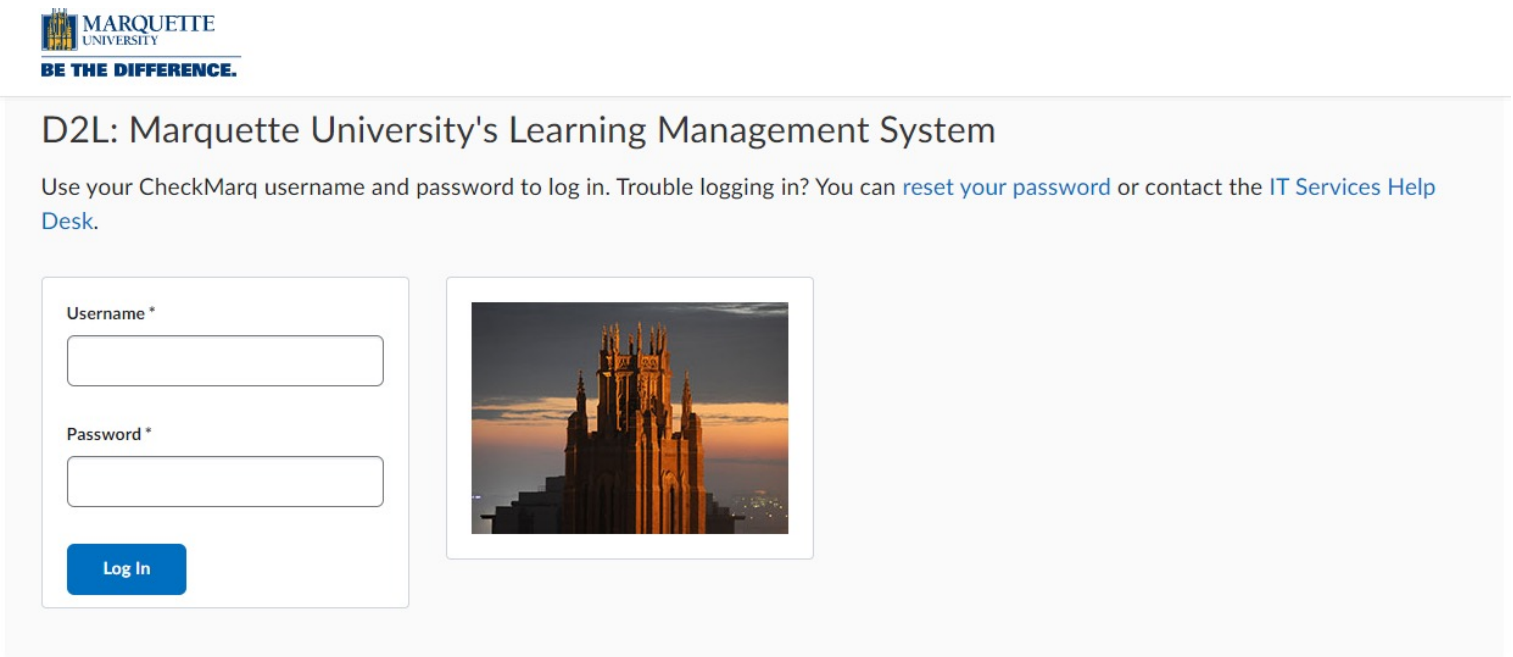
Instructor: Mehdi Maadooliat

Modern Elementary Statistics

Department of Mathematical and Statistical Sciences

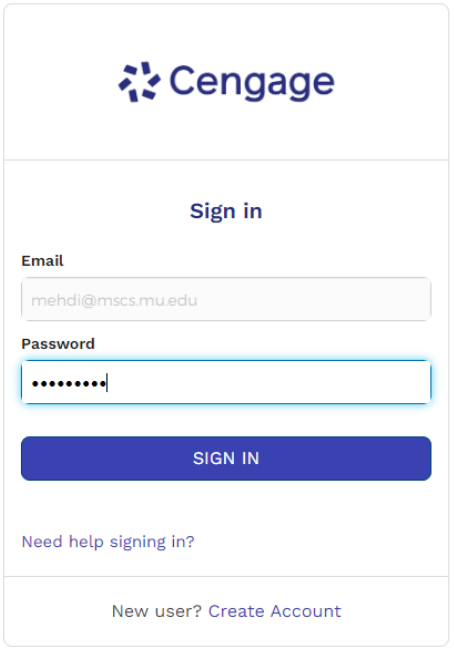
SYLLABUS - D2L - ONLINE MATERIALS

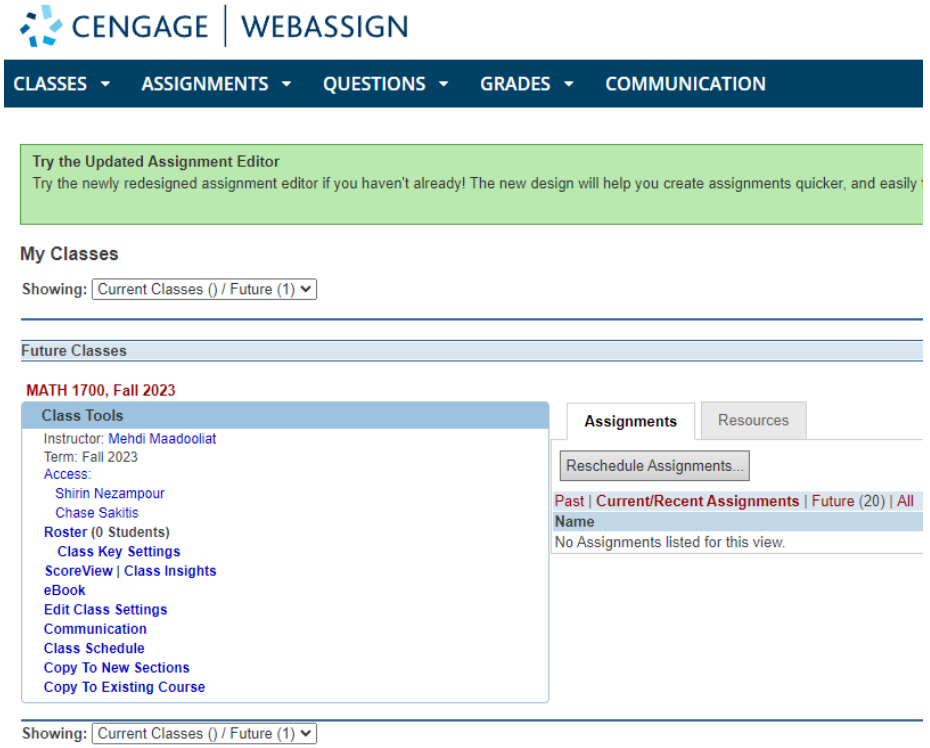
- **Syllabus**
- **Go to http://d2l.mu.edu**
- **Enter your account info and click on Log in!**



