

STAT 270- Chapter 1

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Why Statistics?

Deterministic and Stochastic systems

- Deterministic systems: same set of inputs \rightarrow same output
e.g. physical systems described by differential equations
- Stochastic systems: same set of inputs \rightarrow different output
e.g. tossing a coin

Where does the randomness come from?

- Variation and uncertainty: The inputs of the system are never actually the same!

Examples of statistical practice

- Sample surveys → labor force surveys
- Engineering → what needs to be known when building or expanding a bridge?
- Physics → particle physics (signal vs noise)
- etc.

Statistical analysis

Experiment/Survey → Data → Statistical analysis ↓

- Descriptive statistics
- Inferential statistics

Usually start with descriptive statistics to

- Understand the data
- Summarize the data
 - ① numerical summaries
 - ② graphical summaries

Data:

- sample
- population

Continue with inferential statistics for **sample** data to understand the **population**.

Probability theory vs Statistical Inference

- Probability theory: Uses information about the population to answer questions about the sample
- Inferential statistics: Uses the sample to draw conclusions about the population