Name Key *Statistics Chapter 10: Reading Guide*

For each section of Chapter 10, BEFORE reading the section, predict the meaning of the bolded vocabulary and after reading the section correct or refine what you thought.

Observational Studies		
Term	**Before reading, I thought this meant…**	**After reading I learned…**
observational study	Researchers record the choices made and outcomes. No treatment/factors imposed.	
retrospective study	Based on historical data. Identify subjects first, then look at a set of their data. Not treatment imposed.	
prospective study	Identify subjects in advance and follow to observe future outcomes. No treatment imposed.	

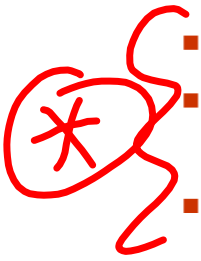
PG 5

Randomized, Comparative Experiments		
Term	**Before reading, I thought this meant…**	**After reading I learned…**
experiment	Researcher applies a treatment/factor, randomly assigns subjects, measures responses.	
random assignment	The process of blindly assigning subjects to different treatment groups to minimize the effect of uncontrollable variables.	
factor	The explanatory variable whose levels are manipulated by the researcher to measure a response	
response variable	The variable that is measured across different treatment groups	
experimental units	Individuals on whom the experiment is performed. subjects, participants	
treatment	The process applied to randomly assigned experimental units. Different levels of the factor.	

Three Principals of Experimental Design		
Term	**Before reading, I thought this meant…**	**After reading I learned…**
control	Experimental units assigned to a baseline treatment level. Provides a basis of comparison.	
randomize	Allows us to equalize the effects of unknown or uncontrollable variables.	
replicate	Being able to repeat an experiment on multiple subjects at the same time or multiple times on a different set of subjects.	

Randomized, Comparative Experiments

- An experiment is a study design that allows us to prove a cause-and-effect relationship.
- In an experiment, the experimenter must identify at least one explanatory variable, called a factor, to manipulate and at least one response variable to measure.
- An experiment:
  - *Manipulates* factor levels to create treatments.
  - *Randomly* assigns subjects to these treatment levels.
  - *Compares* the responses of the subject groups across treatment levels.



Randomized, Comparative Experiments (cont.)

- In an experiment, the experimenter actively and deliberately manipulates the factors to control the details of the possible treatments, and assigns the subjects to those treatments *at random*.
- The experimenter then observes the response variable and *compares* responses for different groups of subjects who have been treated differently.

Randomized, Comparative Experiments (cont.)

- In general, the individuals on whom or which we experiment are called experimental units.
  - When humans are involved, they are commonly called subjects or participants.
  - R*andom selection of subjects* not necessary, but random selection allows generalization to a larger group.
- The specific values that the experimenter chooses for a factor are called the levels of the factor.
- A treatment is a combination of specific levels from all the factors that an experimental unit receives.

The Three Principles of Experimental Design

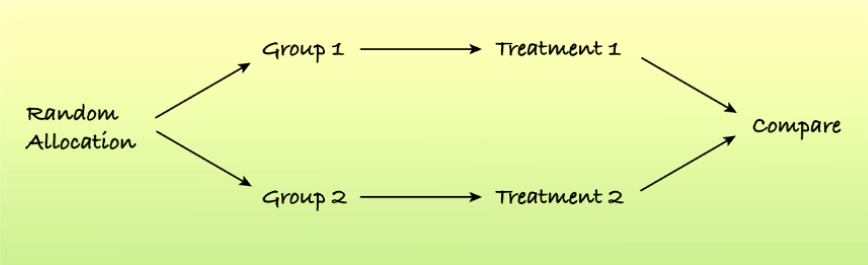
1. Control:
   - We control sources of variation other than the factors we are testing by making conditions as similar as possible for all treatment groups.
2. Randomize assignment of treatments:
   - Randomization allows us to equalize the effects of unknown or uncontrollable sources of variation.
     - It does not eliminate the effects of these sources, but it spreads them out across the treatment levels so that we can see past them.
   - Without randomization, you do not have a valid experiment and will not be able to use the powerful methods of Statistics to draw conclusions from your study.

The Three Principles of Experimental Design (cont.)

3. Replicate:
   - Replicate by applying each treatment to several subjects.
   - Replication of an entire experiment with other subjects is an essential step in science.
   - Later this year we will learn how our sample size helps us calculate how precisely our statistic estimates the true parameter.
     - (We will learn how to calculate a margin of error, just like you read in the newspaper, e.g., ±3%.)

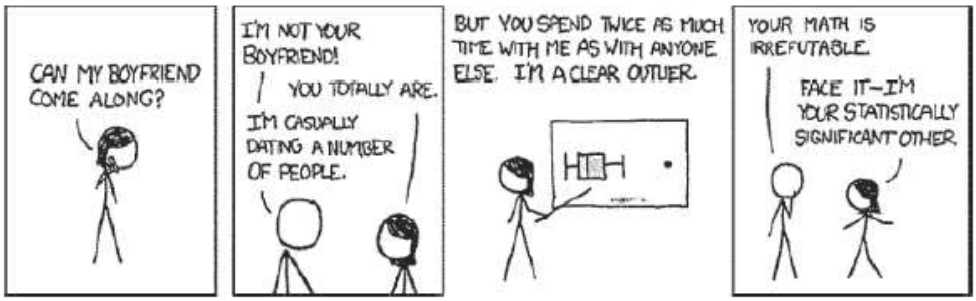
Diagrams of Experiments

- It's often helpful to diagram the procedure of an experiment.
- The following diagram emphasizes the random allocation of subjects to treatment groups, the separate treatments applied to these groups, and the ultimate comparison of results:



Does the Difference Make a Difference?

- How large do the differences need to be to say that there is a difference in the treatments?
- Differences that are larger than we'd get just from the randomization alone are called statistically significant.
- We'll talk more about statistical significance later on. For now, the important point is that a difference is statistically significant if we don't believe that it's likely to have occurred only by chance.



Homework:

Read Ch.10 - pages 248-256

Complete **back** of Reading Guide

(pg.10-8) Packet pg.6