

**LESSON 24: EXERCISES**

- 1) 100 adult Fredonian women are randomly sampled, and they have their heights measured.  $\bar{x} = 63$  inches,  $s = 6$  inches, and  $s^2 = 36$  square inches.
- a) What is a point estimate for the **population mean** of heights of adult Fredonian women?
  - b) What is a point estimate for the **population standard deviation** of heights of adult Fredonian women?
  - c) What is a point estimate for the **population variance** of heights of adult Fredonian women?
- 2) 2000 registered American voters are randomly sampled and interviewed. 1100 of them approve of Senator Smith.
- a) Find  $\hat{p}$ , the **sample proportion** of the interviewed voters who approve of Senator Smith.
  - b) What is a point estimate for the **population proportion** of registered American voters who approve of Senator Smith?
- 3) Gamblers play a new game at a casino. After 5000 rounds of play, the gamblers have won 2000 of them.
- a) Find  $\hat{p}$ , the **sample proportion** of gambler wins among the 5000 rounds of play.
  - b) What is a point estimate for the **probability** that a gambler wins the game in one round of play?

**LESSON 25: EXERCISES**

- 1) A **fair coin** may come up heads 49 times in 100 flips. What kind of error does this represent?
- 2) Let  $\mu$  be the population mean height of adult Fredonian men. Based on a random sample of adult Fredonian men, we obtain (65 inches, 71 inches) as a 95% confidence interval (CI) for  $\mu$ .
- a) What is the **lower limit** of the CI?
  - b) What is the **upper limit** of the CI?
  - c) What is the **sample mean**  $\bar{x}$ ?
  - d) What is the **margin of error**  $E$  for the CI? Show three different ways of getting  $E$ .
  - e) **Write the CI** in terms of the values of  $\bar{x}$  and  $E$ .
  - f) **Interpret** the CI.
- 3) A lecture class takes an exam. We want an interval estimate for  $\mu$ , the **population mean** of exam scores in the class. A random **sample** of five exams is selected and graded. The sample mean  $\bar{x}$  is 65 points. The margin of error  $E$  for a 90% confidence interval (CI) for  $\mu$  is 7 points.
- a) What is the **lower limit** of the CI?
  - b) What is the **upper limit** of the CI?
  - c) **Write the CI** in terms of the values of  $\bar{x}$  and  $E$ .
  - d) **Interpret** the CI.
  - e) Would a **95% CI** be wider or smaller than the 90% CI for  $\mu$ ?
- 4) What is  $\alpha$  for a 90% CI?
- 5) What is  $\alpha$  for an 80% CI?
- 6) What is  $\alpha$  for a 99% CI?

**LESSON 26: EXERCISES**

- 1) Consider the standard normal ( $z$ ) distribution.
  - a) What is the **mean**?
  - b) What is the **standard deviation**?
  - c) Yes or No: Is the distribution **symmetric** about its mean?
- 2) Consider any of the  $t$  distributions.
  - a) What is the **mean**?
  - b) Is the **standard deviation** equal to 1, less than 1, or greater than 1?
  - c) Yes or No: Is the distribution **symmetric** about its mean?
  - d) As the number of degrees of freedom ( $df$ ) increases, what distribution will the  $t$  distributions approach?
- 3) Consider any of the  $\chi^2$  distributions.
  - a) Yes or No: Is the **mean** equal to 0?
  - b) Yes or No: Is the distribution **symmetric** about its mean?
  - c) As the number of degrees of freedom ( $df$ ) increases, what kind of distribution will the  $\chi^2$  distributions approach?
- 4) In most basic applications, how many degrees of freedom ( $df$ ) do we use for  $t$  and  $\chi^2$  distributions if the sample size is ...
  - a)  $n = 10$
  - b)  $n = 25$

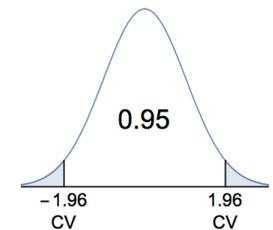
**LESSON 27: EXERCISES**

None, but familiarize yourself with the terminology and concepts.

**LESSON 28: EXERCISES**

- 1) A standardized high school test was designed to have mean 1000 points and population SD 100 points. New teaching methods were then used in high schools. We take a random sample of 50 test results this year, and the sample mean is 970 points. Assume that the population SD is 100 points. You will find a 95% confidence interval (CI) for the population mean of test scores this year.

Use these hints about the  $z$  distribution:

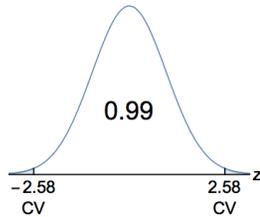


- a) Why do the methods of this Lesson apply to this problem?
- b) **Write the 95% CI** in the form  $\mu = \bar{x} \pm E$ . Clearly show how  $E$  is obtained by plugging into an appropriate formula.
- c) **Write the 95% CI** in the form (lower limit, upper limit).
- d) **Interpret** the CI.
- e) Based on this analysis, is there sufficient evidence against the claim that the population mean of test scores this year is 1000 points?