HOMEWORK - WEBASSIGN

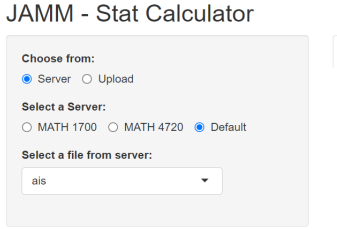
- **Online HW will be assigned and graded through WebAssign.**
- **URL: https://www.webassign.net/wa-auth/login**
- **WebAssign class key:** **marquette 1594 2988**

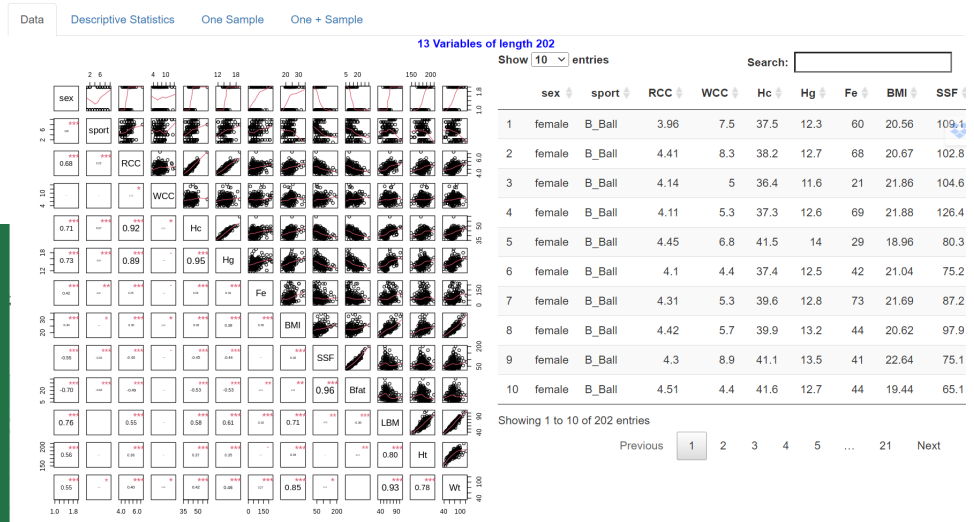




ANALYZING DATA

- Microsoft Excel is a statistical software package that we mostly use in this course.
- You can access Microsoft Excel for from open access labs.





- **Trial use** – Shiny App: JAMM – Statistics Calculator http://sctc.mscs.mu.edu/JAMM.htm

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- **Description: Fundamental theory and methods of statistics without calculus. Descriptive statistics, elements of probability theory, estimation, tests of hypotheses, regression, correlation, introduction to computer methods of statistical tabulation and analysis. This course is recommended for students seeking a general introduction to statistical concepts and is not intended to be a final course in statistics for students who need a thorough working knowledge of statistical methods.**

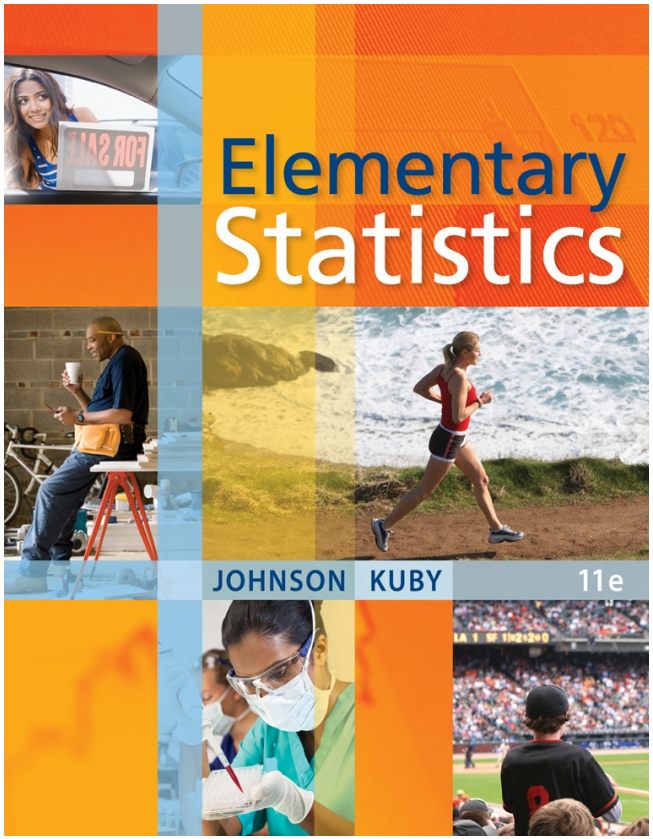
- **Prereq: MATH 105 or equivalent. Equivalent is two years of college preparatory mathematics. May not be taken for credit by students who have received college credit for another probability or statistics course.**

MATH1700 CONT...

- **Text: Elementary Statistics (ISBN: 0538733500) Johnson and Kuby, 11th ed (available via Webassign)**

- **Calculators: You will need some sort of scientific calculator for the course. Will use during exams.**

- **Homework: Homework assignments will be given and graded in Webassign (15% of the Grade).**



MATH 1700 CONT...

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- **Grading: 2 exams throughout the semester during the lecture time, plus the final exam.**
  No make-ups, If "unavoidable absence" as defined in Arts and Sci. Undergrad Bulletin, then % added to final %.
  - **Midterm Exams 50% (25% each), Final Exam 30%**
    Attendance 5%, Homework 15%

- **Grade Scale:**
  - $93.5 \leq x \leq 100$: **(A)** $90 \leq x < 93.5$: **(A-)** $86.5 <= x < 90$: **(B+)**
  - $83.5 \leq x \leq 86.5$: **(B)** $80 \leq x < 83.5$: **(B-)** $76.5 <= x < 90$: **(C+)**
  - $73.5 \leq x \leq 76.5$: **(C)** $70 \leq x < 73.5$: **(C-)** $66.5 <= x < 90$: **(D+)**
  - $60.0 \leq x \leq 66.5$: **(D)** **below** 60.00 : **(F)**

- **Drop Date: Last day without a W 9/5/2023, with a W 11/17/2023**

MATH 1700 CONT…

- **Exams Dates:**
  - Thursday Sep. 28th, and Thursday Oct. 26th.
  - Final Exam: Monday Dec. 11th, 10:30 am – 12:30 pm.

