

## 6.8: Chapter 6 Homework

### 6.3 A Confidence Interval for a Population Standard Deviation Unknown, Small Sample Case

Use the following information to answer the next five exercises. A hospital is trying to cut down on emergency room wait times. It is interested in the amount of time patients must wait before being called back to be examined. An investigation committee randomly surveyed 70 patients. The sample mean was 1.5 hours with a sample standard deviation of 0.5 hours.

1. Identify the following:

1.  $\bar{x}$  = \_\_\_\_\_
2.  $s_x$  = \_\_\_\_\_
3.  $n$  = \_\_\_\_\_
4.  $n - 1$  = \_\_\_\_\_

2. Define the random variables  $X$  and  $\bar{x}$  in words.

3. Which distribution should you use for this problem?

4. Construct a 95% confidence interval for the population mean time spent waiting. State the confidence interval, sketch the graph, and calculate the error bound.

5. Explain in complete sentences what the confidence interval means.

Use the following information to answer the next six exercises: One hundred eight Americans were surveyed to determine the number of hours they spend watching television each month. It was revealed that they watched an average of 151 hours each month with a standard deviation of 32 hours. Assume that the underlying population distribution is normal.

6. Identify the following:

1.  $\bar{x}$  = \_\_\_\_\_
2.  $s_x$  = \_\_\_\_\_
3.  $n$  = \_\_\_\_\_
4.  $n - 1$  = \_\_\_\_\_

7. Define the random variable  $X$  in words.

8. Define the random variable  $\bar{x}$  in words.

9. Which distribution should you use for this problem?

10. Construct a 99% confidence interval for the population mean hours spent watching television per month. (a) State the confidence interval, (b) sketch the graph, and (c) calculate the error bound.

11. Why would the error bound change if the confidence level were lowered to 95%?

Use the following information to answer the next 13 exercises: The data in the table below are the result of a random survey of 39 national flags from various countries. We are interested in finding a confidence interval for the true mean number of colors on a national flag. Let  $X$  = the number of colors on a national flag.

$x$	Freq.
1	1
2	7
3	18
4	7
5	6

**Table 6.8.1**

12. Calculate the following:

1.  $\bar{x}$  = \_\_\_\_\_
2.  $s_x$  = \_\_\_\_\_
3.  $n$  = \_\_\_\_\_

13. Define the random variable  $\bar{x}$  in words.

14. What is  $\bar{x}$  estimating?

15. Is  $\sigma_x$  known?

16. As a result of your answer to the prior question, state the exact distribution you will use for calculating the confidence interval.

*Construct a 95% confidence interval for the true mean number of colors on national flags.*

17. How much area is in both tails (combined)?


18. How much area is in each tail?

19. Calculate the following:

1. lower limit
2. upper limit
3. error bound

20. The 95% confidence interval is \_\_\_\_\_.

21. Fill in the blanks on the graph with the areas, the upper and lower limits of the Confidence Interval and the sample mean.

 This is a template of a normal distribution curve with the central region shaded to represent a confidence interval. The residual areas are on either side of the shaded region. Blanks indicate that students should label the confidence level, residual areas, and points that define the confidence interval.

**Figure 6.8.1**

22. In one complete sentence, explain what the interval means.

23. Using the same  $\bar{x}$ ,  $s_x$ , and level of confidence, suppose that  $n$  were 69 instead of 39. Would the error bound become larger or smaller? How do you know?

24. Using the same  $\bar{x}$ ,  $s_x$ , and  $n = 39$ , how would the error bound change if the confidence level were reduced to 90%? Why?

## 6.4 A Confidence Interval for A Population Proportion

*Use the following information to answer the next two exercises:* Marketing companies are interested in knowing the population percent of women who make the majority of household purchasing decisions.

25. When designing a study to determine this population proportion, what is the minimum number you would need to survey to be 90% confident that the population proportion is estimated to within 0.05?

26. If it were later determined that it was important to be more than 90% confident and a new survey were commissioned, how would it affect the minimum number you need to survey? Why?

*Use the following information to answer the next five exercises:* Suppose the marketing company did do a survey. They randomly surveyed 200 households and found that in 120 of them, the woman made the majority of the purchasing decisions. We are interested in the population proportion of households where women make the majority of the purchasing decisions.

27. Identify the following:

1.  $x$  = \_\_\_\_\_
2.  $n$  = \_\_\_\_\_
3.  $P'$  = \_\_\_\_\_

28. Define the random variables  $X$  and  $P'$  in words.

29. Which distribution should you use for this problem?

30. Construct a 95% confidence interval for the population proportion of households where the women make the majority of the purchasing decisions. State the confidence interval, sketch the graph, and calculate the error bound.

31. List two difficulties the company might have in obtaining random results, if this survey were done by email.

*Use the following information to answer the next five exercises:* Of 1,050 randomly selected adults, 360 identified themselves as manual laborers, 280 identified themselves as non-manual wage earners, 250 identified themselves as mid-level managers, and 160 identified themselves as executives. In the survey, 82% of manual laborers preferred trucks, 62% of non-manual wage earners preferred trucks, 54% of mid-level managers preferred trucks, and 26% of executives preferred trucks.

