Chapter 1

The Nature of Probability and Statistics

Chapter 1 Overview

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Introduction

- **Statistics** is the science of conducting studies to
  - collect,
  - organize,
  - summarize,
  - analyze, and
  - draw conclusions from data.

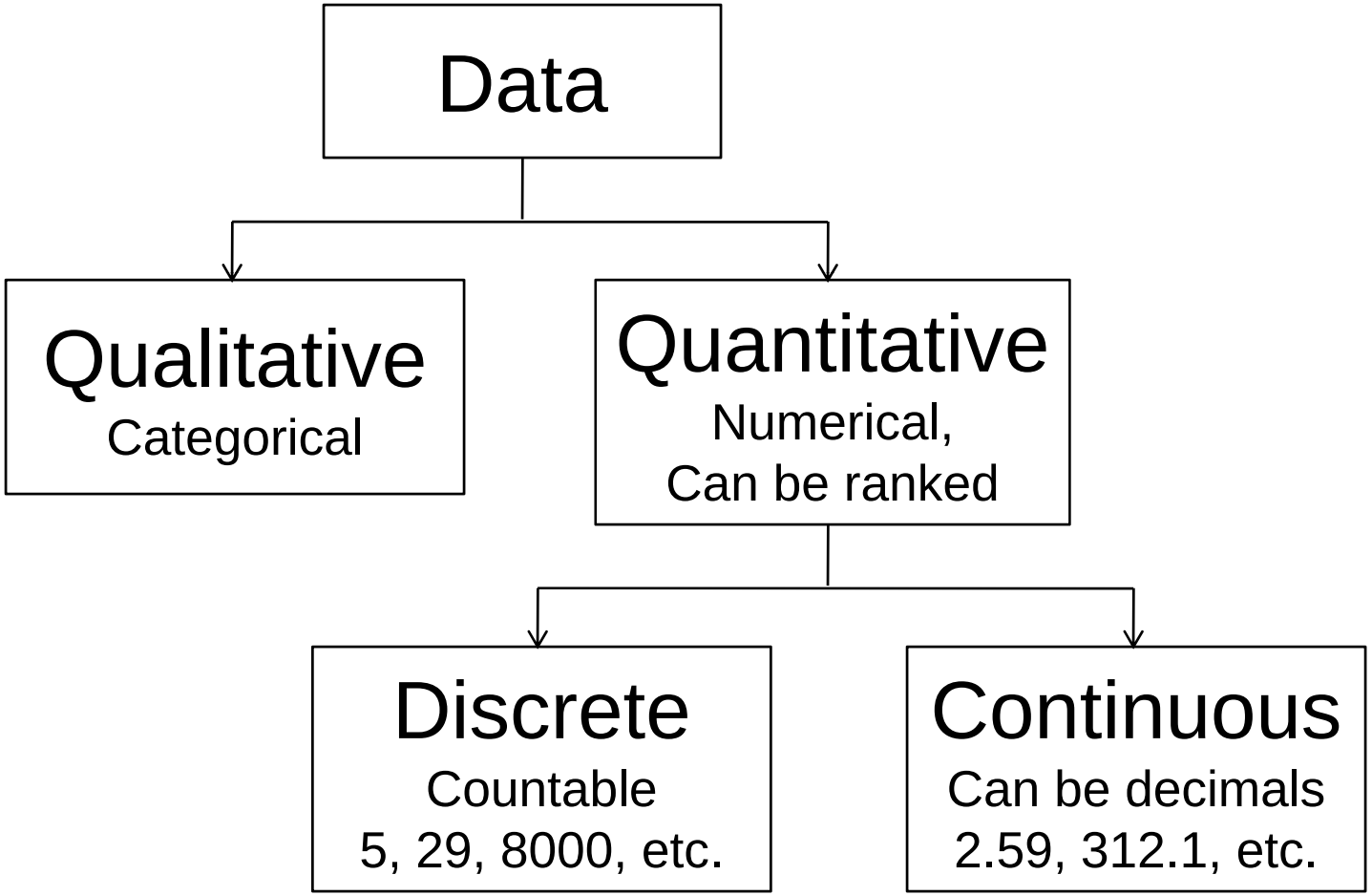
1-1 Descriptive and Inferential Statistics

- A **variable** is a characteristic or attribute that can assume different values.
- The values that a variable can assume are called **data**.
- A **population** consists of all subjects (human or otherwise) that are studied.
- A **sample** is a subset of the population.

1-1 Descriptive and Inferential Statistics

- **Descriptive statistics** consists of the collection, organization, summarization, and presentation of data.
- **Inferential statistics** consists of generalizing from samples to populations, performing estimations and hypothesis tests, determining relationships among variables, and making predictions.

1-2 Variables and Types of Data



1-2 Recorded Values and Boundaries

Variable	Recorded Value	Boundaries
Length	15 centimeters (cm)	14.5-15.5 cm
Temperature	86° Fahrenheit (°F)	85.5-86.5 °F
Time	0.43 second (sec)	0.425-0.435 sec
Mass	1.6 grams (g)	1.55-1.65 g

1-2 Variables and Types of Data

Levels of Measurement

1. **Nominal** – categorical (names)
2. **Ordinal** – nominal, plus can be ranked (order)
3. **Interval** – ordinal, plus intervals are consistent
4. **Ratio** – interval, plus ratios are consistent, true zero

1-2 Variables and Types of Data

Determine the measurement level.

Variable	Nominal	Ordinal	Interval	Ratio	Level
Hair Color	Yes	No			Nominal
Zip Code	Yes	No			Nominal
Letter Grade	Yes	Yes	No		Ordinal
ACT Score	Yes	Yes	Yes	No	Interval
Height	Yes	Yes	Yes	Yes	Ratio
Age	Yes	Yes	Yes	Yes	Ratio
Temperature (F)	Yes	Yes	Yes	No	Interval

1-3 Data Collection and Sampling Techniques

Some Sampling Techniques

- **Random** – random number generator
- **Systematic** – every k^{th} subject
- **Stratified** – divide population into “layers”
- **Cluster** – use intact groups
- **Convenient** – mall surveys

1-4 Observational and Experimental Studies

- In an **observational study**, the researcher merely observes and tries to draw conclusions based on the observations.
- The researcher manipulates the **independent (explanatory) variable** and tries to determine how the manipulation influences the **dependent (outcome) variable** in an **experimental study**.
- A **confounding variable** influences the dependent variable but cannot be separated from the independent variable.

1-5 Uses and Misuses of Statistics

- **Suspect Samples**
  - **Is the sample large enough?**
  - **How was the sample selected?**
  - **Is the sample representative of the population?**
- **Ambiguous Averages**
  - **What particular measure of average was used and why?**

1-5 Uses and Misuses of Statistics

- **Changing the Subject**
  - **Are different values used to represent the same data?**
- **Detached Statistics**
  - **One third fewer calories…….than what?**
- **Implied Connections**
  - **Studies *suggest* that *some* people *may* understand what this statement means.**

1-5 Uses and Misuses of Statistics

- **Misleading Graphs**
  - **Are the scales for the x-axis and y-axis appropriate for the data?**
- **Faulty Survey Questions**
  - **Do you feel that statistics teachers should be paid higher salaries?**
  - **Do you favor increasing tuition so that colleges can pay statistics teachers higher salaries?**

1-6 Computers and Calculators

- **Microsoft Excel**
- **Microsoft Excel with MegaStat**
- **TI-83/84**
- **Minitab**
- **SAS**
- **SPSS**