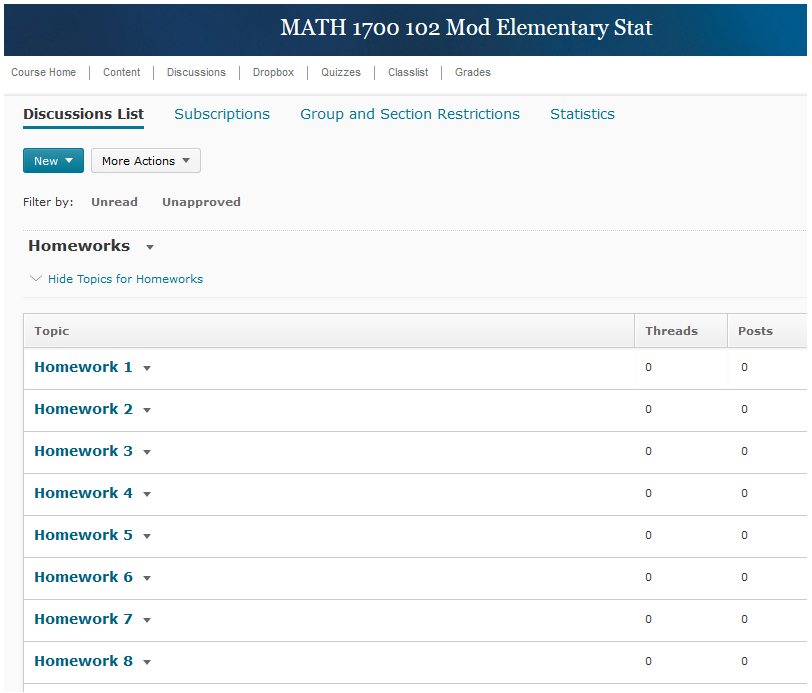
- **TA: Shirin Nezampour**
  - Office Hours: Check Statistics Help Desk (4th floor Cudahy)
  - SN Hours: M 3:00-6:00pm, Tu 2:15-3:15pm, Th 2:15-3:15pm
    W: 3:00-6:00pm (Teams)
  - Email: shirin.nezampour@marquette.edu

- **Instructor: Mehdi Maadooliat, Ph.D.**
  - Office Hours: T 11:00 - 12:15pm (Cudahy Hall Room 369)
    - Th 11:00 - 12:15pm (Statistics Help Desk)
  - Office: Cudahy Hall 369
  - Email: mehdi.maadooliat@marquette.edu

MATH 1700 CONT…

- **Any General questions about Homework, Project and Exams:**
  - **SHOULD** be posted in d2l Discussion Board.
  - TA and I will **NOT** answer general emails about Homework and Exams.

- **Other VALUBLE Resources:**
  - Statistics Help Desk
  - Review Sessions
  - Tutoring Sessions



STATISTICS HELP DESK AND REVIEW SESSIONS

Statistics Help Desk

- **Hours:**
  https://tinyurl.com/statHD
  4th floor of Cudahy Hall

Review Sessions

- **Run by Student Success Coordinator: Chase, Sakitis**
- **Thursdays 6:30-8:30pm**

MATH 1700

Instructor: Mehdi Maadooliat

Algebra Review

Department of Mathematical and Statistical Sciences

ALGEBRA REVIEW

- 1. Summation Notation
- 2. Factorials
- 3. Computations
- 4. Simple Linear Equations

From Dr. Rowe Lecture notes

1. SUMMATION NOTATION

We use symbols to indicate general math operations
Let $x_1, x_2, \ldots, x_n$ and $y_1, y_2, \ldots, y_n$ be two sets of numbers.

The following notation will be used in course:

$$\sum_{i=1}^{n} x_i = x_1 + x_2 + \ldots + x_n$$

$$\left(\sum_{i=1}^{n} x_i \right)^2 = \left(x_1 + x_2 + \ldots + x_n \right)^2$$

$$\sum_{i=1}^{n} x_i^2 = x_1^2 + x_2^2 + \ldots + x_n^2$$

$$\sum_{i=1}^{n} x_i y_i = x_1 y_1 + x_2 y_2 + \ldots + x_n y_n$$

Examples to follow:

1. SUMMATION NOTATION (EXAMPLE)

Example: $x_1, x_2, \ldots, x_n$

Given numbers: 2,1,3.

We have three numbers
$n=3$

We associate each number with an x as:
$x_1=2,\ x_2=1,\ x_3=3$

1. SUMMATION NOTATION (EXAMPLE)

$n=3$

$x_1=2,\ x_2=1,\ x_3=3$

When we write

$$\sum_{i=1}^{3} x_i = x_1 + x_2 + x_3$$

What we mean is

$$\sum_{i=1}^{3} x_i = 2+1+3 = 6$$

$n=3$

$x_1=2,\ x_2=1,\ x_3=3$

When we write

$$\sum_{i=1}^{3} x_i^2 = x_1^2 + x_2^2 + x_3^2$$

What we mean is

$$\sum_{i=1}^{3} x_i^2 = 2^2 + 1^2 + 3^2 = 14$$

1. SUMMATION NOTATION (EXAMPLE)

$n=3$

$x_1=2,\ x_2=1,\ x_3=3$

When we write

$$\left(\sum_{i=1}^{3} x_i\right)^2 = \left(x_1 + x_2 + x_3\right)^2$$

What we mean is

$$\left(\sum_{i=1}^{3} x_i\right)^2 = \left(2+1+3\right)^2 = 36$$

$n=3$

$x_1=2,\ x_2=1,\ x_3=3$ and $y_1=1,\ y_2=2,\ y_3=3$

When we write

$$\sum_{i=1}^{3} x_i\, y_i = x_1 y_1 + x_2 y_2 + x_3 y_3$$

What we mean is

$$\sum_{i=1}^{3} x_i\, y_i = 2\times 1 + 1\times 2 + 3\times 3 = 13$$

2. FACTORIALS

- **A factorial is a multiplication process.**

- **n factorial is written symbolically as $n!$**
- **and means $n! = n \times (n-1) \times (n-2) \times \cdots \times 2 \times 1$**