32. We are interested in finding the 95% confidence interval for the percent of executives who prefer trucks. Define random variables  $X$  and  $P'$  in words.

33. Which distribution should you use for this problem?

34. Construct a 95% confidence interval. State the confidence interval, sketch the graph, and calculate the error bound.

35. Suppose we want to lower the sampling error. What is one way to accomplish that?

36. The sampling error given in the survey is  $\pm 2\%$ . Explain what the  $\pm 2\%$  means.

*Use the following information to answer the next five exercises:* A poll of 1,200 voters asked what the most significant issue was in the upcoming election. Sixty-five percent answered the economy. We are interested in the population proportion of voters who feel the economy is the most important.

37. Define the random variable  $X$  in words.

38. Define the random variable  $P'$  in words.

39. Which distribution should you use for this problem?

40. Construct a 90% confidence interval, and state the confidence interval and the error bound.

41. What would happen to the confidence interval if the level of confidence were 95%?

*Use the following information to answer the next 16 exercises:* The Ice Chalet offers dozens of different beginning ice-skating classes. All of the class names are put into a bucket. The 5 P.M., Monday night, ages 8 to 12, beginning ice-skating class was picked. In that class were 64 girls and 36 boys. Suppose that we are interested in the true proportion of girls, ages 8 to 12, in all beginning ice-skating classes at the Ice Chalet. Assume that the children in the selected class are a random sample of the population.

42. What is being counted?

43. In words, define the random variable  $X$ .

44. Calculate the following:

1.  $x =$  \_\_\_\_\_
2.  $n =$  \_\_\_\_\_
3.  $P' =$  \_\_\_\_\_

45. State the estimated distribution of  $X$ .  $X \sim$  \_\_\_\_\_

46. Define a new random variable  $P'$ . What is  $P'$  estimating?

47. In words, define the random variable  $P'$ .

48. Construct a 95% confidence interval for the true proportion of girls in the ages 8 to 12 beginning ice-skating classes at the Ice Chalet.

49. How much area is in both tails (combined)?


50. How much area is in each tail?

51. Calculate the following:

1. lower limit
2. upper limit
3. error bound

52. The 95% confidence interval is \_\_\_\_\_.

53. Fill in the blanks on the graph with the areas, upper and lower limits of the confidence interval, and the sample proportion.

 Normal distribution curve with two vertical upward lines from the x-axis to the curve. The confidence interval is between these two lines. The residual areas are on either side.

**Figure 6.8.2**

54. In one complete sentence, explain what the interval means.

55. Using the same  $P'$  and level of confidence, suppose that  $n$  were increased to 200. Would the error bound become larger or smaller? How do you know?

56. Using the same  $P'$  and  $n = 100$ , how would the error bound change if the confidence level were increased to 99%? Why?

57. If you decreased the allowable error bound, why would the minimum sample size increase (keeping the same level of confidence)?

*Use the following information to answer the next five exercises:* The standard deviation of the weights of elephants is known to be approximately 15 pounds. We wish to construct a 95% confidence interval for the mean weight of newborn elephant calves. Fifty newborn elephants are weighed. The sample mean is 244 pounds. The sample standard deviation is 11 pounds.

58. Identify the following:

1.  $\bar{x} =$  \_\_\_\_\_
2.  $\sigma =$  \_\_\_\_\_
3.  $n =$  \_\_\_\_\_

59. In words, define the random variables  $X$  and  $\bar{x}$ .

60. Which distribution should you use for this problem?

61. Construct a 95% confidence interval for the population mean weight of newborn elephants. State the confidence interval, sketch the graph, and calculate the error bound.

62. What will happen to the confidence interval obtained, if 500 newborn elephants are weighed instead of 50? Why?

*Use the following information to answer the next seven exercises:* The U.S. Census Bureau conducts a study to determine the time needed to complete the short form. The Bureau surveys 200 people. The sample mean is 8.2 minutes. There is a known standard deviation of 2.2 minutes. The population distribution is assumed to be normal.

63. Identify the following:

1.  $\bar{x} =$  \_\_\_\_\_
2.  $\sigma =$  \_\_\_\_\_
3.  $n =$  \_\_\_\_\_

64. In words, define the random variables  $X$  and  $\bar{x}$ .

65. Which distribution should you use for this problem?

66. Construct a 90% confidence interval for the population mean time to complete the forms. State the confidence interval, sketch the graph, and calculate the error bound.

67. If the Census wants to increase its level of confidence and keep the error bound the same by taking another survey, what changes should it make?

68. If the Census did another survey, kept the error bound the same, and surveyed only 150 people instead of 200, what would happen to the level of confidence? Why?

69. Suppose the Census needed to be 99% confident of the population mean length of time. Would the Census have to survey more people? Why or why not?

