

# STATISTICS 101 - Homework 4 Answers

**Not to be turned in**

1. Read pages 222 through 238 and beginning on page 238, do exercises 11, 12, 13, 18 and 20
  - (8 pts) Problem 11
    - (a) This is a voluntary response sample. Only people who see the ad, feel strongly about the issue and have web access will respond.
    - (b) (2 pts) This is a cluster sample. The clusters are the schools. While this is a random sampling procedure, it is probably not a good one to use in this case, since parents at one school might have different opinions than parents at all the schools.
    - (c) This is a census. This will be subject to nonresponse bias.
    - (d) This is a stratified sample. With a good follow-up on nonresponses, this sample should be unbiased.
  - Problem 12
    - (a) This sample has voluntary response bias. Only people who see the show and feel strongly about the issue will respond.
    - (b) This sample also has voluntary response bias. Only strongly motivated parents will attend PTA meetings.
    - (c) This is a multi-stage sample. There is stratification by school and then clustering by grade. As long as the parents respond, this should be a good design. There should be follow-up to make sure the select parents respond to the survey.
    - (d) This is systematic sampling. As long as the starting point is random, this method should produce reliable data.
  - Problem 13
    - (a) Responses to these questions will differ. Question 1 will probably get no answers more often than Question 2. This is response bias, based on the wording of the question.
    - (b) A question with neutral wording might be: Do you think standardized tests are appropriate for deciding whether a student should be promoted to the next grade?
  - Problem 18
    - (a) The statistic calculated is the mean mileage for the last six fill-ups.
    - (b) The parameter of interest is the gas mileage of the car.
    - (c) The driving conditions for the last six fill-ups might not be the same as the overall driving conditions for the car. For example, they might all be in the same weather season, where gas mileage is similar.
    - (d) The EPA is trying to estimate the mean gas mileage for all cars of this type (make, model and year).
  - Problem 20
    - (a) A simple random sample might not be representative of the workers at the company as a whole. Also there is a potential for response bias. People will not generally express discontent to their bosses!
    - (b) Assign each worker a number; there are 439 workers so assign the workers a number from 001 to 439. Randomly select a certain number of workers using either a random number table or a computer.
    - (c) The simple random sample might not give a good cross section of the different types of employees. There are relatively few foreman and project managers, and we want to make sure their opinions are noted, as well as the opinions of the laborers.
    - (d) A good sampling strategy for this type of population is to stratify the sample by job type, selecting a certain percentage of workers of each job type to include in the survey.

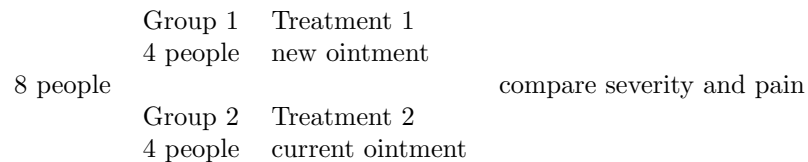
- (e) Each of the 14 project managers should be assigned a number, from 01 to 14. Then the random number table should be used to select 2 of the workers. The actual workers selected will vary depending on which row of the random number table was used.

2. Read pages 241 through 257 and beginning on page 257, do exercises 32, 34, 36.

- Problem 32

- (a) The experimental units are the 8 people with shingles. The factor is the ointment. The factor has two levels: the current ointment and the new ointment. So there are two treatments. The 8 people should be randomly assigned to the two treatment groups. There should be a total of 4 people in each treatment group. Before the experiment begins, patients should be evaluated by the doctors to determine the severity and shingles and patients should be asked to rate their pain. Then the treatment (either new or current ointment) should be applied for a specific length of time. At the end of the experiment, patients should be evaluated again by the same doctors for the severity and pain level of shingles. This experiment should be double-blind: patients and the doctors should not know which treatment group they belong to.

Students might include a diagram of the experimental design. This is not required for the problem, but the design should look like this.