- **Example:**
- $3! = 3 \times 2 \times 1 = 6$

- **Your turn!**
- $5! = ?$

3. COMPUTATIONS

- **Suppose** $x = 20, y = 14, s = 16, w = -2, m = 15, n = 10$.
- **Compute** $x + 2y - 4w$
- **Compute** $x + 6w - 4s$
- **Compute** $x + y\frac{\sqrt{s}}{n}$
- **Compute** $\sqrt{\frac{1}{n} + \frac{1}{m}}$

4. SIMPLE LINEAR EQUATIONS

- **Find x for:**
- $1 - x = 0.23$

- **Find x for:**
- $2 - 2x = 3x + 3$

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Chapter 1

Department of Mathematical and Statistical Sciences

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CHAPTER 1

- What is Statistics?
- Data Description
- Populations and Samples
- Parameter and Statistic
- Numerical vs. Categorical Data
- Sampling Techniques

1.1 What Is Statistics?

STATISTICS IS ALL AROUND US!

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1. **Weather Forecasts**
   - Do you watch the weather forecast sometime during the day? How do you use that information? Have you ever heard the forecaster talk about weather models? These computer models are built using statistics that compare prior weather conditions with current weather to predict future weather.
2. **Emergency Preparedness**
   - What happens if the forecast indicates that a hurricane is imminent or that tornadoes are likely to occur? Emergency management agencies move into high gear to be ready to rescue people. Emergency teams rely on statistics to tell them when danger may occur.
3. **Medical Studies**
   - Scientists must show a statistically valid rate of effectiveness before any drug can be prescribed. Statistics are behind every medical study you hear about.

Refference: 10 Everyday Reasons Why Statistics Are Important

STATISTICS IS ALL AROUND US! CONT...

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4. Predicting Disease

- Lots of times on the news reports, statistics about a disease are reported. If the reporter simply reports the number of people who either have the disease or who have died from it, it's an interesting fact but it might not mean much to your life. But when statistics become involved, you have a better idea of how that disease may affect you.
- For example, studies have shown that 85 to 95 percent of lung cancers are smoking related. The statistic should tell you that almost all lung cancers are related to smoking and that if you want to have a good chance of avoiding lung cancer, you shouldn't smoke.

5. Genetics

- Many people are afflicted with diseases that come from their genetic make-up and these diseases can potentially be passed on to their children. Statistics are critical in determining the chances of a new baby being affected by the disease.

Refference: 10 Everyday Reasons Why Statistics Are Important

STATISTICS IS ALL AROUND US! CONT...

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6. Political Campaigns

- Whenever there's an election, the news organizations consult their models when they try to predict who the winner is. Candidates consult voter polls to determine where and how they campaign. Statistics play a part in who your elected government officials will be

7. Insurance

- You know that in order to drive your car you are required by law to have car insurance. If you have a mortgage on your house, you must have it insured as well. The rate that an insurance company charges you is based upon statistics from all drivers or homeowners in your area.

8. Stock Market

- Another topic that you hear a lot about in the news is the stock market. Stock analysts also use statistical computer models to forecast what is happening in the economy.

Refference: 10 Everyday Reasons Why Statistics Are Important

STATISTICS IS ALL AROUND US! CONT...

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9. Consumer Goods

- Wal-Mart, a worldwide leading retailer, keeps track of everything they sell and use statistics to calculate what to ship to each store and when. From analyzing their vast store of information, for example, Wal-Mart decided that people buy strawberry Pop Tarts when a hurricane is predicted in Florida! So they ship this product to Florida stores based upon the weather forecast.

10. Quality Testing

- Companies make thousands of products every day and each company must make sure that a good quality item is sold. But a company can't test each and every item that they ship to you, the consumer. So the company uses statistics to test just a few, called a sample, of what they make. If the sample passes quality tests, then the company assumes that all the items made in the group, called a batch, are good.

Refference: 10 Everyday Reasons Why Statistics Are Important

WHAT IS STATISTICS?

Many Teens Use Phones in Class

84% teens have cell phones

16% teens do not

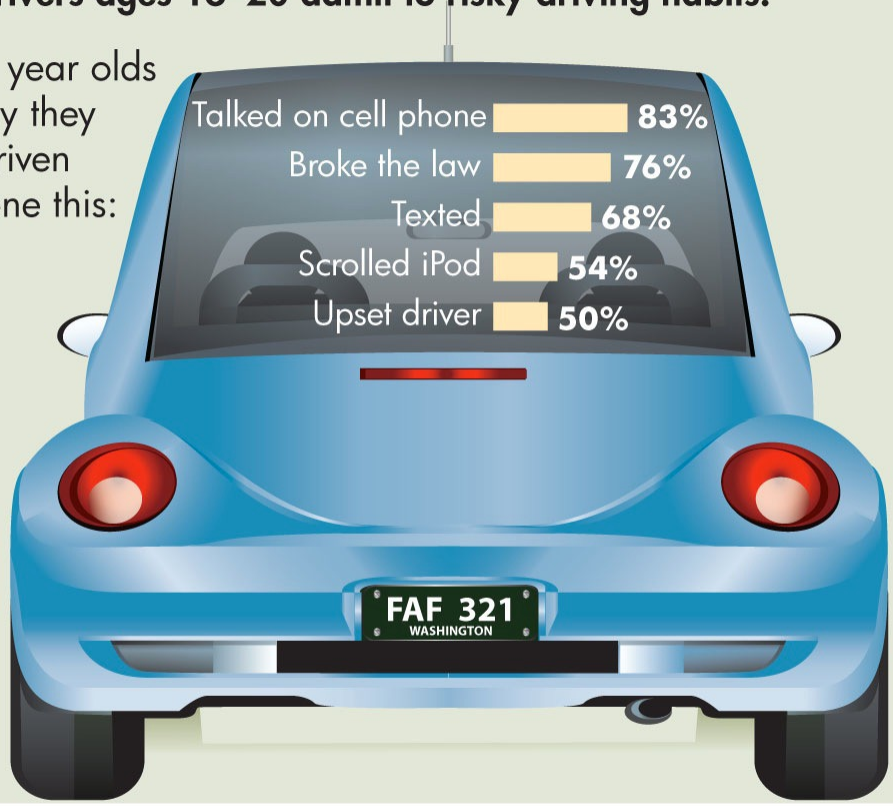
An average of 440 text messages sent per week –110 of them during class. Works out to be 3 text messages per class period.