*Use the following information to answer the next ten exercises:* A sample of 20 heads of lettuce was selected. Assume that the population distribution of head weight is normal. The weight of each head of lettuce was then recorded. The mean weight was 2.2 pounds with a standard deviation of 0.1 pounds. The population standard deviation is known to be 0.2 pounds.

70. Identify the following:

1.  $\bar{x}$  = \_\_\_\_\_
2.  $\sigma$  = \_\_\_\_\_
3.  $n$  = \_\_\_\_\_

71. In words, define the random variable  $X$ .

72. In words, define the random variable  $\bar{x}$ .

73. Which distribution should you use for this problem?

74. Construct a 90% confidence interval for the population mean weight of the heads of lettuce. State the confidence interval, sketch the graph, and calculate the error bound.

75. Construct a 95% confidence interval for the population mean weight of the heads of lettuce. State the confidence interval, sketch the graph, and calculate the error bound.

76. In complete sentences, explain why the confidence interval in Question #75 is larger than in Question #74.

77. In complete sentences, give an interpretation of what the interval in Question #75 means.

78. What would happen if 40 heads of lettuce were sampled instead of 20, and the error bound remained the same?

79. What would happen if 40 heads of lettuce were sampled instead of 20, and the confidence level remained the same?

*Use the following information to answer the next 14 exercises:* The mean age for all Foothill College students for a recent Fall term was 33.2. The population standard deviation has been pretty consistent at 15. Suppose that twenty-five Winter students were randomly selected. The mean age for the sample was 30.4. We are interested in the true mean age for Winter Foothill College students. Let  $X$  = the age of a Winter Foothill College student.

80.  $\bar{x}$  = \_\_\_\_\_

81.  $n$  = \_\_\_\_\_

82. \_\_\_\_\_ = 15

83. In words, define the random variable  $\bar{x}$ .

84. What is  $\bar{x}$  estimating?

85. Is  $\sigma_x$  known?

86. As a result of your answer to Question #83, state the exact distribution you will use for calculating the confidence interval.

*Construct a 95% confidence interval for the true mean age of Winter Foothill College students by working out then answering the next seven exercises.*

87. How much area is in both tails (combined)?  $\alpha$  = \_\_\_\_\_


88. How much area is in each tail?  $\frac{\alpha}{2}$  = \_\_\_\_\_

89. Identify the following specifications:

1. lower limit
2. upper limit
3. error bound

90. The 95% confidence interval is: \_\_\_\_\_.

91. Fill in the blanks on the graph with the areas, upper and lower limits of the confidence interval, and the sample mean.

 Normal distribution curve with two vertical upward lines from the x-axis to the curve. The confidence interval is between these two lines. The residual areas are on either side.

**Figure 6.8.3**

92. In one complete sentence, explain what the interval means.

93. Using the same mean, standard deviation, and level of confidence, suppose that  $n$  were 69 instead of 25. Would the error bound become larger or smaller? How do you know?

94. Using the same mean, standard deviation, and sample size, how would the error bound change if the confidence level were reduced to 90%? Why?
95. Find the value of the sample size needed to if the confidence interval is 90% that the sample proportion and the population proportion are within 4% of each other. The sample proportion is 0.60. Note: Round all fractions up for  $n$ .
96. Find the value of the sample size needed to if the confidence interval is 95% that the sample proportion and the population proportion are within 2% of each other. The sample proportion is 0.650. Note: Round all fractions up for  $n$ .
97. Find the value of the sample size needed to if the confidence interval is 95% that the sample proportion and the population proportion are within 5% of each other. The sample proportion is 0.70. Note: Round all fractions up for  $n$ .
98. Find the value of the sample size needed to if the confidence interval is 90% that the sample proportion and the population proportion are within 1% of each other. The sample proportion is 0.50. Note: Round all fractions up for  $n$ .
99. Find the value of the sample size needed to if the confidence interval is 95% that the sample proportion and the population proportion are within 2% of each other. The sample proportion is 0.65. Note: Round all fractions up for  $n$ .
100. Find the value of the sample size needed to if the confidence interval is 95% that the sample proportion and the population proportion are within 4% of each other. The sample proportion is 0.45. Note: Round all fractions up for  $n$ .
101. Find the value of the sample size needed to if the confidence interval is 90% that the sample proportion and the population proportion are within 2% of each other. The sample proportion is 0.3. Note: Round all fractions up for  $n$ .

### 6.3 A Confidence Interval for a Population Standard Deviation Unknown, Small Sample Case

102. In six packages of “The Flintstones® Real Fruit Snacks” there were five Bam-Bam snack pieces. The total number of snack pieces in the six bags was 68. We wish to calculate a 95% confidence interval for the population proportion of Bam-Bam snack pieces.

