

What Are We
Summarizing?

Robb T.
Koether

Homework
Review

Introduction

Qualitative
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Quantitative
Variables

Caution

Continuous and
Discrete Variables

Assignment

What Are We Summarizing?

Lecture 11
Sections 4.1 - 4.2

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Outline

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Exercise 3.20, p. 172

- An experiment was conducted to compare two different methods of teaching piano in individual lessons to beginning pupils of five different ages (6, 7, 8, 9, and 10 years).
- Four piano teachers took part in the experiment.
- Each teacher taught six pupils at each of the five age levels.
- For each group of six pupils at each age level, the first three randomly selected pupils were assigned to Method I and the remaining three were taught with Method II.

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Exercise 3.20, p. 172

- An independent examiner rated each pupil's progress after one year of lessons.
- The examiner did not know which method had been used with each pupil.
 - (a) Identify the response variable(s).
 - (b) Identify the explanatory variable(s).
 - (c) How many experimental units (i.e., pupils) are needed for the experiment?

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Solution

- (a) The response variable is the examiner's rating of a pupil.
- (b) The explanatory variables are the pupil's age, the pupil's teacher, and which method was used.
- (c) There are four teachers and each taught six pupils at each of five age levels.

$$4 \times 6 \times 5 = 120.$$

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- **Statisticians like to quantify everything.**
- Given a set of data, they want to summarize it with a single number.
- How might we summarize
 - A sample of political affiliations?
 - A sample of body weights?
 - A sample of steak preferences (rare, medium, etc.)?
 - A sample of family sizes?
 - A sample of temperatures throughout the day?

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Qualitative Variables

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Definition (Qualitative variable)

A **qualitative variable** is a variable whose values are nonnumerical.

- The values of a qualitative variable may or may not have a natural order.
 - Political affiliation.
 - Steak preference.

Summarizing Qualitative Variables

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- Typically, we use **percentages** or **proportions** to summarize qualitative variables.
 - 40% of the subjects are Democrats.
 - 50% of the people prefer their steak medium.

Quantitative Variables

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Definition (Quantitative variable)

A **quantitative variable** is a variable whose values are numerical.

- The values of a quantitative variable always have a natural order.
 - A person's weight.
 - Number of children.
 - Temperature.

Summarizing Quantitative Variables

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- Typically, we use averages to summarize quantitative variables.
 - The people in the sample weigh an average of 156.2 lbs.
 - The people in the sample have an average of 2.3 children.
 - The average temperature for the day was -2.2° C (28° F).

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- Some qualitative variables may appear to be quantitative when they are really qualitative.
- Rate your child's intelligence:
 - 1 Way below average
 - 2 Below average
 - 3 Average
 - 4 Above average
 - 5 Way above average

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- If two people select #4, does that mean that their children are equally intelligent?
- If one person selects #2 and another person selects #4, does that mean that the second person's child is twice as intelligent as the first person's child?
- If two people choose #1 and #5, is that the same as if they both had chosen #3?

Continuous and Discrete Variables

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- Quantitative variables fall into two categories.

Definition (Continuous variable)

A **continuous variable** is a variable whose set of *possible* values forms a complete interval of real numbers.

Definition (Discrete variable)

A **discrete variable** is a variable whose set of *possible* values forms a set of isolated points on the number line.

Continuous Variables

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- Typically continuous variables are *measured* quantities.
 - Length
 - Time
 - Area
 - Weight

Discrete Variables

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- Typically discrete variables are *count data*.
 - Family size = number of children in the family.
 - Heart rate = number of beats per minute.
- A verbal description usually contains the phrase “the number of.”
- Caution: Would weight (“number of pounds”) be discrete?

Discrete vs. Continuous

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- Some data may be mistakenly thought to be discrete.
 - Time = “number of minutes.”
 - Weight = “number of pounds.”
- What if the minutes and pounds were rounded off to the nearest minute or pound.
- What about heart rate, measured in beats per minute?

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Homework

- Read Sections 4.1 - 4.2, pages 212 - 219.
- Let's Do It! 4.1.
- Page 219, exercises 1 - 5.