

INTRODUCTION



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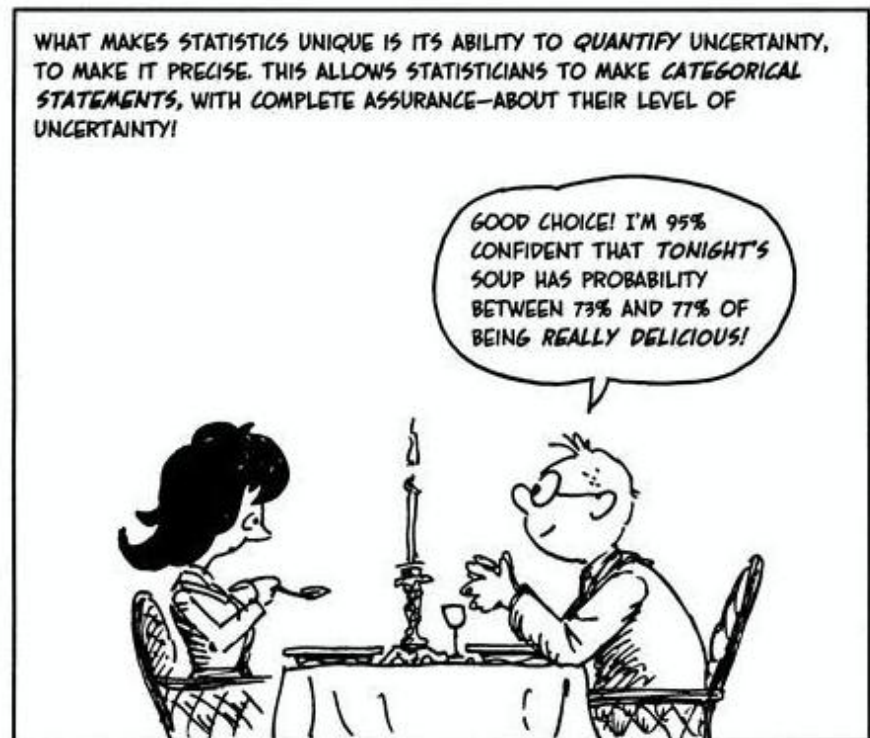
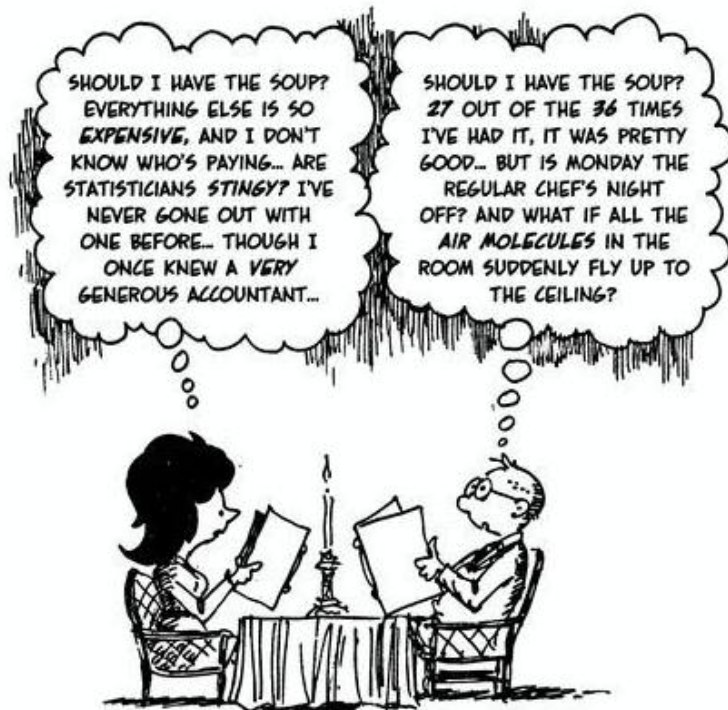
Statistic in a Word

Statistic is about variation.