Source:
Common Sense Media survey of 1013 teens May/June 2009

Busy Behind the Wheel

Most drivers ages 16–20 admit to risky driving habits.

16–20 year olds who say they have driven and done this:



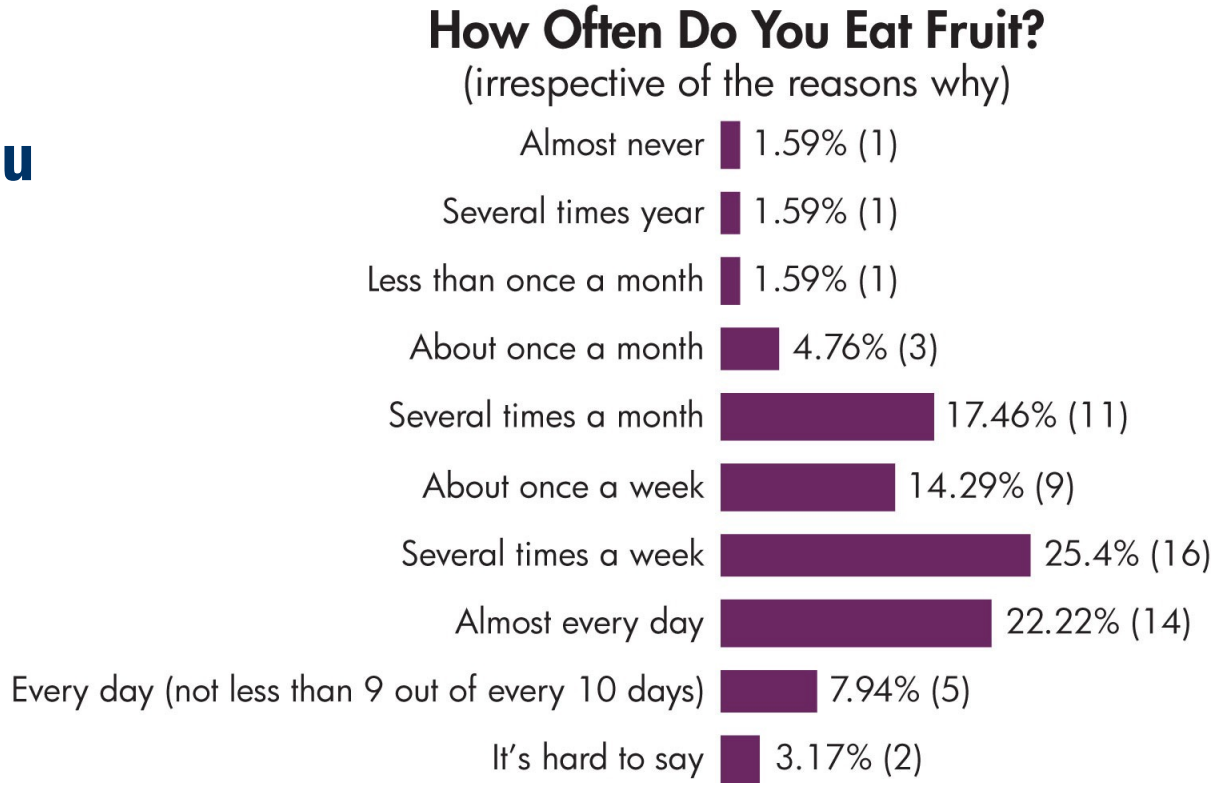
Source: National Organization for Youth Safety, Allstate Foundation online survey of 605 drivers ages 16–20. (6/16/09)

WHAT IS STATISTICS?

- **Statistics is all around us!**

Postyour.info is a worldwide service where Internet users from arround the world can take part in questionnaires. [http://postyour.info/] Below is a graph depicting the combined summary of how users answered one of the posted questions. Results given in Percent (count).

- **How often do you eat fruit?**



WHAT IS STATISTICS?

- **Statistics has become the universal language of the sciences. As potential users of statistics, we need to master both the "science" and the "art" of using statistical methodology correctly.**

- **Careful use of statistical methods will enable us to obtain accurate information from data. These methods include**
  - **(1) carefully defining the situation,**
  - **(2) gathering data,**
  - **(3) accurately summarizing the data, and**
  - **(4) deriving and communicating meaningful conclusions.**

WHAT IS STATISTICS?

- The field of statistics can be divided into two main branches.

- Descriptive statistics is what most people think of when they hear the word *statistics*. It includes the collection, presentation, and description of sample data.

- The term inferential statistics refers to the technique of interpreting the values resulting from the descriptive techniques and making decisions and drawing conclusions about the population.

WHAT IS STATISTICS?

