AE Additional Exercises

1. A national news network is interested in the opinion which Americans have regarding a national healthcare policy. During the evening news, they display a 900 telephone number and ask their viewers to call in and respond to the question: *Do you favor a national healthcare policy in the U.S.?*

Survey Responses	
Category	**% of Responses**
Yes	45
No	45
Do not have enough information to decide	10

- **a.** What sampling technique was used for this survey?
- **b.** What biases may be present in the responses?
- **c.** Is 45% a reasonable estimate of the proportion of all Americans who favor a national healthcare policy? Explain.

2. An entrepreneur wants to open a new Indian restaurant in a resort community. To determine if there is a market for the new restaurant, the entrepreneur decides to conduct a survey.

- **a.** What is the population of interest to the entrepreneur?
- **b.** Can you think of any good sources for a sampling frame?
- **c.** What are the shortcomings (if any) of the sources you picked for the sampling frame?

3. A manufacturer is developing a new type of paint. Test panels were exposed to various corrosive conditions to measure the protective ability of the paint. Based on the results of the test, the manufacturer has concluded that the mean life before corrosive failure for the new paint is 168 hours with a standard deviation of 30 hours. If the manufacturer's conclusions are correct, find the probability that the paint on a sample of 60 test panels will have a mean life before corrosive failure of less than 150 hours.

4. Seventy-five percent of the students graduating from high school in a small Iowa farm town attend college. The town's Chamber of Commerce randomly selects 30 recent graduates and inquires whether or not they will attend college.

- **a.** Find the probability that at least 80% of the surveyed students will be attending college.
- **b.** Find the probability that at most 70% of the surveyed students will be attending college.
- **c.** Find the probability that between 65% and 85% of the surveyed students will be attending college.
- **d.** Why might the data gathered from this sample misestimate the proportion of students who will actually be attending college?

5. A biology professor is interested in the proportion of students at his college who are pre-med majors. In his next class, he asks for the students who are pre-med majors to raise their hands. Fifty percent of the students raised their hands.

- **a.** What type of sampling technique was used for this survey?
- **b.** What types of biases may be present in the responses?
- **c.** Is 50% a reasonable point estimate of the proportion of students at the college who are pre-med majors? Explain.

6. A report released by the U.S. Census Bureau in November of 2001 stated that fewer families fit the traditional family makeup in 2000 as compared with 1970. The report stated that in 1970, 5.6 million families were headed by women with no husband present, and 16.6% of the households consisted of people living alone. In 2000, these figures increased to 16.2 million and 26.7% respectively. The report also stated that in 1970, 40% of the households consisted of married couples with no children while in the year 2000 this decreased to 25%. Suppose that a random sample of 150 households is chosen in 2000, and the percent of these that consist of people living alone is determined.

- **a.** Find the probability that at least 30% of those households sampled consist of people living alone.
- **b.** Find the probability that at most 28% of those sampled households consist of people living alone.
- **c.** Find the probability that between 26% and 36% of those households consist of people living alone.

7. It is known that the percentage return for a group of stocks in the technology sector is normally distributed with a mean of 15 percent and a standard deviation of 22 percent. Suppose you selected a random sample of 10 stocks from this sector.

- **a.** What are the mean and standard deviation of $\bar{x}$?
- **b.** Find the interval containing 68.26% of all possible sample mean returns.

8. A restaurant wants to determine the average time to prepare meals for its customers. To aid in this process, the restaurant randomly selects the meal preparation time of 150 of its customers and finds that the average preparation time is 18 minutes with a standard deviation of eight minutes. Describe the distribution of the sample mean of preparation time for its customers.

9. With such a large number of people using text messages as a means of communication, a company is interested in determining the number of work hours lost due to text messaging. Based on a survey of 30 randomly selected employees (anonymously, of course), the company has determined that the average amount of time spent texting over a one-month period is 180 minutes with a standard deviation of 60 minutes.