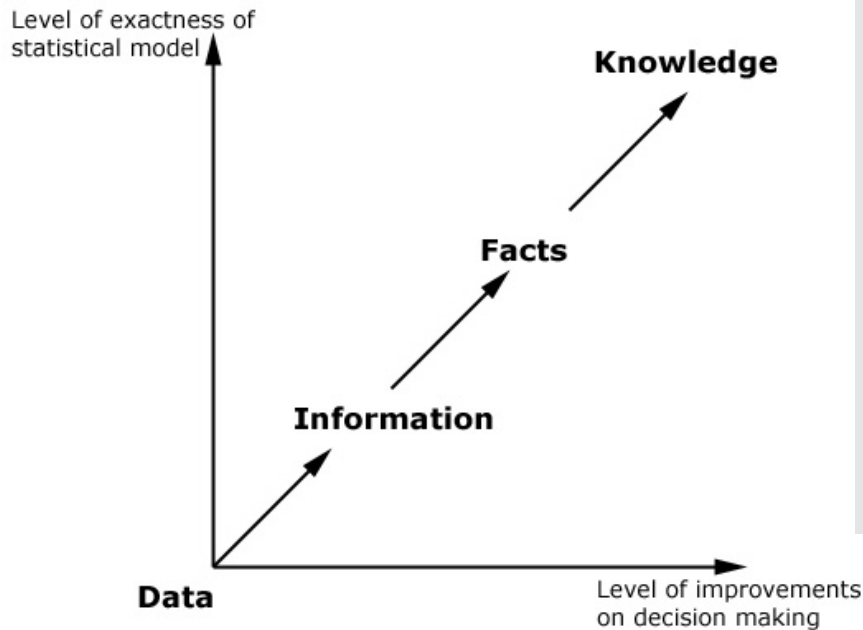
Data vary because we don't see everything and because even what we do see and measure, we measure imperfectly.

So, in a very basic way, statistics is about the real, imperfect world in which we live.

WE MUDDLE THROUGH LIFE MAKING CHOICES
BASED ON INCOMPLETE INFORMATION...



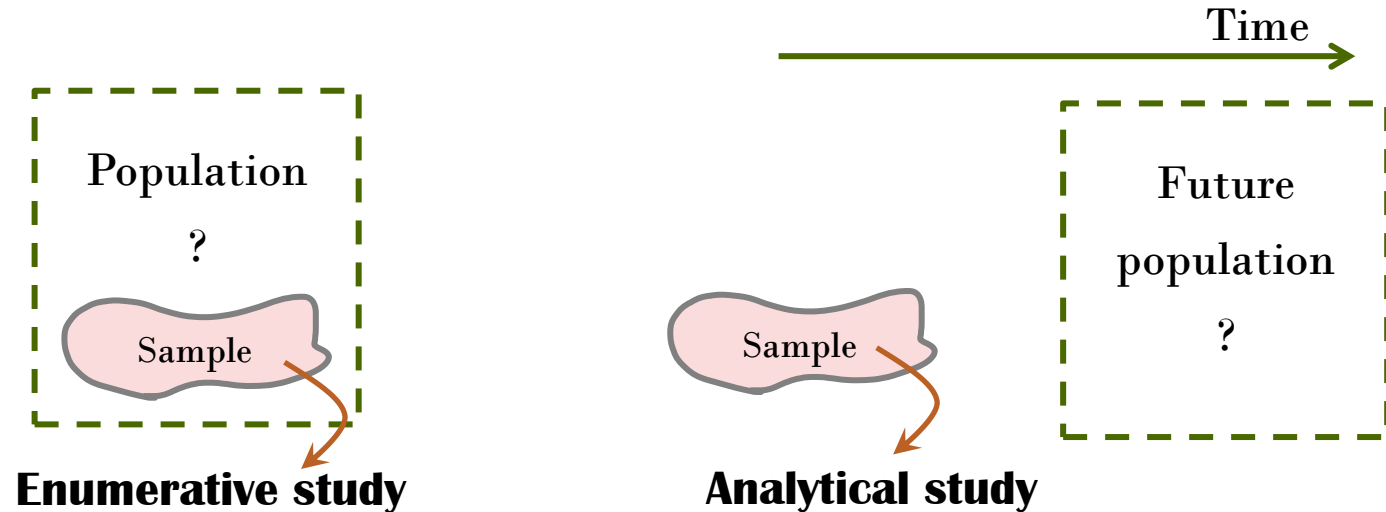
Engineering Problem-Solving Method



- ① Develop a clear description of the problem
- ② Identify the important factors
- ③ Propose or refine a model
- ④ Collect data
- ⑤ Manipulate the model
- ⑥ Confirm the solution
- ⑦ Draw conclusions and make recommendations

The field of statistics deals with the collection, presentation, analysis, and use of data to make decisions and solve problems.

