8.1 Exercises

8.13 What’s wrong? Explain what is wrong with each of the following:

(a) The margin of error for a confidence interval used for an opinion poll takes into account the fact that people who did not answer the poll questions may have had different responses from those who did answer the questions.

(b) If the $P$-value for a significance test is 0.35, we can conclude that the null hypothesis has a 35% chance of being true.

(c) A student project used a confidence interval to describe the results in a final report. The confidence level was 110%.

8.16 Most desirable mates. A poll of 5000 residents in Brazil, Canada, China, France, Malaysia, South Africa, and the United States asked about what profession they would prefer a marriage partner to have. The choice receiving the highest percent, 16% of the responses, was doctors, nurses, and other health care professionals.

(a) Find the sample proportion with a 95% confidence interval for the proportion of people who would prefer a doctor, nurse, or other health care professional as a marriage partner.

(b) Convert the estimate and the confidence interval to percents.

8.17 Guitar Hero and Rock Band. An electronic survey of 7,061 players of Guitar Hero and Rock Band reported that 67% of those who do not currently play a musical instrument said that they are likely to begin playing a real musical instrument in the next two years. The reports describing the survey do not give the number of respondents who do not currently play a musical instrument.

(a) Explain why it is important to know the number of respondents who do not currently play a musical instrument.

(b) Assume that half of the respondents do not currently play a musical instrument. Find the count of players who said that they are likely to begin playing a real musical instrument in the next two years.

(c) Give a 99% confidence interval for the population proportion who would say that they are likely to begin playing a real musical instrument in the next two years.

(d) The survey collected data from two separate consumer panels. There were 3300 respondents from the LightSpeed consumer panel and the others were from Guitar Center’s proprietary consumer panel. Comment on the sampling procedure used for this survey and how it would influence your interpretation of the findings.
8.20 Students doing community service. In a sample of 159,949 first-year college students, the National Survey of Student Engagement reported that 39% participated in community service or volunteer work.

(a) Find the margin of error for 99% confidence.

(b) Here are some facts from the report that summarizes the survey. The students were from 617 four-year colleges and universities. The response rate was 36%. Institutions paid a participation fee of between $1800 and $7800 based on the size of their undergraduate enrollment. Discuss these facts as possible sources of error in this study. How do you think these errors would compare with the error that you calculated in part (a)?

8.21 Plans to study abroad. The survey described in the previous exercise also asked about items related to academics. In response to one of these questions, 42% of first-year students reported that they plan to study abroad.

(a) Based on the information available, how many students plan to study abroad?

(b) Give a 99% confidence interval for the population proportion of first-year college students who plan to study abroad.

8.22 Student credit cards. In a survey of 1430 undergraduate students, 1087 reported that they had one or more credit cards. Give a 95% confidence interval for the proportion of all college students who have at least one credit card.

8.23 How many credit cards? The summary of the survey described in the previous exercise reported that 43% of undergraduates had four or more credit cards. Give a 95% confidence interval for the proportion of all college students who have four or more credit cards.

8.24 How would the confidence interval change? Refer to Exercise 8.23.

(a) Would a 99% confidence interval be wider or narrower than the one that you found in that exercise? Verify your results by computing the interval.

(b) Would a 90% confidence interval be wider or narrower than the one that you found in Exercise 8.23? Verify your results by computing the interval.

8.26 Do you enjoy driving your car? The Pew Research Center recently polled $n = 1048$ U.S. drivers and found that 69% enjoyed driving their automobiles.

(a) Construct a 95% confidence interval for the proportion of U.S. drivers who enjoy driving their automobiles.

(b) In 1991, a Gallup Poll reported this percent to be 79%. Using the data from this poll, test the claim that the percent of drivers who enjoy driving their cars has declined since 1991. Report the large-sample $z$ statistic and its $P$-value.
8.27 Getting angry at other drivers. Refer to Exercise 8.26. The same Pew Poll found that 38% of the respondents “shouted, cursed or made gestures to other drivers” in the last year.

(a) Construct a 95% confidence interval for the true proportion of U.S. drivers who did these actions in the last year.

(b) Does the fact that the respondent is self-reporting these actions affect the way that you interpret the results? Write a short paragraph explaining your answer.

8.28 Cheating during a test. A national survey of high school students conducted by the Josephson Institute of Ethics was sent to 37,328 students, and 24,142 were returned. One question asked students if they had cheated during a test in the last school year. Of those who returned the survey, 9054 responded that they had cheated at least two times in the last year.

(a) What is the sample proportion of respondents who cheated at least twice?

