

9.2 Exercises

Basic Concepts

1. What is an estimator? Give an example.
2. What three questions should be asked when considering a random variable?
3. Explain the difference between a biased estimator and an unbiased estimator.
4. Give two examples of estimators that are unbiased.
5. Is an unbiased estimator always closer to the parameter being estimated than a biased estimator? Explain.
6. What is the standard error of the mean and what does it indicate?
7. What are two desirable characteristics of the sample mean?
8. Explain the Central Limit Theorem.
9. What effect does increasing the sample size have on the accuracy of an estimate?

Exercises

10. Suppose that the length of babies born in a local hospital has a mean of 20 inches and a standard deviation of 1 inch. Calculate the mean and the standard deviation of the sample mean for each of the following sample sizes. (Assume the population is infinite.)
 - a. $n = 35$
 - b. $n = 50$
 - c. $n = 75$
 - d. What happens to the size of the standard deviation of the sample mean as the sample size increases?
11. Suppose that the average ages of employees at the credit union where you bank has a mean of 50 years and a standard deviation of 10 years. Calculate the mean and standard error for each of the following sample sizes (assume the population is infinite).
 - a. $n = 40$
 - b. $n = 55$
 - c. $n = 100$
 - d. What happens to the size of the standard error as the sample size increases?
12. Suppose that the average time teenagers spend on social media per day is a normally distributed population with a mean of 8 hours (480 minutes) and a standard deviation of 2 hours (120 minutes). If \bar{x} is the average (in minutes) of a sample of 50, find the following probabilities.
 - a. $P(\bar{x} \leq 500)$
 - b. $P(\bar{x} \geq 450)$
 - c. $P(423 \leq \bar{x} \leq 514)$
 - d. $P(400 \leq \bar{x} \leq 496)$

- 13.** A company fills bags with fertilizer for retail sale. The weights of the bags of fertilizer have a normal distribution with a mean weight of 15 lb and standard deviation of 1.70 lb.
- What is the probability that a randomly selected bag of fertilizer will weigh between 14 and 16 pounds?
 - If 35 bags of fertilizer are randomly selected, find the probability that the average weight of the 35 bags will be between 14 and 16 pounds.
- 14.** A travel agency conducted a survey of the prices charged by ocean cruise ship lines and determined they were approximately normally distributed with a mean of \$210 per day (base ticket price and onboard spending) and a standard deviation of \$20 per day.
- If an ocean cruise ship line is chosen at random, find the probability that it will charge less than \$175 per day.
 - What is the probability that the average charge for a randomly selected sample of 35 ocean cruise ship lines will be less than \$175 per day?
- 15.** The turkeys found in a particular county have an average weight of 15.6 pounds with a standard deviation of 4.00 pounds. Forty-five turkeys are randomly selected for a county fair.
- Find the probability that the average weight of the turkeys will be less than 14.5 pounds.
 - What is the probability that the average weight of the turkeys will be more than 17 pounds?
 - Find the probability that the average weight of the turkeys will be between 13 and 18 pounds.
- 16.** The average score for a water safety instructor (WSI) exam is 75 with a standard deviation of 12. Fifty scores for the WSI exam are randomly selected.
- Find the probability that the average of the fifty scores is at least 80.
 - Find the probability that the average of the fifty scores is at most 70.
 - Find the probability that the average of the fifty scores is between 72 and 78.
- 17.** A college food service buys frozen fish in boxes labeled 10 pounds. The true average weight of the boxes is 8 pounds with a standard deviation of 2 pounds. The food service director suspects that the boxes do not contain as much fish as advertised. He decides to inspect 40 boxes from the next shipment. If the average weight is less than 10 pounds he will reject the entire shipment. Find the probability that the food service director will not reject the shipment.