

Understanding Experiments

Lecture 10 Section 3.5

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Outline

Understanding Experiments

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Homework Review

Introduction

Control Groups

Randomized Design

Blinded Experiments

Assignment

- 1 Homework Review
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- 3 Control Groups
- 4 Randomized Design
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Exercise 2.32, p. 122

A 1-in-14 systematic sample will be taken from a population of 555 members of an art appreciation club. The 555 members are labeled from 1 through 555.

- (a) What is the chance that the member with label 17 will be selected?
- (b) Suppose the sample is selected and the number with label 17 is included. What is the sample size for the resulting sample?

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Solution

- (a) Because we are using 1-in-14 sampling, the chance is $1/14$.
- (b)
- If 17 was included, then the selected random number must have been 3 ($3 + 14 = 17$).
 - Also, $555/14 = 39 \text{ rem } 9$.
 - That means that there are 39 full blocks of size 14 and one partial block of size 9.
 - Since $3 \leq 9$, we will pick up one member from the partial block.
 - That will make the sample size 40.

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- Suppose a drug is given to 100 patients suffering from a particular disease.
- After 2 weeks, 90% of the patients have recovered.
- The researchers conclude that the drug was effective.
- What is wrong with this?

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Treatment and Control Groups

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Assignment

Definition (Treatment group)

The **treatment group** is the group that receives the treatment.

Definition (Control group)

The **control group** is similar to the treatment group in all respects except that it does not receive the treatment.

Randomized Design

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Assignment

- Why would it be wrong to allow the individuals themselves to choose whether to be in the treatment group or the control group?
- Why would it be wrong for the researchers to decide, subject by subject, who goes into which group?

Randomized Design

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Definition (Randomized design)

A **randomized design** is a design in which the subjects are randomly assigned to either the treatment group or the control group.

Randomized Design

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Assignment

- Suppose that there are 100 subjects.
- Number them 1 - 100.
- Then use a random number generator to obtain 50 (distinct) random numbers from 1 - 100.
- Those 50 subjects would be assigned to the treatment group.
- The rest would be assigned to the control group.

Possible Bias

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- Are the subjects in the treatment group aware of the purpose of the experiment?
- Are the subjects in the control group aware that they are not receiving the drug?
- Will it make a difference?

Two Types of Bias

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Definition (Response bias)

A sampling method exhibits **response bias** if the subjects give what they perceive to be the desired response rather than the true response.

Definition (Experimenter bias)

A sampling method exhibits **experimenter bias** if the observer records the desired values rather than the true observed values.

- How can we avoid these biases?

Placebos

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Definition (Placebo)

A **placebo** is a treatment, usually a pill, that is known to have no effect.

Definition (Single-blind experiment)

A **single-blind experiment** is an experiment in which the subjects do not know who is in the treatment group and who is in the control group.

Placebos

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- Everybody in the treatment group is administered the drug.
- Everybody in the control group gets the placebo.
- The researchers look for differences in the groups' recovery rates.

Double-Blind Experiments

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Definition (Double-blind experiment)

A **double-blind experiment** is an experiment in which neither the subjects nor the observers know who is in the treatment group and who is in the control group.

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Homework

- Read Section 3.5, pages 168 - 171, 173 - 182.
- Let's Do It! 3.5, 3.6, 3.7, 3.8.
- Page 171, exercises 17 - 22.
- Page 182, exercises 25, 26, 28 - 31.
- Chapter 3 review, p. 196, exercises 39 - 43, 45, 47, 49 - 51, 59, 60, 67, 68, 70.