Solution

According to the table, we see that to be 99% confident that the sample standard deviation will be within 5% of the true population standard deviation, the minimum sample size required is 1337.

Minimum Sample Sizes for Estimating Standard Deviation

s is Within this Percentage of the Value of σ	Minimum Sample Size Needed for 95% Level of Confidence	Minimum Sample Size Needed for 99% Level of Confidence
1%	19,206	33,220
5%	769	1337
10%	193	337
20%	49	86
30%	22	39
40%	13	23
50%	9	15

Therefore, the market researcher must include at least 1337 home prices for her study to have the level of precision that she needs.

8.5 Section Exercises

Note: *For all exercises in this section, you may assume that the requirements mentioned in this section are met; namely, all samples of a given size have an equal probability of being chosen and the population distribution is approximately normal.*

Point Estimates for Population Variances and Population Standard Deviations

Find each specified point estimate.

1. What is the best point estimate for the population standard deviation if the sample standard deviation is 3.5?
2. What is the best point estimate for the population standard deviation if the sample variance is 25?
3. Consider a sample of caps for three-inch pipes. Their diameters are measured and found to have a variance of 0.12. Give a point estimate for the population variance in diameter lengths of the caps.
4. For a random sample of 112 largemouth bass, the mean weight was found to be 2.7 pounds with a standard deviation of 0.8 pounds. Give a point estimate for the population variance of weights of largemouth bass.

Critical Values for Confidence Intervals for Population Variances

Determine the critical values for the left and right endpoints of a confidence interval for the population variance using the given information.

5. $n = 25, \quad \alpha = 0.05$
6. $n = 17, \quad \alpha = 0.10$
7. $n = 22, \quad c = 0.90$
8. $n = 10, \quad c = 0.95$

Confidence Intervals for Population Variances and Population Standard Deviations

Construct a confidence interval for the population variance at the given level of confidence.

9. $n = 12, \quad s^2 = 19.2, \quad c = 0.95$

10. $n = 20, \quad s^2 = 14.2, \quad c = 0.99$

11. $n = 23, \quad s^2 = 11.9, \quad c = 0.99$

12. $n = 29, \quad s^2 = 26.5, \quad c = 0.98$

Construct a confidence interval for the population standard deviation at the given level of confidence.

13. $n = 63, \quad s = 2.4, \quad c = 0.99$

14. $n = 41, \quad s = 1.2, \quad c = 0.95$

15. $n = 50, \quad s = 6.8, \quad c = 0.98$

16. $n = 56, \quad s = 3.5, \quad c = 0.99$

Construct and interpret each specified confidence interval.

17. A commercial grocer is testing the variance in the weights of packages of strawberries. The weights of the packages are measured in ounces, and a random sample of 15 packages of strawberries has a variance of 3.80. Construct and interpret a 90% confidence interval for the variance in weights of all packages of strawberries.

18. A tire manufacturer is testing the tire pressure in its new line of SUV tires. A random sample of 10 tire pressure readings, measured in pounds per square inch (psi), yields a variance of 31.8. Construct and interpret a 95% confidence interval for the variance in tire pressures for all new SUV tires produced by the manufacturer.

19. Speeds were measured in miles per hour (mph) for a random sample of 26 fastballs thrown by major league pitchers, and the variance in speed was 21.5. Construct and interpret a 98% confidence interval for the variance in speeds of all fastballs thrown by major league pitchers.

20. A company is testing 63 randomly selected compact fluorescent light bulbs to see how long they last. The study results show a standard deviation of 121.4 hours. Construct and interpret a 99% confidence interval for the true standard deviation for the lifetimes of the compact fluorescent light bulbs.

21. A transit system at a large theme park is testing how long it takes for a driver to complete one circuit. A sample of 40 completed circuits shows a standard deviation of 7.7 minutes. Construct and interpret a 98% confidence interval for the standard deviation in completion times for all circuits driven.

22. After testing 31 pairs of noise-reducing earmuffs, the standard deviation of the reductions in noise levels is calculated to be 0.9 decibels. Construct and interpret a 95% confidence interval for the standard deviation of noise level reductions produced by all pairs of this type of noise-reducing earmuffs.

23. Consider the following sample data.

3.2	3.6	2.9	3.0	3.0
3.1	3.2	3.3	2.9	3.3
2.9	3.1	3.4	3.3	3.0

Build and interpret a 99% confidence interval for the population variance.

24. The following sample of weights (in ounces) was taken from 14 boxes of crackers randomly selected from the assembly line.

16.87	16.92	17.01	16.98	16.99	16.92	16.91
17.00	17.01	16.96	16.95	16.94	17.00	16.92

Build and interpret a 98% confidence interval for the population variance for the weights of all boxes of crackers that come off the assembly line.

25. The weights of 89 randomly selected new truck engines from one factory were found to have a standard deviation of 1.59 pounds. Construct and interpret a 95% confidence interval for the population standard deviation of the weights of all new truck engines in this particular factory.

26. A butcher uses a machine that packages ground beef in one-pound portions. A sample of 52 packages of ground beef has a standard deviation of 0.2 pounds. Construct and interpret a 99% confidence interval to estimate the standard deviation of the weights of all packages prepared by the machine.

Minimum Sample Sizes for Estimating Population Variances and Population Standard Deviations

Find the minimum sample size needed to construct a confidence interval with the desired characteristics.

27. Find the minimum sample size needed to be 95% confident that the sample variance is within 20% of the population variance.

28. Find the minimum sample size needed to be 99% confident that the sample variance is within 5% of the population variance.

29. Find the minimum sample size needed to be 99% confident that the sample standard deviation is within 10% of the population standard deviation.

30. Find the minimum sample size needed to be 95% confident that the sample standard deviation is within 1% of the population standard deviation.