Section 8.2 Exercises

8.52 Podcast downloading. The Podcast Alley Web site recently reported that they have 53,501 podcasts available for downloading with 3,447,545 episodes. A Pew survey of Internet users described the results of two surveys about podcast downloading. The first was conducted between February and April 2006 and surveyed 2822 Internet users. They found that 198 of these said that they had downloaded a podcast to listen to it or view it later at least once. In a more recent survey, conducted in May 2008, there were 1553 Internet users. Of this total, 295 said that they had downloaded a podcast to listen to it or view it later.

(a) Refer to the table that appears at the beginning of this section (page 490). Fill in the numerical values of all quantities that are known.

(b) Find the estimate of the difference between the proportion of Internet users who had ever downloaded podcasts as of February to April 2006 and the proportion as of May 2008.

(c) Is the large-sample confidence interval for the difference in two proportions appropriate to use in this setting? Explain your answer.

(d) Find the 95% confidence interval for difference.

(e) Convert your estimated difference and confidence interval to percents.

(f) One of the surveys was conducted between February and April whereas the other was conducted in May. Do you think that this difference should have any effect on the interpretation of the results? Be sure to explain your answer.

8.53 Significance test for podcast downloading. Refer to the previous exercise. Test the null hypothesis that the two proportions are equal. Report the test statistic with the $P$-value and summarize your conclusion.

8.54 Are more Internet users downloading podcasts? Refer to the previous two exercises. The ratio of the proportion in the 2008 sample to the proportion in the 2006 sample is about 2.7.

(a) Can you conclude that 2.7 times as many people are downloading podcasts? Explain why or why not.

(b) Can you conclude from the data available that there has been an increase from 2006 to 2008 in the number of people who downloaded podcasts? If your answer is no, explain what additional data you would need or what additional assumptions you would need to make to be able to draw this conclusion.
8.55 **Adult gamers versus teen gamers.** A Pew Internet Project Data Memo presented data comparing adult gamers with teen gamers with respect to the devices on which they play. The data are from two surveys. The adult survey had 1063 gamers while the teen survey had 1064 gamers. The memo reports that 54% of adult gamers played on game consoles (Xbox, PlayStation, Wii, etc.) while 89% of teen gamers played on game consoles.

(a) Refer to the table that appears at the beginning of this section (page 490). Fill in the numerical values of all quantities that are known.

(b) Find the estimate of the difference between the proportion of teen gamers who played on game consoles and the proportion of adults who played on these devices.

(c) Is the large sample confidence interval for the difference in two proportions appropriate to use in this setting? Explain your answer.

(d) Find the 95% confidence interval for difference.

(e) Convert your estimated difference and confidence interval to percents.

(f) The adult survey was conducted between October and December 2008 whereas the teen survey was conducted between November 2007 and February 2008. Do you think that this difference should have any effect on the interpretation of the results? Be sure to explain your answer.

8.56 **Significance test for gaming on consoles.** Refer to the previous exercise. Test the null hypothesis that the two proportions are equal. Report the test statistic with the P-value and summarize your conclusion.

8.57 **Gamers on computers.** The report described in Exercise 8.55 also presented data from the same surveys for gaming on computers (desktops or laptops). These devices were used by 73% of adult gamers and by 76% of teen gamers. Answer the questions given in Exercise 8.55 for gaming on computers.

8.58 **Significance test for gaming on consoles.** Refer to the previous exercise. Test the null hypothesis that the two proportions are equal. Report the test statistic with the P-value and summarize your conclusion.

8.63 **Pet ownership and gender.** In the Health ABC Study, 595 subjects owned a pet and 1939 subjects did not. Among the pet owners, there were 285 women; 1024 of the non–pet owners were women. Find the proportion of pet owners who were women. Do the same for the non–pet owners. Give a 95% confidence interval for the difference in the two proportions. (Be sure to let Population 1 correspond to the group with the higher proportion so that the difference will be positive.)
8.64 Effects of reducing air pollution. A study that evaluated the effects of a reduction in exposure to traffic-related air pollutants compared respiratory symptoms of 283 residents of an area with congested streets with 165 residents in a similar area where the congestion was removed because a bypass was constructed. The symptoms of the residents of both areas were evaluated at baseline and again a year after the bypass was completed. For the residents of the congested streets, 17 reported that their symptoms of wheezing improved between baseline and one year later, while 35 of the residents of the bypass streets reported improvement.

(a) Find the two sample proportions.

(b) Report the difference in the proportions and the standard error of the difference.

(c) What are the appropriate null and alternative hypotheses for examining the question of interest? Be sure to explain your choice of the alternative hypothesis.

(d) Find the test statistic. Construct a sketch of the distribution of the test statistic under the assumption that the null hypothesis is true. Find the $P$-value and use your sketch to explain its meaning.

(e) Is no evidence of an effect the same as evidence that there is no effect? Use a 95% confidence interval to answer this question. Summarize your ideas in a way that could be understood by someone who has very little experience with statistics.

(f) The study was done in the United Kingdom. To what extent do you think that the results can be generalized to other circumstances?

8.67 Who gets stock options? Different kinds of companies compensate their key employees in different ways. Established companies may pay higher salaries, while new companies may offer stock options that will be valuable if the company succeeds. Do high-tech companies tend to offer stock options more often than other companies? One study looked at a random sample of 200 companies. Of these, 91 were listed in the Directory of Public High Technology Corporations and 109 were not listed. Treat these two groups as SRSs of high-tech and non-high-tech companies. Seventy-three (73) of the high-tech companies and 75 of the non-high-tech companies offered incentive stock options to key employees.

(a) Give a 95% confidence interval for the difference in the proportions of the two types of companies that offer stock options.

(b) Compare the two groups of companies with a significance test.

(c) Summarize your analysis and conclusions.
8.68 Cheating during a test: 2002 versus 2004. In Exercise 8.28, you examined the proportion of high school students who cheated on tests at least twice during the past year. Included in that study were the results for both 2002 and 2004. A reported 9054 out of 24,142 students said they cheated at least twice in 2004. A reported 5794 out of 12,121 students said they cheated at least twice in 2002. Give an estimate of the difference between these two proportions with a 90% confidence interval.

8.70 Bicycle accidents, alcohol, and gender. In Exercise 8.38 (page 489) we examined the percent of fatally injured bicyclists tested for alcohol who tested positive. Here we examine the same data with respect to gender.

<table>
<thead>
<tr>
<th>Gender</th>
<th>n</th>
<th>X (tested positive)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>191</td>
<td>27</td>
</tr>
<tr>
<td>Male</td>
<td>1520</td>
<td>515</td>
</tr>
</tbody>
</table>

(a) Summarize the data by giving the estimates of the two population proportions and a 95% confidence interval for their difference.

(b) The standard error \( SE_D \) contains a contribution from each sample, \( \hat{p}_1(1 - \hat{p}_1)/n_1 \) and \( \hat{p}_2(1 - \hat{p}_2)/n_2 \). Which of these contributes the larger amount to the standard error of the difference? Explain why.

(c) Use a test of significance to examine whether the two proportions are equal.

8.71 Pet ownership and gender: the significance test. In Exercise 8.63 (page 503) we compared the proportion of pet owners who were women with the proportion of non–pet owners who were women in the Health ABC Study. Use a significance test to make the comparison and summarize the results of your analysis.