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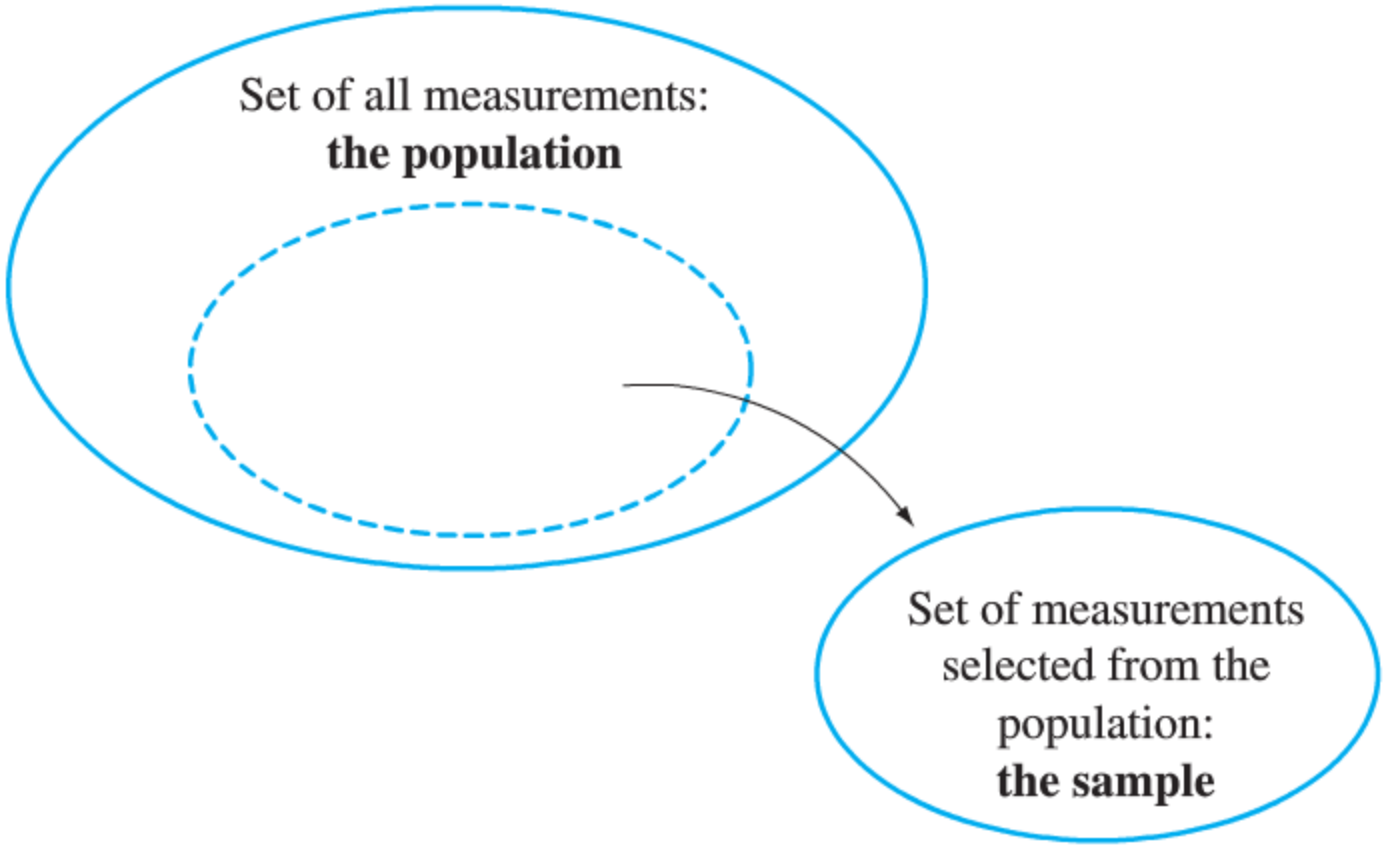
- **Statistics** The science of collecting, describing, and interpreting data.
- **Population** A collection, or set, of individuals, objects, or events whose properties are to be analyzed.
  - The set of "all students who have ever attended a U.S. college" is an example of a well-defined population.
- **Sample** A subset of a population.
- **Variable** A characteristic of interest about each individual element of a population or sample.
  - A student's age at entrance into college, the color of the student's hair, the student's height, and the student's weight are four variables.
- **Data value** The value of the variable associated with one element of a population or sample. This value may be a number, a word, or a symbol.

POPULATION VS. SAMPLE

- **Population**: The entire group of interest
- **Sample**: A part of the population selected to draw conclusions about the entire population



WHAT IS STATISTICS?

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- **Data** The set of values collected from the variable from each of the elements that belong to the sample.
  - The set of 25 heights collected from 25 students is an example of a set of data.
- **Experiment** A planned activity whose results yield a set of data.
  - An experiment includes the activities for both selecting the elements and obtaining the data values.
- **Parameter** A numerical value summarizing all the data of an entire population.
  - A parameter is a value that describes the entire population. Often a Greek letter is used to symbolize the name of a parameter.
- **Statistic** A numerical value summarizing the sample data.
  - Often letters of the English alphabet is used to symbolize the name of a statistic.

WHAT IS STATISTICS?

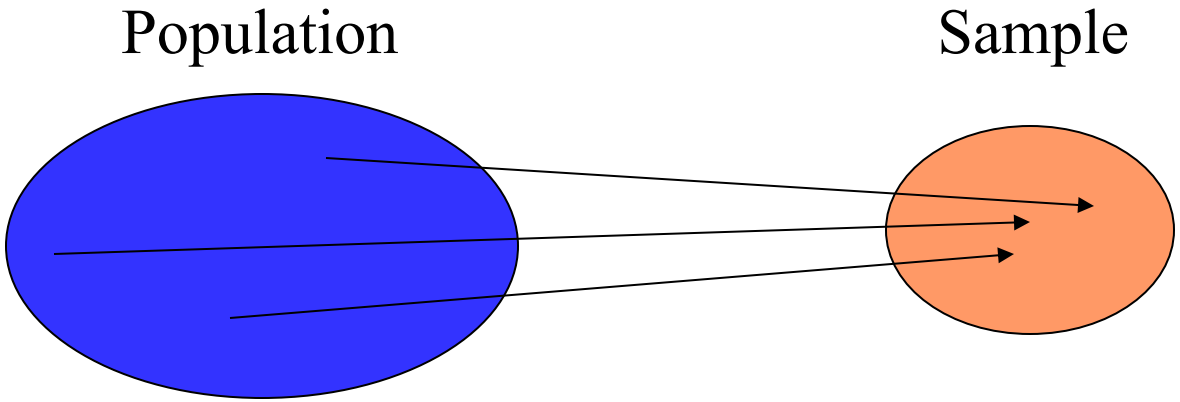
- **Describing a Population**
  - It is common practice to use Greek letters when talking about a population.
  - We call the mean of a population μ.
  - We call the standard deviation of a population σ and the variance σ^2.
  - It is important to know that for a given population there is only one true mean and one true standard deviation and variance or one true proportion.
  - There is a special name for these values: parameters.

WHAT IS STATISTICS?

- **Describing a Sample**
  - We call the mean of a sample $\overline{x}$.
  - We call the standard deviation of a sample s and the variance s^2.
  - There are many different possible samples that could be taken from a given population. For each sample there may be a different mean, standard deviation, variance, or proportion.
  - There is a special name for these values: statistics.