1. Define the random variables  $X$  and  $P'$  in words.
2. Which distribution should you use for this problem? Explain your choice
3. Calculate  $P'$ .
4. Construct a 95% confidence interval for the population proportion of Bam-Bam snack pieces per bag.
  1. State the confidence interval.
  2. Sketch the graph.
  3. Calculate the error bound.
5. Do you think that six packages of fruit snacks yield enough data to give accurate results? Why or why not?

103. A random survey of enrollment at 35 community colleges across the United States yielded the following figures: 6,414; 1,550; 2,109; 9,350; 21,828; 4,300; 5,944; 5,722; 2,825; 2,044; 5,481; 5,200; 5,853; 2,750; 10,012; 6,357; 27,000; 9,414; 7,681; 3,200; 17,500; 9,200; 7,380; 18,314; 6,557; 13,713; 17,768; 7,493; 2,771; 2,861; 1,263; 7,285; 28,165; 5,080; 11,622. Assume the underlying population is normal.

1.
  - $\bar{x}$  = \_\_\_\_\_
  - $s_x$  = \_\_\_\_\_
  - $n$  = \_\_\_\_\_
  - $n - 1$  = \_\_\_\_\_
2. Define the random variables  $X$  and  $\bar{x}$  in words.
3. Which distribution should you use for this problem? Explain your choice.
4. Construct a 95% confidence interval for the population mean enrollment at community colleges in the United States.
  - State the confidence interval.
  - Sketch the graph.
5. What will happen to the error bound and confidence interval if 500 community colleges were surveyed? Why?

104. Suppose that a committee is studying whether or not there is waste of time in our judicial system. It is interested in the mean amount of time individuals waste at the courthouse waiting to be called for jury duty. The committee randomly surveyed 81 people who recently served as jurors. The sample mean wait time was eight hours with a sample standard deviation of four hours.

1.
  - $\bar{x}$  = \_\_\_\_\_

- $s_x =$  \_\_\_\_\_
- $n =$  \_\_\_\_\_
- $n - 1 =$  \_\_\_\_\_

2. Define the random variables  $X$  and  $\bar{x}$  in words.
3. Which distribution should you use for this problem? Explain your choice.
4. Construct a 95% confidence interval for the population mean time wasted.
  - State the confidence interval.
  - Sketch the graph.
5. Explain in a complete sentence what the confidence interval means.

**105.** A pharmaceutical company makes tranquilizers. It is assumed that the distribution for the length of time they last is approximately normal. Researchers in a hospital used the drug on a random sample of nine patients. The effective period of the tranquilizer for each patient (in hours) was as follows: 2.7; 2.8; 3.0; 2.3; 2.3; 2.2; 2.8; 2.1; and 2.4.

1. ◦  $\bar{x} =$  \_\_\_\_\_  
 ◦  $s_x =$  \_\_\_\_\_  
 ◦  $n =$  \_\_\_\_\_  
 ◦  $n - 1 =$  \_\_\_\_\_
2. Define the random variable  $X$  in words.
3. Define the random variable  $\bar{x}$  in words.
4. Which distribution should you use for this problem? Explain your choice.
5. Construct a 95% confidence interval for the population mean length of time.
  - State the confidence interval.
  - Sketch the graph.
6. What does it mean to be “95% confident” in this problem?

**106.** Suppose that 14 children, who were learning to ride two-wheel bikes, were surveyed to determine how long they had to use training wheels. It was revealed that they used them an average of six months with a sample standard deviation of three months. Assume that the underlying population distribution is normal.

1. ◦  $\bar{x} =$  \_\_\_\_\_  
 ◦  $s_x =$  \_\_\_\_\_  
 ◦  $n =$  \_\_\_\_\_  
 ◦  $n - 1 =$  \_\_\_\_\_
2. Define the random variable  $X$  in words.
3. Define the random variable  $\bar{x}$  in words.
4. Which distribution should you use for this problem? Explain your choice.
5. Construct a 99% confidence interval for the population mean length of time using training wheels.
  - State the confidence interval.
  - Sketch the graph.
6. Why would the error bound change if the confidence level were lowered to 90%?

**107.** The Federal Election Commission (FEC) collects information about campaign contributions and disbursements for candidates and political committees each election cycle. A political action committee (PAC) is a committee formed to raise money for candidates and campaigns. A Leadership PAC is a PAC formed by a federal politician (senator or representative) to raise money to help other candidates’ campaigns.

The FEC has reported financial information for 556 Leadership PACs that operating during the 2011–2012 election cycle. The following table shows the total receipts during this cycle for a random selection of 30 Leadership PACs.

\$46,500.00	\$0	\$40,966.50	\$105,887.20	\$5,175.00
\$29,050.00	\$19,500.00	\$181,557.20	\$31,500.00	\$149,970.80
\$2,555,363.20	\$12,025.00	\$409,000.00	\$60,521.70	\$18,000.00

\$61,810.20	\$76,530.80	\$119,459.20	\$0	\$63,520.00
\$6,500.00	\$502,578.00	\$705,061.10	\$708,258.90	\$135,810.00
\$2,000.00	\$2,000.00	\$0	\$1,287,933.80	\$219,148.30

**Table 6.8.2**

$$\bar{x} = \$251,854.23$$

$$s = \$521,130.41$$

Use this sample data to construct a 95% confidence interval for the mean amount of money raised by all Leadership PACs during the 2011–2012 election cycle. Use the Student's  $t$ -distribution.