(Exercises) E.30

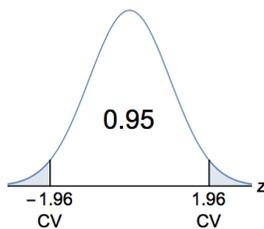
- 2) We will repeat Exercise 1, except that you will find a 99% confidence interval (CI) for the population mean of test scores this year.

Use these hints about the  $z$  distribution:



- a) (Skip this; we did this in Exercise 1.)
  - b) **Write the 99% CI** in the form  $\mu = \bar{x} \pm E$ . Clearly show how  $E$  is obtained by plugging into an appropriate formula.
  - c) **Write the 99% CI** in the form (lower limit, upper limit).
  - d) **Interpret** the CI.
  - e) Based on this analysis, is there sufficient evidence against the claim that the population mean of test scores this year is 1000 points?
- 3) The organization that creates the standardized test in Exercises 1 and 2 would like to know the population mean of test scores this year. Assume that the population SD is 100 points; let's assume that the sample SD will also be 100 points. **Find the required sample size  $n$**  that would give us a margin of error of 5 points for a 95% confidence interval (CI) for the population mean. Clearly show how this is obtained by plugging into an appropriate formula. **Interpret** your result, as in the notes.

Use these hints about the  $z$  distribution:

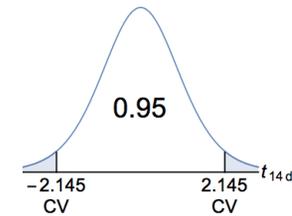


(Exercises) E.31

## LESSON 29: EXERCISES

- 1) A random sample of 15 employees at a large company are surveyed about their incomes. Assume that incomes at the company are approximately normally distributed. The sample mean income is \$60,000, and the sample SD is \$25,000. You will find a 95% confidence interval (CI) for the population mean income at the company.

Use these hints about the  $t$  distribution on 14 degrees of freedom (df):



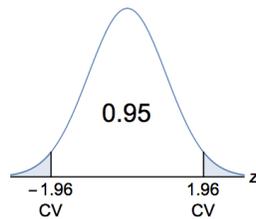
- a) Why do the methods of this Lesson apply to this problem?
- b) **Write the 95% CI** in the form  $\mu = \bar{x} \pm E$ . Clearly show how  $E$  is obtained by plugging into an appropriate formula.
- c) **Write the 95% CI** in the form (lower limit, upper limit).
- d) **Interpret** the CI.

## LESSON 30: EXERCISES

- 1) A magician's coin is flipped 200 times. It comes up heads 110 times. You will find a 95% confidence interval (CI) for the probability that the coin comes up heads on a flip.

Round off values of  $\hat{p}$ ,  $\hat{q}$ , and  $E$  to three decimal places.

Use these hints about the  $z$  distribution:



- a) Find the sample proportion of heads,  $\hat{p}$ .
- b) Find the sample proportion of tails,  $\hat{q}$ .
- c) **Verify** that normal approximations are appropriate in this problem.
- d) **Write the 95% CI** in the form  $p = \hat{p} \pm E$ . Clearly show how  $E$  is obtained by plugging into an appropriate formula.
- e) **Write the 95% CI** in the form (lower limit, upper limit).
- f) **Interpret** the CI.
- g) Based on this analysis, is there sufficient evidence against the claim that the coin is fair?
- h) We want to know the probability that the coin comes up heads on a flip. **Find the required sample size  $n$**  that would give us a margin of error of 0.05 for a 95% confidence interval (CI) for this probability. Clearly show how this is obtained by plugging into an appropriate formula (the one giving us a conservative estimate).
- i) Is your answer to h) more than, or less than, 200 [flips]? Compare the margin of error in h) with the one from d).

## LESSON 31: EXERCISES

- 1) A wrench produced by a company is supposed to have size 1 inch. The wrench sizes produced by the company are approximately **normally distributed**. We randomly select 25 wrenches. The sample variance is 0.0025 square inches.

- a) We will find confidence intervals (CIs) for the population variance and SD of the wrench sizes produced by the company. Why do the methods of this Lesson apply to this problem?
- b) **Find** a 95% confidence interval (CI) for the population variance of the wrench sizes produced by the company. Clearly show how the limits are obtained by plugging into an appropriate formula. **Write** the CI in either the form lower limit  $< \sigma^2 <$  upper limit or (lower limit, upper limit). **Interpret** the CI.
- c) **Also find** a 95% confidence interval (CI) for the population SD of the wrench sizes produced by the company. Clearly show how the limits are obtained by plugging into an appropriate formula. **Write** the CI in either the form lower limit  $< \sigma <$  upper limit or (lower limit, upper limit). **Interpret** the CI.

Use these hints about the  $\chi^2$  distribution on 24 degrees of freedom (df):

