Section 7.3

Exercise 1. Let's suppose that we wanted to estimate the proportion of Bay Area adults who support the Golden State Warriors. We take a random sample of 200 adults. How would we use the sample to estimate the proportion of adults who root for the Warriors?

Definition: A **point estimate** is a single value (or point) used to approximate a population parameter.

Fact: The sample proportion $\hat{p}$ is the best point estimate of the population proportion p.

Exercise 2. Let's suppose we wanted to find the proportion of Evergreen Valley College students who have an iPhone. Since it is impractical to ask every single student at Evergreen Valley for this piece of information, we decide to take a simple random sample of 400 students. The number of students who have an iPhone is 100. So, the proportion of students **in the sample** who have an iPhone is $100/400 = 1/4$.

(a) How likely is it that the proportion for the entire college is 1/4?

(b) How likely is it that the proportion is "close" to 1/4?

1/4 is the best point estimate of the population proportion p, but we don't know accurate it is. In practice, we use a range of values to make an estimate.

Here is the confidence interval for p (with a confidence level of c):

$$\hat{p} \pm z_c \sqrt{\frac{\hat{p}\hat{q}}{n}}$$

The margin of error is $E = z_c \sqrt{\frac{\hat{p}\hat{q}}{n}}$.

Here are the three requirements of a sample in order to construct a confidence interval:

1. The sample is a simple random sample.
2. The conditions for the binomial distribution are satisfied. That is, there is a fixed number of trials, the trials are independent, there are two categories of outcomes, and the probabilities remain constant for each trial.
3. There are at least 5 successes and at least 5 failures.

Exercise 3. An insurance company checks police records on 582 accidents selected at random and notes that teenagers were at the wheel in 91 of them. Create a 95% confidence interval for the percentage of all auto accidents that involve teenage drivers.

Are the three requirements met?

The first step is to find the margin of error. To do that, we need to find z_c.

So, $z_c =$

$\hat{p} =$

$\hat{q} =$

Applying the formula,

$E = z_c \sqrt{\frac{\hat{p}\hat{q}}{n}} =$

Again, the confidence interval is ($\hat{p}$ - E, $\hat{p}$ + E).

So, the confidence interval is

Class Exercise 1. Large trees growing near power lines can cause power failures during storms when their branches fall on the lines. Power companies spend a great deal of time and money trimming and removing trees to prevent this problem. Researchers are developing hormone and chemical treatments that will stunt or slow tree growth. If the treatment is too severe, however, the tree will die. In one series of laboratory experiments on 216 sycamore trees, 41 trees died. Give a 99% confidence interval for the proportion of sycamore trees that would be expected to die from this particular treatment. **Answer: (0.121, 0.259)**

Class Exercise 2. In 1998, a San Diego reproductive clinic reported 49 live births to 207 women under the age of 40 who had previously been unable to conceive. Find a 90% confidence interval for the success rate at this clinic. **Answer: (0.188, 0.285)**

Sample Size for Estimating p

$n = p(1-p)(\frac{z_c}{E})^2$ if you have a preliminary estimate for p

$n = \frac{1}{4}(\frac{z_c}{E})^2$ if you do *not* have a preliminary estimate for p

Exercise 4. How hard is to reach a businessperson by phone? Let p be the proportion of calls to businesspeople for which the caller reaches the person being called on the *first* try. (#24)

(a) If you have no preliminary estimate for p, how many business phone calls should you include in a random sample to be 80% sure that the point estimate $\hat{p}$ will be within a distance of 0.03 from p?

(b) *The Book of Odds* by Shook and Shook (Signet) reports that businesspeople can be reached by a single phone call approximately 17% of time. Using this (national) estimate for p, answer part (a).

Class Exercise 3. The National Council of Small Businesses is interested in the proportion of small businesses that declared Chapter 11 bankruptcy last year. Since there are so many small businesses, the National Council intends to estimate the proportion from a random sample. Let p be the proportion of small businesses that declared Chapter 11 bankruptcy last year. (#26)
(a) If you have no preliminary sample is taken to estimate p, how large a sample is necessary to be 95% sure that a point estimate $\hat{p}$ will be within a distance of 0.10 from p? **Answer: 97**

(b) In a preliminary random sample of 38 small businesses, it was found that six had declared Chapter 11 bankruptcy. How many *more* small businesses should be included in the sample to be 95% sure that a point estimate $\hat{p}$ will be within a distance of 0.10 from p? **Answer: 52 total**

Homework

C Problems: 7-25 ODD
B Problems: 1
A Problems: 3, 5, 27