**108.** *Forbes* magazine published data on the best small firms in 2012. These were firms that had been publicly traded for at least a year, have a stock price of at least \$5 per share, and have reported annual revenue between \$5 million and \$1 billion. The table here shows the ages of the corporate CEOs for a random sample of these firms.

48	58	51	61	56
59	74	63	53	50
59	60	60	57	46
55	63	57	47	55
57	43	61	62	49
67	67	55	55	49

**Table 6.8.3**

Use this sample data to construct a 90% confidence interval for the mean age of CEO's for these top small firms. Use the Student's  $t$ -distribution.

**109.** Unoccupied seats on flights cause airlines to lose revenue. Suppose a large airline wants to estimate its mean number of unoccupied seats per flight over the past year. To accomplish this, the records of 225 flights are randomly selected and the number of unoccupied seats is noted for each of the sampled flights. The sample mean is 11.6 seats and the sample standard deviation is 4.1 seats.

1.  $\bar{x} =$  \_\_\_\_\_  
 $s_x =$  \_\_\_\_\_  
 $n =$  \_\_\_\_\_  
 $n - 1 =$  \_\_\_\_\_
2. Define the random variables  $X$  and  $\bar{x}$  in words.
3. Which distribution should you use for this problem? Explain your choice.
4. Construct a 90% confidence interval for the population mean number of unoccupied seats per flight.
  - State the confidence interval.
  - Sketch the graph.

**110.** In a recent sample of 84 used car sales costs, the sample mean was \$6,425 with a standard deviation of \$3,156. Assume the underlying distribution is approximately normal.

1. Which distribution should you use for this problem? Explain your choice.
2. Define the random variable  $\bar{x}$  in words.
3. Construct a 95% confidence interval for the population mean cost of a used car.
  - State the confidence interval.
  - Sketch the graph.
4. Explain what a “95% confidence interval” means for this study.



**111.** Six different national brands of chocolate chip cookies were randomly selected at the supermarket. The grams of fat per serving are as follows: 8; 8; 10; 7; 9; 9. Assume the underlying distribution is approximately normal.

1. Construct a 90% confidence interval for the population mean grams of fat per serving of chocolate chip cookies sold in supermarkets.
  - State the confidence interval.
  - Sketch the graph.
2. If you wanted a smaller error bound while keeping the same level of confidence, what should have been changed in the study before it was done?
3. Go to the store and record the grams of fat per serving of six brands of chocolate chip cookies.
4. Calculate the mean.
5. Is the mean within the interval you calculated in part a? Did you expect it to be? Why or why not?

**112.** A survey of the mean number of cents off that coupons give was conducted by randomly surveying one coupon per page from the coupon sections of a recent San Jose Mercury News. The following data were collected: 20¢; 75¢; 50¢; 65¢; 30¢; 55¢; 40¢; 40¢; 30¢; 55¢; \$1.50; 40¢; 65¢; 40¢. Assume the underlying distribution is approximately normal.

1.
  - $\bar{x} =$  \_\_\_\_\_
  - $s_x =$  \_\_\_\_\_
  - $n =$  \_\_\_\_\_
  - $n - 1 =$  \_\_\_\_\_
2. Define the random variables  $X$  and  $\bar{x}$  in words.
3. Which distribution should you use for this problem? Explain your choice.
4. Construct a 95% confidence interval for the population mean worth of coupons.
  - State the confidence interval.
  - Sketch the graph.
5. If many random samples were taken of size 14, what percent of the confidence intervals constructed should contain the population mean worth of coupons? Explain why.

*Use the following information to answer the next two exercises:* A quality control specialist for a restaurant chain takes a random sample of size 12 to check the amount of soda served in the 16 oz. serving size. The sample mean is 13.30 with a sample standard deviation of 1.55. Assume the underlying population is normally distributed.

**113.** Find the 95% confidence interval for the true population mean for the amount of soda served.

- a. [12.42, 14.18]
- b. [12.32, 14.29]
- c. [12.50, 14.10]
- d. Impossible to determine

## 6.4 A Confidence Interval for A Population Proportion

**114.** Insurance companies are interested in knowing the population percent of drivers who always buckle up before riding in a car.

1. When designing a study to determine this population proportion, what is the minimum number you would need to survey to be 95% confident that the population proportion is estimated to within 0.03?
2. If it were later determined that it was important to be more than 95% confident and a new survey was commissioned, how would that affect the minimum number you would need to survey? Why?

**115.** Suppose that the insurance companies did do a survey. They randomly surveyed 400 drivers and found that 320 claimed they always buckle up. We are interested in the population proportion of drivers who claim they always buckle up.