Enumerative versus Analytical Study



Population

An entire group of objects that have been made or will be made, described by a characteristic of interest.

Population parameters are unknown and usually unknowable.

Sample

The group of objects actually measured in a statistical study.

A sample is usually a subset of the population of interest.

Sample statistics estimate population parameters.

What are Data?

Do data have to be numbers?

Data values are useless without their context.

The W's: WHO, WHAT and in what units, WHEN, WHERE, WHY, HOW



What are Data?

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The W's: WHO, WHAT and in what units, WHEN, WHERE, WHY, HOW.

57605	Dodge SX 2.0	Loaded/Keyless	28000	14495
58205	Dodge SX 2.0	Loaded/Keyless	19500	15495
57805	Chrysler Sebring Touring	Keyless/Trac Cont	31500	15995
58465	Chrysler Sebring Touring	Keyless/Trac Cont	32500	15995
58455	Chrysler Sebring Touring	Keyless/Trac Cont	34000	16695
58495	Chrysler Sebring Touring	Keyless/Trac Cont	22500	16695
58375	Chrysler PT Cruiser	Cruise/KeylessD	29500	17795
58475	Dodge Grand Caravan	Quads/Rear AC	52000	19895
58285	Dodge Grand Caravan	Sto&Go/Keyless	43500	21695
57965	Chrysler PT Cruiser Convertible	Touring/Loaded	7000	22195

What are Data?

Who - Individual cases about whom (or which) we record some characteristics (may be referred to as respondents, subjects, participants, experimental units, records, or cases).

What and Why - The characteristics recorded about each individual are called variables.

Stock #	Model	Description	Odometer	Price↑
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What are Data?

When a variable names categories, we call it a **catagorical variable**. (You may also see them called qualitative.) When a measured variable with units answers question about the quantity of what is measured, we call it a **quantitative variable**.

...and WHEN, WHERE, WHY, HOW?

Stock #	Model	Description	Odometer	Price↑
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Data Types

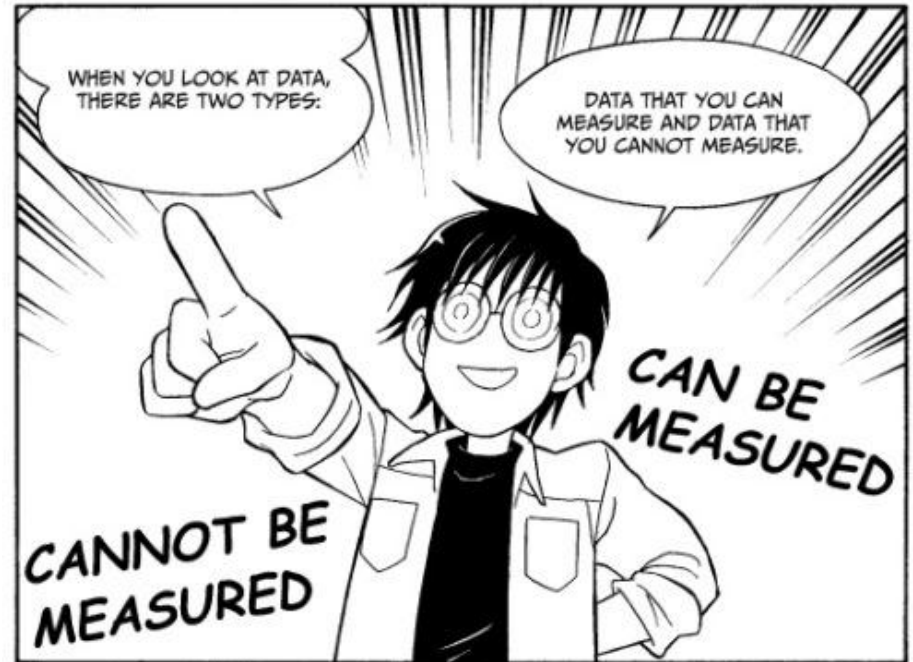
Qualitative data (or Attribute or Caragorical Data)

Discrete, proportion, and count of defects are the most common.
We can count.