- **a.** What is the probability that the average amount of time spent using text messages is more than 210 minutes in this one-month period?
- **b.** Thinking that it's practically impossible for her employees to spend, on average, three hours a month texting while at work, the manager conducts another survey. She randomly samples 45 employees and finds that the average amount of time spent texting while at work over a one-month period is less than 180 minutes. Is it reasonable to conclude that the average amount of time spent using text messaging has decreased since the initial survey? Justify your answer.
- **c.** How might the data gathered from this sample not accurately depict the loss of productivity from text messaging?

10. Suppose that a random sample of size 64 was selected and the researcher found that the mean was 30 and the standard deviation was 4.

- **a.** What is the probability that the sample mean is more than 31.25?
- **b.** What assumptions were made in part **a.**?

11. A town is considering building a high school football stadium approximately one-half mile from a well-established housing development. The residents of the development opposed the stadium construction due to the noise coming from the stadium during games. In presenting their argument, the residents indicated that any noise more than 103 decibels would be unacceptable. Using a sample of 35 games previously played in the old arena, the town found that the average decibels were 100 with a standard deviation of 8 decibels.

a. What is the probability that a randomly selected game will generate noise in excess of 103 decibels at the stadium?

b. What is the probability that a randomly selected game will generate a noise level of exactly 103 decibels?

c. Suppose a compromise was made that required the noise level to be lower than 103 decibels 95% of the time. Will the mean level of the noise have to be lowered to comply with the new regulation? If so, by how much? Assume that the standard deviation remains at 8 decibels.

12. The town manager believes that 60% of the residents will approve the construction of the proposed high school football stadium. A random sample of 100 residents will be used to estimate the proportion of residents that will approve the construction.

a. Assuming that the town manager is correct and that $p = 0.6$, describe the sampling distribution of $\hat{p}$.

b. What is the probability that between 50% and 70% of the residents will approve the stadium construction?

13. It is believed that 90% of all adults and 85% of all kids between the ages of 12 and 17 have cellular phones. Suppose a sample of 500 adults and 400 kids was taken.

a. Describe the sampling distribution of the proportion of adults that have cellular phones. Assume that the stated probabilities above are true.

b. Describe the sampling distribution of the proportion of kids that have cellular phones. Assume that the stated probabilities above are true.

c. What is the probability that the sample proportion of adults having cell phones will be within 2% of the true proportion?

d. What is the probability that the sample proportion of kids having cell phones will be within 4% of the true proportion?

14. A survey of college students was conducted to learn about their attitudes toward alcohol abuse on college campuses. Sixty-two percent of student respondents indicated that they believe there was a high rate of alcohol abuse on college campuses. Suppose that a sample of 250 college students was taken. What is the probability that more than seventy percent believed that there was a high rate of alcohol abuse on college campuses?

15. A credit card issuer believes that 75% of college students between the ages of 18 and 22 have more than $5000 of credit card debt. The credit card issuer conducted a survey of 500 college students between the ages of 18 and 22.

a. What is the probability that at least 70% of college students between the ages of 18 and 22 have credit card debt in excess of $5000?

b. Assuming that the credit card issuer is correct, what is the probability that the proportion will be within three percent of the population proportion?

c. What is the probability that the proportion will not be within three percent of the population proportion?

16. A marketing firm conducts a survey by mail with a 20% response rate. If the firm mailed 1000 surveys for a new study, what is the probability that at least 220 individuals will respond?

17. Suppose that it has been reported by a group of researchers that the average number of hours of TV viewing per household per week in the United States is 50.4 hours. Suppose the standard deviation is 11.8 hours, and a random sample of 42 U.S. households is taken.

a. What is the probability that the sample average is more than 35 hours? If the sample average is actually more than 35 hours, what would it mean in terms of the figures presented by the researchers?

b. Suppose the population standard deviation is unknown. If 71% of all sample means are greater than 49 hours and the population mean is still 50.4 hours, what is the value of the population standard deviation? Use a sample size of 42.