1.
  - $x =$  \_\_\_\_\_
  - $n =$  \_\_\_\_\_
  - $P' =$  \_\_\_\_\_
2. Define the random variables  $X$  and  $P'$ , in words.
3. Which distribution should you use for this problem? Explain your choice.
4. Construct a 95% confidence interval for the population proportion who claim they always buckle up.

- State the confidence interval.
- Sketch the graph.

5. If this survey were done by telephone, list three difficulties the companies might have in obtaining random results.

**116.** According to a recent survey of 1,200 people, 61% feel that the president is doing an acceptable job. We are interested in the population proportion of people who feel the president is doing an acceptable job.

1. Define the random variables  $X$  and  $P'$  in words.
2. Which distribution should you use for this problem? Explain your choice.
3. Construct a 90% confidence interval for the population proportion of people who feel the president is doing an acceptable job.
  - State the confidence interval.
  - Sketch the graph.

**117.** An article regarding interracial dating and marriage recently appeared in the Washington Post. Of the 1,709 randomly selected adults, 315 identified themselves as Latino, 323 identified themselves as Black, 254 identified themselves as Asian, and 779 identified themselves as White. In this survey, 86% of Black respondents said that they would welcome a White person into their families. Among Asian respondents, 77% would welcome a white person into their families, 71% would welcome a Latino person, and 66% would welcome a Black person.

1. We are interested in finding the 95% confidence interval for the percent of all Black adults who would welcome a White person into their families. Define the random variables  $X$  and  $P'$ , in words.
2. Which distribution should you use for this problem? Explain your choice.
3. Construct a 95% confidence interval.
  - State the confidence interval.
  - Sketch the graph.

**118.** Refer to the information in the prior question.

1. Construct three 95% confidence intervals.
  - percent of all Asians who would welcome a White person into their families.
  - percent of all Asians who would welcome a Latino into their families.
  - percent of all Asians who would welcome a Black person into their families.
2. Even though the three point estimates are different, do any of the confidence intervals overlap? Which?
3. For any intervals that do overlap, in words, what does this imply about the significance of the differences in the true proportions?
4. For any intervals that do not overlap, in words, what does this imply about the significance of the differences in the true proportions?

**119.** Stanford University conducted a study of whether running is healthy for men and women over age 50. During the first eight years of the study, 1.5% of the 451 members of the 50-Plus Fitness Association died. We are interested in the proportion of people over 50 who ran and died in the same eight-year period.

1. Define the random variables  $X$  and  $P'$  in words.
2. Which distribution should you use for this problem? Explain your choice.
3. Construct a 95% confidence interval for the population proportion of people over 50 who ran and died in the same eight-year period.
  - State the confidence interval.
  - Sketch the graph.
4. Explain what a “95% confidence interval” means for this study.

**120.** A telephone poll of 1,000 adult Americans was reported in an issue of Time Magazine. One of the questions asked was “What is the main problem facing the country?” Twenty percent answered “crime.” We are interested in the population proportion of adult Americans who feel that crime is the main problem.

1. Define the random variables  $X$  and  $P'$  in words.
2. Which distribution should you use for this problem? Explain your choice.
3. Construct a 95% confidence interval for the population proportion of adult Americans who feel that crime is the main problem.

- State the confidence interval.
- Sketch the graph.

4. Suppose we want to lower the sampling error. What is one way to accomplish that?

5. The sampling error given by Yankelovich Partners, Inc. (which conducted the poll) is  $\pm 3\%$ . In one to three complete sentences, explain what the  $\pm 3\%$  represents.

**121.** Refer to the previous question. Another question in the poll was “[How much are] you worried about the quality of education in our schools?” Sixty-three percent responded “a lot”. We are interested in the population proportion of adult Americans who are worried a lot about the quality of education in our schools.

1. Define the random variables  $X$  and  $P'$  in words.
2. Which distribution should you use for this problem? Explain your choice.
3. Construct a 95% confidence interval for the population proportion of adult Americans who are worried a lot about the quality of education in our schools.
  - State the confidence interval.
  - Sketch the graph.
4. The sampling error given by Yankelovich Partners, Inc. (which conducted the poll) is  $\pm 3\%$ . In one to three complete sentences, explain what the  $\pm 3\%$  represents.

*Use the following information to answer the next three exercises:* According to a Field Poll, 79% of California adults (actual results are 400 out of 506 surveyed) feel that “education and our schools” is one of the top issues facing California. We wish to construct a 90% confidence interval for the true proportion of California adults who feel that education and the schools is one of the top issues facing California.

**122.** The point estimate for the true population proportion is:

- a. 0.90
- b. 1.27
- c. 0.79
- d. 400

**123.** A 90% confidence interval for the population proportion is \_\_\_\_\_.

- a. [0.761, 0.820]
- b. [0.125, 0.188]
- c. [0.755, 0.826]
- d. [0.130, 0.183]

*Use the following information to answer the next two exercises:* Five hundred and eleven (511) homes in a certain southern California community are randomly surveyed to determine if they meet minimal earthquake preparedness recommendations. One hundred seventy-three (173) of the homes surveyed met the minimum recommendations for earthquake preparedness, and 338 did not.

