

The Field of Statistics

- ◆ Does Vitamin C prevent colds?
- ◆ What are the properties of a survey instrument?
- ◆ Which political candidate is most likely to be elected?
- ◆ Does an early education experience affect later school performance?
- ◆ Is yawning contagious?

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What is Statistics?

- ◆ American Heritage® Dictionary: “The mathematics of the collection, organization, and interpretation of numerical data, especially the analysis of population characteristics by inference from sampling.”
- ◆ Your textbook: “Statistics is a way of reasoning, along with a collection of tools and methods, designed to help us understand the world.”

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What Do Statisticians Do?

- ◆ Study the safety of **nuclear power** plants
- ◆ Evaluate the environmental impact of **pollution**
- ◆ Determine the effectiveness of new **drugs**
- ◆ Estimate the U.S. **unemployment** rate
- ◆ Analyze **consumer demand** for products
- ◆ Plan and analyze **agricultural** experiments

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Statistics


- ◆ Statistics is about the study of variation. Our goal is to describe, quantify, explain, and/or predict variability in data.

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Outcomes for this Course

- ◆ Guidelines for Assessment and Instruction in Statistics Education (GAISE) from the American Statistical Association (ASA)
- ◆ First course in Statistics at the college level.
- ◆ Statistical Literacy


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You should believe and understand why:

- ◆ Data beat anecdotes.
- ◆ Variability is natural and is also predictable and quantifiable.
- ◆ Random *sampling* allows results of surveys and experiments to be extended to the population from which the sample was taken.
- ◆ Random *assignment* in comparative experiments allows cause and effect conclusions to be drawn.
- ◆ Association is not causation.
- ◆ Statistical significance does not necessarily imply practical importance, especially for studies with large sample sizes.
- ◆ Finding no statistically significant difference or relationship does not necessarily mean there is no difference or no relationship in the population, especially for studies with small sample sizes.


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You should recognize:

- ◆ Common sources of bias in surveys and experiments.
- ◆ How to determine the population to which the results of statistical inference can be extended, if any, based on how the data were collected.
- ◆ How to determine when a cause and effect inference can be drawn from an association, based on how the data were collected (e.g., the design of the study)
- ◆ That words such as “normal”, “random” and “correlation” have specific meanings in statistics that may differ from common usage.


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You should understand:

- ◆ How to obtain or generate data.
- ◆ How to graph the data as a first step in analyzing data, and how to know when that’s enough to answer the question of interest.
- ◆ How to interpret numerical summaries and graphical displays of data - both to answer questions and to check conditions (in order to use statistical procedures correctly).
- ◆ How to make appropriate use of statistical inference.
- ◆ How to communicate the results of a statistical analysis.


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You should understand the basic ideas of statistical inference:

- ◆ The concept of a sampling distribution and how it applies to making statistical inferences based on samples of data (including the idea of standard error)
- ◆ The concept of statistical significance including significance levels and p -values.
- ◆ The concept of confidence interval, including the interpretation of confidence level and margin of error.


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You should know:

- ◆ How to interpret statistical results in context.
- ◆ How to critique news stories and journal articles that include statistical information, including identifying what's missing in the presentation and the flaws in the studies or methods used to generate the information.
- ◆ When to call for help from a statistician.

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How can I do well in this class?

- ◆ Attend all lectures and labs.
- ◆ Complete all assignments.
- ◆ Go over all answers to assignments on webpage.
- ◆ READ and STUDY the textbook.
- ◆ Come to office hours with questions.
- ◆ Form study groups with fellow students.
- ◆ Make sure you can use a calculator and JMP.
- ◆ Make sure you can do basic algebra.

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STATISTICS \neq MATHEMATICS

- ◆ Mathematics is a tool used in statistics.
 - Similar to how physicists use mathematics.
- ◆ Mathematics and statistics are related through the study of probability.
- ◆ THIS IS NOT a mathematics course.

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