(b) Compute the 95% confidence interval for the true proportion of students who have cheated on at least two tests in the last year.

(c) Compute the nonresponse rate for this study. Does this influence how you interpret these results? Write a short discussion of this issue.

8.32 Instant versus fresh-brewed coffee. A matched pairs experiment compares the taste of instant versus fresh-brewed coffee. Each subject tastes two unmarked cups of coffee, one of each type, in random order and states which he or she prefers. Of the 40 subjects who participate in the study, 12 prefer the instant coffee. Let $p$ be the probability that a randomly chosen subject prefers fresh-brewed coffee to instant coffee. (In practical terms, $p$ is the proportion of the population who prefer fresh-brewed coffee.)

(a) Test the claim that a majority of people prefer the taste of fresh-brewed coffee. Report the large-sample $z$ statistic and its $P$-value.

(b) Draw a sketch of a standard Normal curve and mark the location of your $z$ statistic. Shade the appropriate area that corresponds to the $P$-value.

(c) Is your result significant at the 5% level? What is your practical conclusion?

8.37 Dogs sniffing out cancer. A 2005 study by researchers set out to determine whether dogs could be trained to detect lung and breast cancer by sniffing exhaled breath samples. For the breast cancer portion, breath samples from 6 cancer patients and 17 cancer-free volunteers were used. Each dog had to sniff five breath samples. For 125 trials, there were four control samples and one cancer sample. A correct response involved lying down next to the sample from the breast cancer patient. Collectively, the dogs correctly identified the cancer sample in 110 of these trials. Construct a 95% confidence interval for the true proportion of times these dogs will correctly identify a breast cancer sample.
8.38 **Bicycle accidents and alcohol.** In the United States approximately 900 people die in bicycle accidents each year. One study examined the records of 1711 bicyclists aged 15 or older who were fatally injured in bicycle accidents between 1987 and 1991 and were tested for alcohol. Of these, 542 tested positive for alcohol (blood alcohol concentration of 0.01% or higher).

(a) Summarize the data with appropriate descriptive statistics.

(b) To do statistical inference for these data, we think in terms of a model where $p$ is a parameter that represents the probability that a tested bicycle rider is positive for alcohol. Find a 99% confidence interval for $p$.

(c) Can you conclude from your analysis of this study that alcohol causes fatal bicycle accidents? Explain.

(d) In this study 386 bicyclists had blood alcohol levels above 0.10%, a level defining legally drunk in many states at the time. Give a 99% confidence interval for the proportion who were legally drunk according to this criterion.

8.39 **Tossing a coin 10,000 times!** The South African mathematician John Kerrich, while a prisoner of war during World War II, tossed a coin 10,000 times and obtained 5067 heads.

(a) Is this significant evidence at the 5% level that the probability that Kerrich’s coin comes up heads is not 0.5? Use a sketch of the standard Normal distribution to illustrate the $P$-value.

(b) Use a 95% confidence interval to find the range of probabilities of heads that would not be rejected at the 5% level.

8.40 **Is there interest in a new product?** One of your employees has suggested that your company develop a new product. You decide to take a random sample of your customers and ask whether or not there is interest in the new product. The response is on a 1 to 5 scale with 1 indicating “definitely would not purchase”; 2, “probably would not purchase”; 3, “not sure”; 4, “probably would purchase”; and 5, “definitely would purchase.” For an initial analysis, you will record the responses 1, 2, and 3 as “No” and 4 and 5 as “Yes.” What sample size would you use if you wanted the 95% margin of error to be 0.15 or less?

8.41 More information is needed.** Refer to the previous exercise. Suppose that after reviewing the results of the previous survey, you proceeded with preliminary development of the product. Now you are at the stage where you need to decide whether or not to make a major investment to produce and market it. You will use another random sample of your customers, but now you want the margin of error to be smaller. What sample size would you use if you wanted the 95% margin of error to be 0.075 or less?
8.42 Sample size needed for an evaluation. You are planning an evaluation of a semester-long alcohol awareness campaign at your college. Previous evaluations indicate that about 25% of the students surveyed will respond “Yes” to the question “Did the campaign alter your behavior toward alcohol consumption?” How large a sample of students should you take if you want the margin of error for 95% confidence to be about 0.1?

8.44 Are the customers dissatisfied? An automobile manufacturer would like to know what proportion of its customers are dissatisfied with the service received from their local dealer. The customer relations department will survey a random sample of customers and compute a 95% confidence interval for the proportion that are dissatisfied. From past studies, they believe that this proportion will be about 0.15. Find the sample size needed if the margin of error of the confidence interval is to be no more than 0.02.