**124.** Find the confidence interval at the 90% confidence level for the true population proportion of southern California community homes meeting at least the minimum recommendations for earthquake preparedness.

- a. [0.2975, 0.3796]
- b. [0.6270, 0.6959]
- c. [0.3041, 0.3730]
- d. [0.6204, 0.7025]

**125.** The point estimate for the population proportion of homes that do not meet the minimum recommendations for earthquake preparedness is \_\_\_\_\_.

- a. 0.6614
- b. 0.3386
- c. 173
- d. 338

**126.** On May 23, 2013, Gallup reported that of the 1,005 people surveyed, 76% of U.S. workers believe that they will continue working past retirement age. The confidence level for this study was reported at 95% with a  $\pm 3\%$  margin of error.

1. Determine the estimated proportion from the sample.
2. Determine the sample size.
3. Identify  $CL$  and  $\alpha$ .
4. Calculate the error bound based on the information provided.
5. Compare the error bound in part d to the margin of error reported by Gallup. Explain any differences between the values.
6. Create a confidence interval for the results of this study.
7. A reporter is covering the release of this study for a local news station. How should she explain the confidence interval to her audience?

**127.** A national survey of 1,000 adults was conducted on May 13, 2013 by Rasmussen Reports. It concluded with 95% confidence that 49% to 57% of Americans believe that big-time college sports programs corrupt the process of higher education.

1. Find the point estimate and the error bound for this confidence interval using 95% confidence.
2. Can we (with 95% confidence) conclude that more than half of all American adults believe this?
3. Use the point estimate from part a and  $n = 1,000$  to calculate a 90% confidence interval for the proportion of American adults that believe that major college sports programs corrupt higher education.
4. Can we (with 90% confidence) conclude that at least half of all American adults believe this?

**128.** Public Policy Polling recently conducted a survey asking adults across the U.S. about music preferences. When asked, 80 of the 571 participants admitted that they have illegally downloaded music.

1. Create a 99% confidence interval for the true proportion of American adults who have illegally downloaded music.
2. This survey was conducted through automated telephone interviews on May 6 and 7, 2013. The error bound of the survey compensates for sampling error, or natural variability among samples. List some factors that could affect the survey's outcome that are not covered by the margin of error.
3. Without performing any calculations, describe how the confidence interval would change if the confidence level changed from 99% to 90%.

**129.** You plan to conduct a survey on your college campus to learn about the political awareness of students. You want to estimate the true proportion of college students on your campus who voted in the 2012 presidential election with 95% confidence and a margin of error no greater than five percent. How many students must you interview?

**130.** Among various ethnic groups, the standard deviation of heights is known to be approximately three inches. We wish to construct a 95% confidence interval for the mean height of male Swedes. Forty-eight male Swedes are surveyed. The sample mean is 71 inches. The sample standard deviation is 2.8 inches.

1.
  - o  $\bar{x} =$  \_\_\_\_\_
  - o  $\sigma =$  \_\_\_\_\_
  - o  $n =$  \_\_\_\_\_
2. In words, define the random variables  $X$  and  $\bar{x}$ .
3. Which distribution should you use for this problem? Explain your choice.
4. Construct a 95% confidence interval for the population mean height of male Swedes.
  - o State the confidence interval.
  - o Sketch the graph.
5. What will happen to the level of confidence obtained if 1,000 male Swedes are surveyed instead of 48? Why?

**131.** Announcements for 84 upcoming engineering conferences were randomly picked from a stack of IEEE Spectrum magazines. The mean length of the conferences was 3.94 days, with a standard deviation of 1.28 days. Assume the underlying population is normal.

1. In words, define the random variables  $X$  and  $\bar{x}$ .
2. Which distribution should you use for this problem? Explain your choice.
3. Construct a 95% confidence interval for the population mean length of engineering conferences.
  - o State the confidence interval.
  - o Sketch the graph.

132. Suppose that an accounting firm does a study to determine the time needed to complete one person's tax forms. It randomly surveys 100 people. The sample mean is 23.6 hours. There is a known standard deviation of 7.0 hours. The population distribution is assumed to be normal.

1.
  - $\bar{x}$  = \_\_\_\_\_
  - $\sigma$  = \_\_\_\_\_
  - $n$  = \_\_\_\_\_
2. In words, define the random variables  $X$  and  $\bar{x}$ .
3. Which distribution should you use for this problem? Explain your choice.
4. Construct a 90% confidence interval for the population mean time to complete the tax forms.
5. If the firm wished to increase its level of confidence and keep the error bound the same by taking another survey, what changes should it make?
6. If the firm did another survey, kept the error bound the same, and only surveyed 49 people, what would happen to the level of confidence? Why?
7. Suppose that the firm decided that it needed to be at least 95% confident of the population mean length of time to within one hour. How would the number of people the firm surveys change? Why?

