Statistics 101 – Homework 6

Solution

Assignment:

1. Do the following problems from the text, *Intro Stats*, 3rd Edition. If you have an earlier edition of the text, check with someone who has the 3rd Edition to make sure you do the correct problems.

    a) Chapter 11 – problems 7, 8, 15, and 21.
    b) Chapter 12 – problems 3, 4, 7, 10, and 23.
    c) Chapter 13 – problems 1, 2, 7, 9, 10, and 12.

    If you have questions about the problems in the book, see your course instructor.

2. CBS News/New Your Times conducted a public opinion survey between September 19th and 23rd, 2009. 1,042 randomly selected adults from across the United States were contacted and asked the question, "Do you approve or disapprove of the way Barack Obama is handling health care?" 47% of the people contacted said they approve, 45% said they disapprove, and 8% were unsure.

    a) Identify the population.

    The population consists of all adults in the United States.

    b) Identify the population parameter of interest.

    A population parameter is the proportion of all adults in the United States that approve of the way Barack Obama is handling health care. Alternatively, the proportion of all adults in the United States that disapprove of the way Barack Obama is handling health care is another population parameter.

    c) Identify the sample.

    The sample consists of the 1,042 adults from across the United States who where contacted and asked the question.

    d) Are the percentages given in the description sample statistics or population parameters? Explain briefly.

    The percentages given are sample statistics because they summarize the responses of the 1,042 adults in the sample.

    e) Identify the sampling method, including whether or not randomization was employed.

    The sampling method is not spelled out but the sample was selected randomly.

f) Identify any potential sources of bias you can detect and any problems you see in generalizing to the population of interest.

Because the sample was selected at random, there should not be any sources of bias for generalizing to the sampling frame. If the poll was conducted by telephone then the sampling frame contains only those adults in the United States with telephones so there could be a potential bias of excluding adults in the United States without telephones.

3. Below is a list of 10 individuals, name and gender. We wish to select 3 individuals at random from the list of 10.

0 Kaeli (F)	1 Ryan (M)	2 Lindsey (F)	3 Jon (M)	4 Matt (M)
5 Kristi (F)	6 Dawn (F)	7 Alisha (F)	8 Juan (M)	9 Amy (F)

a) Explain how you would use the table of random numbers in the back of your text (row 22 starting from the left) to select a simple random sample of three individuals. Who are the three individuals selected?

To select a simple random sample, read from left to right on row 22 and select the first 3 unique (non-repeating) numbers between 0 and 9. The numbers selected identify the individuals that will be chosen.

Row 22 – 02763

Therefore select 0 Kaeli (F), 2 Lindsey (F) and 7 Alisha (F)

b) Describe how you would randomly sample to ensure that there would be one male (M) and two females (F) chosen. Again use the table of random numbers in the back of your text (row 22 starting from the left) to select your sample of one male (M) and two females (F).

One way to do this is to stratify the group into males and females and then use the random number table to select a simple random sample from each group.

Select the two females first then the male.

Row 22 – 02763

For females select 0 Kaeli (F), 2 Lindsey (F).
For males select 3 Jon (M).

Select the male first and then the two females.

Row 22 – 02763 33701

For males select 3 Jon (M).
For females select 7 Alisha (F), 0 Kaeli (F).

4. The following is excerpted from a Des Moines Register article that appeared Sunday, September 27, 2009.

Study finds antennas are key to monarch butterfly navigation.

Millions of monarch butterflies migrate to Mexico for the winter; and scientists have long speculated on how the insects find their way. It turns out that their antennas are the key. How do we know? Researchers painted butterfly antennas black, and the insects got lost. The researchers … did the test by holding the butterflies' wings gently and dipping their antennas in enamel paint. The ones with black paint were unable to orient to the south … while butterflies whose antennas were coated with clear paint had no trouble navigating. Because the animals with black paint got lost even though their eyes were able to see light, the researchers concluded the antennas were vital for navigation.

a) Why is this study an experiment and not an observational study?

This study is an experiment because there is a manipulated variable, what color paint is put on the antennas. A treatment is imposed on the butterflies.

b) What is the response variable? Is this variable categorical or numerical?

The response variable is whether or not the butterfly can navigate and not get lost. This is a categorical variable.

c) What are the treatments?

The two treatments are dipping antennas in clear paint or in black paint.

d) Is there a control group? Explain briefly.

One might consider dipping antennas in clear paint a "control" group because you are treating all the butterflies similarly, dipping antennas in paint, but the clear paint lets light in.

Alternatively, one might consider a control group a group of butterflies that received no paint at all. In this latter case there would not be such a group in the experiment.

e) Suppose there were 100 butterflies in the experiment, explain briefly how butterflies should have been assigned to treatments. Your explanation should be complete enough so that a person not knowledgeable in statistics could follow your explanation and actually assign the butterflies to the treatments.

You have to first be able to uniquely identify the 100 butterflies with an ID number from 00 to 99. Use the table of random numbers to select 50 unique (no repeats) 2-digit numbers. These 50 numbers identify the butterflies that will have their antennas dipped in black paint. The remaining 50 butterflies will have their antennas dipped in clear paint.

5. The following is excerpted from an article in the Des Moines Register on May 16, 2009.

Mixing energy drinks, alcohol can be dangerous, study shows.

Along with a jolt of caffeine, the beverages, such as Red Bull, Rockstar, Monster and Amp, have the potential for negative health effects if mixed with alcohol, according to the research.

A survey of 4,200 North Carolina college students showed that the 25 percent of students who drank alcohol and energy drinks combined consumed more alcohol than their peers who didn't mix booze and energy drinks.

Students who drank energy drinks with alcohol were twice as likely to be injured or to take advantage of someone sexually and almost twice as likely to ride with a drunken driver, the survey showed.

a) Why is this study an observational study and not an experiment? Explain briefly.

There is no manipulated variable and no treatment is imposed. The college students are simply asked to report on their drinking habits.

b) Is this a prospective or a retrospective study? Explain briefly.

The study is retrospective because the students are asked about their past behavior.

c) What is the explanatory variable? Is it categorical or numerical?

The explanatory variable is whether or not a student drinks alcohol with energy drinks. This is a categorical variable.

d) What is one response variable?

There are several response variables including how much alcohol a student consumes, whether or not they were injured while drinking, whether or not they took advantage of someone sexually while drinking and whether or not they rode with a drunken driver while drinking.

e) How should the college students have been selected so that the results of the survey can be generalized to all college students in North Carolina?

In order for the results of the survey to be generalized to all college students in North Carolina, the sample of students must be selected at random from all students attending college in North Carolina.