POPULATION VS SAMPLE

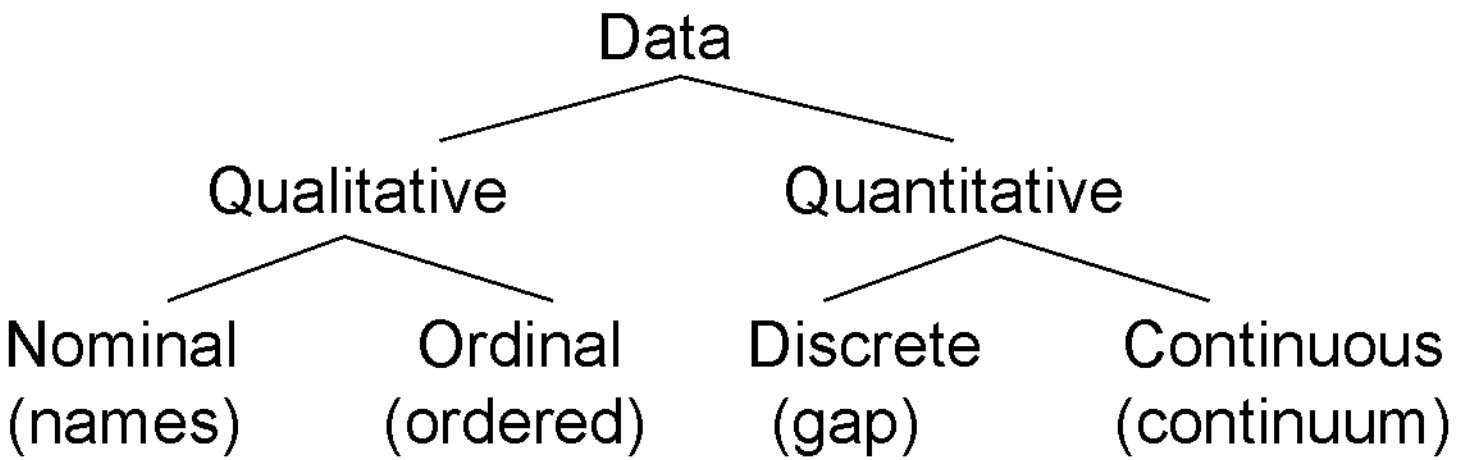
- **We use sample statistics to make inference about population parameters**



Mean:	μ	$\bar{x}$
Standard Deviation:	σ	s

WHAT IS STATISTICS?

- **Data** **The set of values collected from the variable from each of the elements that belong to the sample.**



WHAT IS STATISTICS?

- **Qualitative (Categorical) variable: A variable that describes or categorizes an element of a population.**
  - **Nominal variable: A qualitative variable that characterizes an element of a population. No ordering. No arithmetic.**
  - **Ordinal variable: A qualitative variable that incorporates an ordered position, or ranking.**

- **Quantitative (Numerical) variable: A variable that quantifies an element of a population.**
  - **Discrete variable: A quantitative variable that can assume a countable number of values. Gap between successive values.**
  - **Continuous variable: A quantitative variable that can assume an uncountable number of values. Continuum of values.**

TYPES OF VARIABLES

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Examples:

	Numeric		Categorical	
Variable	**Discrete**	**Continuous**	**Nominal**	**Ordinal**
Weight		X		
Hours Enrolled	X			
Major			X	
Zip Code			X	

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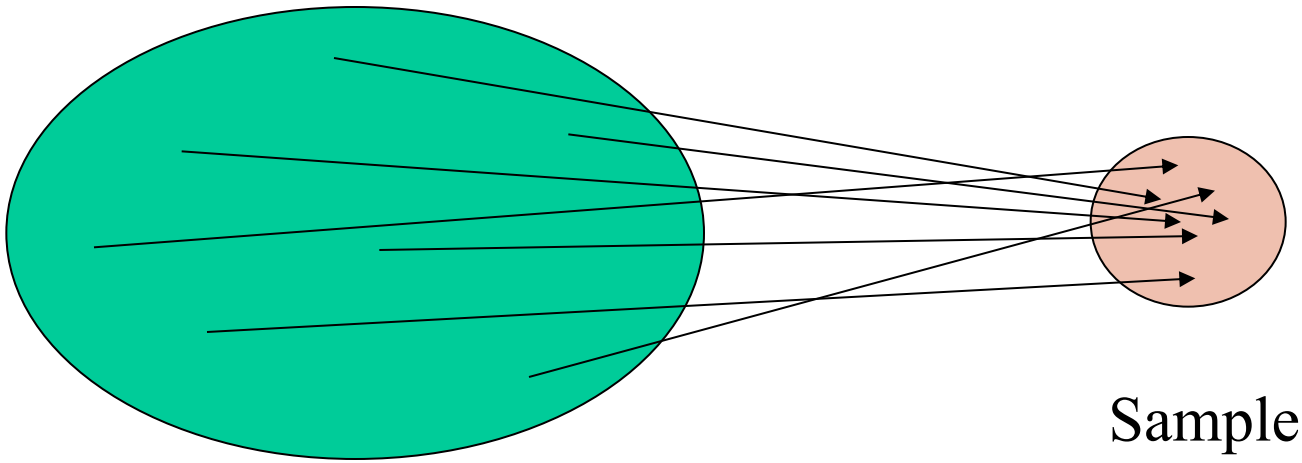
IS IT THAT EASY?