133. A sample of 16 small bags of the same brand of candies was selected. Assume that the population distribution of bag weights is normal. The weight of each bag was then recorded. The mean weight was two ounces with a standard deviation of 0.12 ounces. The population standard deviation is known to be 0.1 ounce.

1.
  - $\bar{x}$  = \_\_\_\_\_
  - $\sigma$  = \_\_\_\_\_
  - $s_x$  = \_\_\_\_\_
2. In words, define the random variable  $X$ .
3. In words, define the random variable  $\bar{x}$ .
4. Which distribution should you use for this problem? Explain your choice.
5. Construct a 90% confidence interval for the population mean weight of the candies.
  - State the confidence interval.
  - Sketch the graph.
6. Construct a 99% confidence interval for the population mean weight of the candies.
  - State the confidence interval.
  - Sketch the graph.
  - Calculate the error bound.
7. In complete sentences, explain why the confidence interval in part f is larger than the confidence interval in part e.
8. In complete sentences, give an interpretation of what the interval in part f means.

134. A camp director is interested in the mean number of letters each child sends during his or her camp session. The population standard deviation is known to be 2.5. A survey of 20 campers is taken. The mean from the sample is 7.9 with a sample standard deviation of 2.8.

1.
  - $\bar{x}$  = \_\_\_\_\_
  - $\sigma$  = \_\_\_\_\_
  - $n$  = \_\_\_\_\_
2. Define the random variables  $X$  and  $\bar{x}$  in words.
3. Which distribution should you use for this problem? Explain your choice.
4. Construct a 90% confidence interval for the population mean number of letters campers send home.
  - State the confidence interval.
  - Sketch the graph.
5. What will happen to the error bound and confidence interval if 500 campers are surveyed? Why?

135. What is meant by the term "90% confident" when constructing a confidence interval for a mean?

1. If we took repeated samples, approximately 90% of the samples would produce the same confidence interval.

2. If we took repeated samples, approximately 90% of the confidence intervals calculated from those samples would contain the sample mean.
3. If we took repeated samples, approximately 90% of the confidence intervals calculated from those samples would contain the true value of the population mean.
4. If we took repeated samples, the sample mean would equal the population mean in approximately 90% of the samples.

**136.** The Federal Election Commission collects information about campaign contributions and disbursements for candidates and political committees each election cycle. During the 2012 campaign season, there were 1,619 candidates for the House of Representatives across the United States who received contributions from individuals. The table below shows the total receipts from individuals for a random selection of 40 House candidates rounded to the nearest \$100. The standard deviation for this data to the nearest hundred is  $\sigma = \$909,200$ .

\$3,600	\$1,243,900	\$10,900	\$385,200	\$581,500
\$7,400	\$2,900	\$400	\$3,714,500	\$632,500
\$391,000	\$467,400	\$56,800	\$5,800	\$405,200
\$733,200	\$8,000	\$468,700	\$75,200	\$41,000
\$13,300	\$9,500	\$953,800	\$1,113,500	\$1,109,300
\$353,900	\$986,100	\$88,600	\$378,200	\$13,200
\$3,800	\$745,100	\$5,800	\$3,072,100	\$1,626,700
\$512,900	\$2,309,200	\$6,600	\$202,400	\$15,800

**Table 6.8.4**

1. Find the point estimate for the population mean.
2. Using 95% confidence, calculate the error bound.
3. Create a 95% confidence interval for the mean total individual contributions.
4. Interpret the confidence interval in the context of the problem.

**137.** The American Community Survey (ACS), part of the United States Census Bureau, conducts a yearly census similar to the one taken every ten years, but with a smaller percentage of participants. The most recent survey estimates with 90% confidence that the mean household income in the U.S. falls between \$69,720 and \$69,922. Find the point estimate for mean U.S. household income and the error bound for mean U.S. household income.

**138.** The average height of young adult males has a normal distribution with standard deviation of 2.5 inches. You want to estimate the mean height of students at your college or university to within one inch with 95% confidence. How many male students must you measure?

**139.** If the confidence interval is change to a higher probability, would this cause a lower, or a higher, minimum sample size?

**140.** If the tolerance is reduced by half, how would this affect the minimum sample size?

**141.** If the value of  $P$  is reduced, would this necessarily reduce the sample size needed?

**142.** A company has been running an assembly line with 97.42% of the products made being acceptable. Then, a critical piece broke down. After the repairs the decision was made to see if the number of defective products made was still close enough to the long standing production quality. Samples of 500 pieces were selected at random, and the defective rate was found to be 0.025%.

1. Is this sample size adequate to claim the company is checking within the 90% confidence interval?
2. The 95% confidence interval?

---

6.8: Chapter 6 Homework is shared under a [not declared](#) license and was authored, remixed, and/or curated by LibreTexts.