Quatitative data (or Variable Data)

Continuous data
We can measure.

Note: Sometimes we treat a variable depending on what we want to learn from it.



Collecting Engineering Data

Generally, engineering data are collected in one of three ways:

- A retrospective study
- An observational study
- A designed experiment

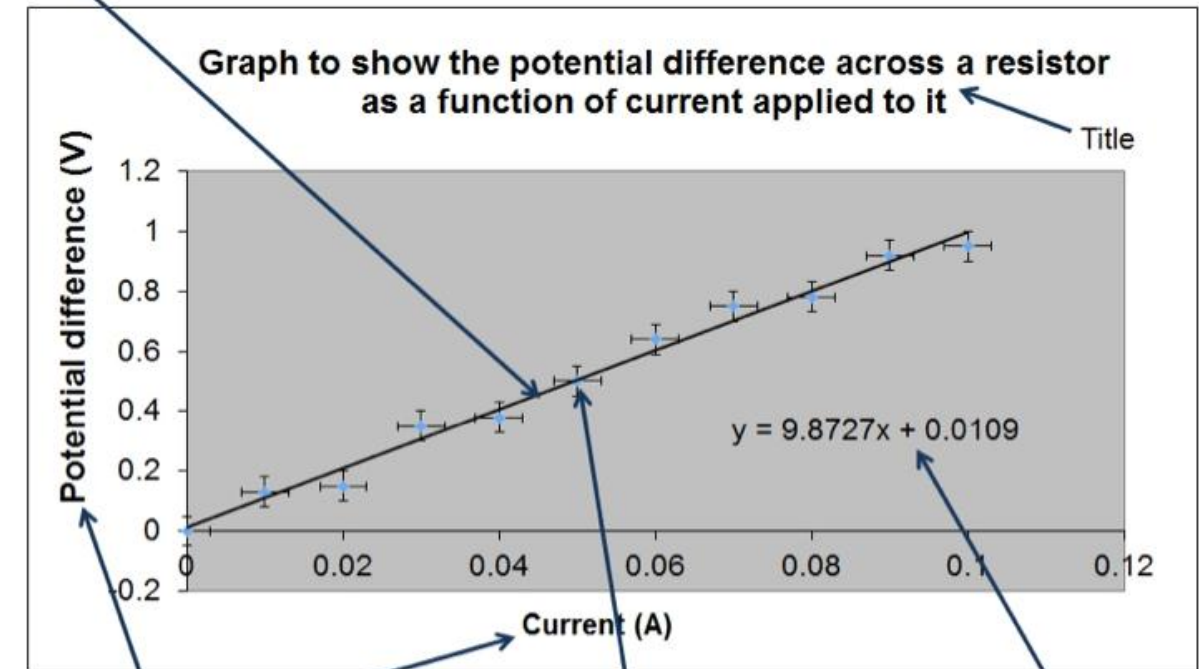
Almost all statistical analysis based on the idea of using a sample of data selected from some population, **physical and conceptual population**.

Random sampling with replication produce valid and correct results for statistical methods.



Mechanistic and Empirical Models

Appropriate trendline



Axes Labels with units

Error Bars (x and y directions)

Optional legend but make sure you write important information somewhere in you lab book

Ex. Ohm's law

$$I = V/R$$

$$I = V/R + \epsilon$$

Content

- Population and Sample
- Data Presentation
- Random Variables and Probability Distributions
- Decision Making – Hypothesis Testing
 - 1 sample
 - 2 samples
- Building Empirical Models
- (ANOVA)
- (Intro to DOE)