SAMPLING A SINGLE POPULATION

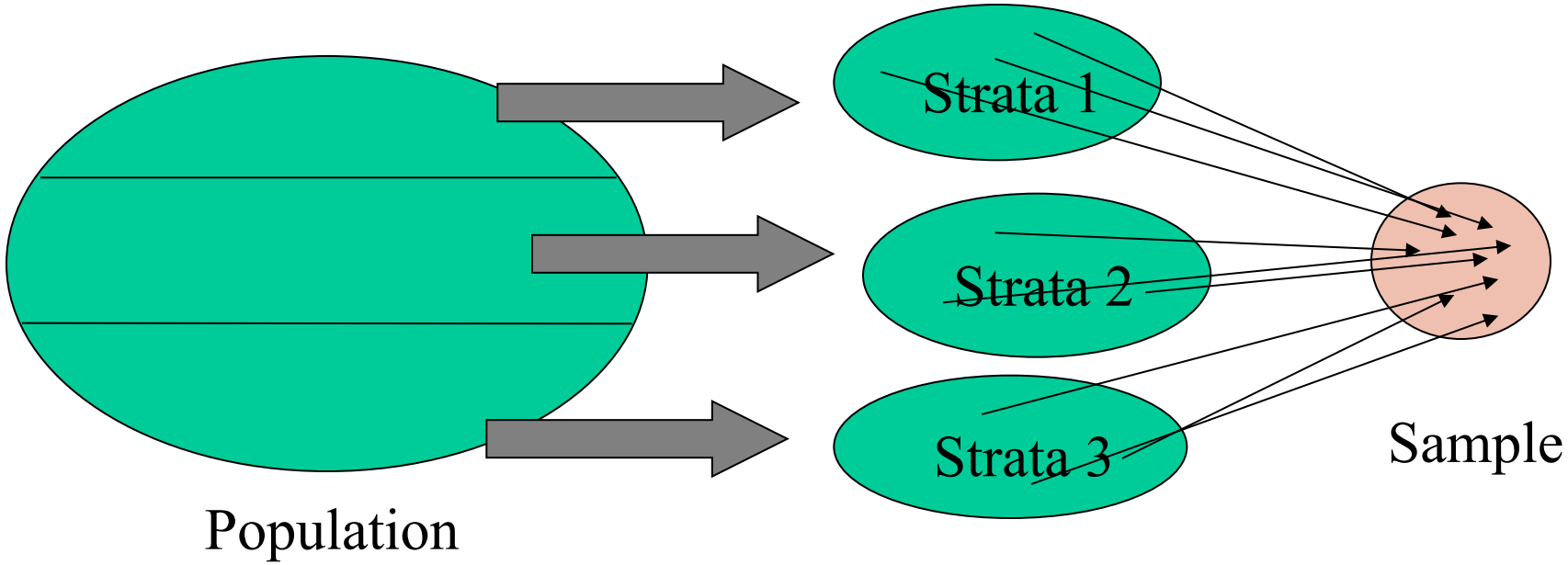
- **Sampling Techniques**
  - **Simple Random Sample (SRS): every member of the population has an equal chance of being selected.**



- **Simple Random Sample**

SAMPLING A SINGLE POPULATION

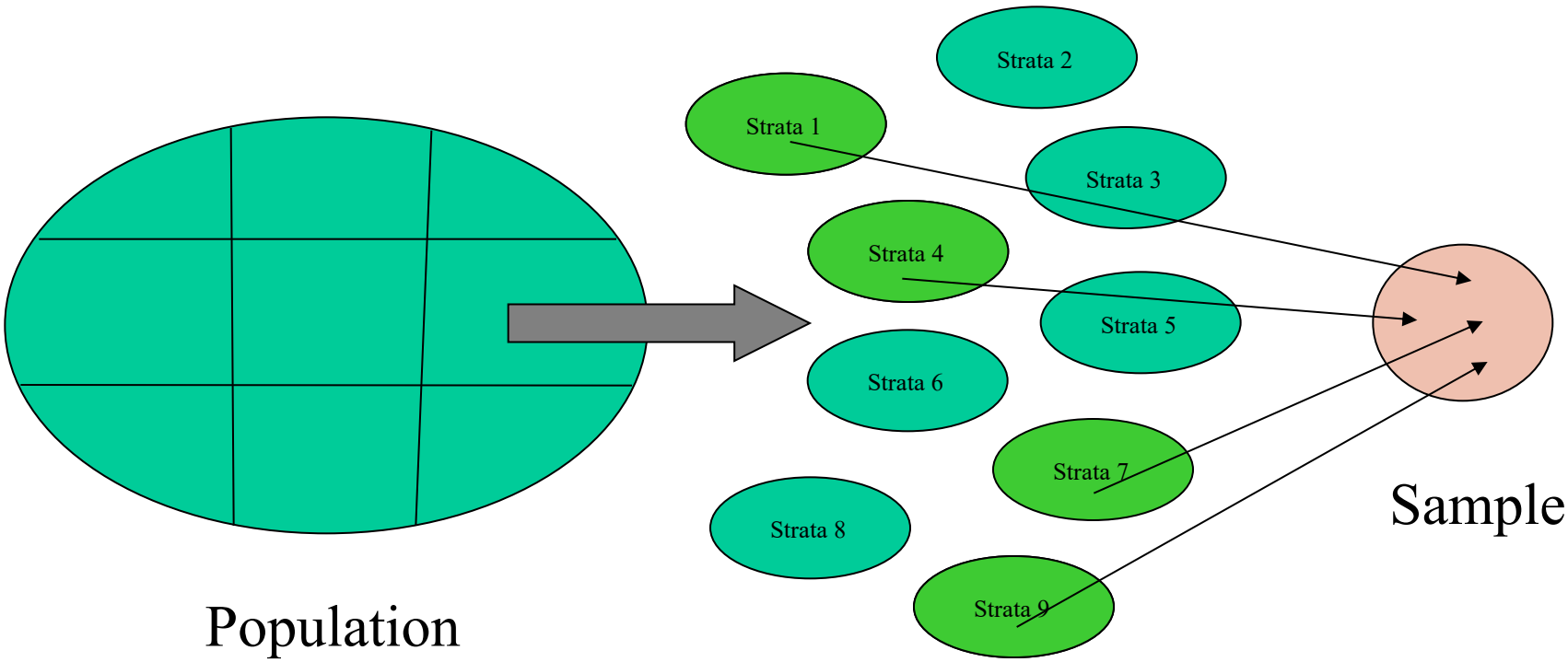
- **Sampling Techniques**
  - **Stratified Random Sample: Divide the sample into several strata. Then take a SRS from each stratum.**



- **Advantage: Each stratum is guaranteed to be randomly sampled**
- **Example: Obtain a list of all SSN for individuals in the U.S. who are over 65. Divide up the SSNs into region of the country (time zones). Then randomly sample 30 from each time zone.**

SAMPLING A SINGLE POPULATION

- **Sampling Techniques**
  - **Cluster Sample: Divide the sample into several strata or clusters. Then take a SRS of clusters.**



SAMPLING A SINGLE POPULATION

- **Sampling Techniques**
  - **Cluster Sample**
    - **Advantage: May be the only feasible method, given resources.**
    - **Example: Obtain a list of all SSNs for individuals in the U.S. who are over 65. Sort the SSNs by the last 4 digits making each set of 100 a cluster. Use a random number table to pick the clusters. You may get the 4100's, 5600's and 8200's for example.**

QUESTIONS?

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- **ANY QUESTION?**