- (b) Let letters A through H correspond to numbers 1 through 8. Ignore the numbers 0 and 9 in the list of random numbers and also ignore any repeats. The first four subjects chosen will be assigned to the treatment group 1 and the other four subjects will be assigned to treatment group 2.

Given the random numbers, one treatment group is 4183, which corresponds to the subjects with last name D, A, H, C. This makes the other treatment group the subjects with last name B, E, F, G.

- (c) Assuming the ointments look and feel the same, the experiment should be able to be blinded to both the patients and the doctors. This would be double-blinding.
- (d) The experimental units should be divided into two groups, males and females. Then the entire experiment should be conducted separately on both blocks. This will enable the researchers to look at both the effect of the ointment and the effect of gender on symptom improvement.

- Problem 34

- (a) The students tutored were not randomly assigned to the course. The students are a voluntary response sample. It is possible their scores would have improved without taking the course.
- (b) Answers will vary. You should have 1 factor, which is the study course and 2 levels of this factor, study course and no study course. The response variable is the improvement on the SAT score on the second test. The subjects should be a group of volunteers who have taken the SAT. The subjects should then be divided into two groups, the study course group and the no study course group. The study course group will receive the study course and at the end, both groups will retake the SAT.
- (c) Answers will vary. The subjects should be blocked into groups depending on their original SAT score. You should have at least 2 blocks maybe 3 blocks (Low, Medium, and High Scores). Once you have blocked the subjects, then use the same design from part (b).

- Problem 36

Answers will vary. This experiment has two factors (water temperature, wash cycle). The water temperature factor has 2 levels (hot, cold) and the wash cycle has 2 levels (regular, delicates).

The 2 factors with 2 levels each gives 4 treatments total. The response variable is the level of cleaning of the grass stains. This should be judged by “expert people.” Randomly assign the 30 t-shirts to the 4 treatment groups.

3. The following is excerpted verbatim from a package of COLD-EEZE<sup>®</sup>.

**CLINICALLY PROVEN COLD-EEZE<sup>®</sup> WITH ZIGG<sup>TM</sup>**

The following studies apply **only to Cold-Eeze<sup>®</sup> with Zigg<sup>TM</sup> (Zinc Gluconate Glycine)**, the **only** great tasting lozenge proven effective in treating a Common Cold.

A randomized, double-blind placebo study, with **23mg of ionic zinc** in a citrus flavored lozenge, concluded that treatment of a cold with our Patented formula within 48 hours of the onset resulted in symptom relief and a **42% reduction** in the duration of the common cold.

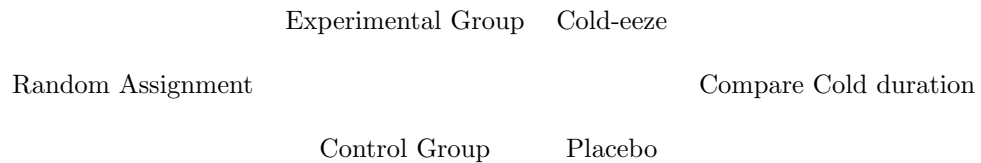
- (a) What is a “randomized, double-blind placebo study”?

The subjects were randomly assigned to a treatment group. The treatment groups consisted of 2 groups, 1 group received the Cold-Eeze tablets and the other group received a placebo. Neither the subjects nor the researchers in direct contact with the subjects knew which treatment group the subject belonged to.

- (b) What important piece of information is missing from the description of the study?

The description does not tell you anything about the subjects; how many of them, their gender, age, general health, etc.

- (c) Make a diagram to show how this study was designed.



- (d) What does the phrase “resulted in a 42% reduction in the duration of common cold symptoms.” mean?

The treatment group that received Cold-Eeze as a whole had colds that lasted 42% shorter than the treatment group that received the placebo.

- (e) Zinc lozenges have a unique and strong taste. What problem could this cause in this “randomized, double-blind placebo study”?

This characteristic of zinc lozenges could be difficult to replicate in a placebo. The subjects then might be able to tell which treatment group they belonged to.