9.5 Section Exercises

Note: *For all exercises in this section, you may assume that the requirements mentioned in this section are met; namely, the samples are independent, simple random samples, and both population distributions are approximately normal.*

Point Estimates for Ratios of Two Population Variances

Calculate the point estimate for the ratio of the population variances.

1. $n_1 = 13, \quad n_2 = 17, \quad s_1^2 = 3.467, \quad s_2^2 = 2.903$

2. $n_1 = 23, \quad n_2 = 20, \quad s_1^2 = 0.689, \quad s_2^2 = 0.542$

3. $n_1 = 8, \quad n_2 = 10, \quad s_1^2 = 12.103, \quad s_2^2 = 10.874$

4. $n_1 = 26, \quad n_2 = 28, \quad s_1^2 = 1.472, \quad s_2^2 = 1.327$

Critical Values for Confidence Intervals for Ratios of Two Population Variances

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

5. $n_1 = 18, \quad n_2 = 23, \quad s_1^2 = 12.470, \quad s_2^2 = 12.205, \quad$ 95% level of confidence

6. $n_1 = 21, \quad n_2 = 20, \quad s_1^2 = 134.943, \quad s_2^2 = 125.908, \quad \alpha = 0.10$

7. $n_1 = 9, \quad n_2 = 9, \quad s_1^2 = 0.974, \quad s_2^2 = 0.903, \quad c = 0.95$

8. $n_1 = 18, \quad n_2 = 19, \quad s_1^2 = 20.461, \quad s_2^2 = 18.321, \quad c = 0.90$

9. $n_1 = 12, \quad n_2 = 13, \quad s_1^2 = 5.100, \quad s_2^2 = 5.098, \quad \alpha = 0.01$

10. $n_1 = 7, \quad n_2 = 6, \quad s_1^2 = 4.110, \quad s_2^2 = 3.873, \quad$ 99% level of confidence

Confidence Intervals for Ratios of Two Population Variances

Construct a confidence interval for the ratio of the two population variances using the given information.

11. $\dfrac{s_1^2}{s_2^2} = 1.23, \quad F_{\alpha/2} = 2.4499, \quad F_{(1-\alpha/2)} = 0.3556$

12. $\dfrac{s_1^2}{s_2^2} = 6.31, \quad F_{\alpha/2} = 5.4160, \quad F_{(1-\alpha/2)} = 0.0688$

13. $n_1 = 13, \quad n_2 = 12, \quad \dfrac{s_1^2}{s_2^2} = 1.14, \quad \alpha = 0.05$

14. $n_1 = 14, \quad n_2 = 18, \quad \dfrac{s_1^2}{s_2^2} = 2.84, \quad \alpha = 0.05$

15. $n_1 = 9, \quad n_2 = 12, \quad \dfrac{s_1^2}{s_2^2} = 1.23, \quad \alpha = 0.01$

16. $n_1 = 20, \quad n_2 = 20, \quad \dfrac{s_1^2}{s_2^2} = 1.87, \quad \alpha = 0.10$

17. $n_1 = 15, \quad n_2 = 16, \quad s_1^2 = 8.455, \quad s_2^2 = 2.897, \quad$ 95% level of confidence

18. $n_1 = 18, \quad n_2 = 17, \quad s_1^2 = 4.067, \quad s_2^2 = 3.903, \quad$ 95% level of confidence

Construct each specified confidence interval and interpret the interval.

19. A medical researcher is trying to determine whether the population variances of systolic blood pressure levels are the same for patients who take a new medication for high blood pressure and patients who do not take the new medication. The control group consists of 20 patients with a sample variance in systolic blood pressure of 124.940. The treatment group, who is taking the new medication, consists of 23 patients with a sample variance in systolic blood pressure of 123.980. Construct and interpret a 90% confidence interval for the ratio of the population variances of systolic blood pressure levels for the two groups.

20. A track coach wants to make sure that two of her star runners are equally consistent in their times for the race. She times 16 of Amy's practice runs and calculates that the sample variance in times (measured in seconds) is 2.560. She then times 15 of Veronika's practice runs and calculates that the sample variance in times is 2.519. Construct and interpret a 90% confidence interval for the ratio of the population variances of Amy's and Veronika's run times.

21. A quality control inspector is testing two machines that are used to fill bags of flour to determine if they are running consistently. In particular, he wants to know whether the population variances of the amounts of flour per bag are equal for the two machines. He measures the weights, in pounds, of 11 bags of flour filled by Machine A and calculates a sample variance of 0.584. He then measures the weights of 10 bags of flour filled by Machine B and calculates a sample variance of 0.499. Construct and interpret a 99% confidence interval for the ratio of the population variances of the weights of the bags of flour for the two machines. If it is important that the two machines have the same variance, should the inspector adjust one of the machines, and if so, which machine needs adjusting?

22. A nutritionist is comparing two new diets, and after running previous tests to determine if the same amount of weight can be lost using both diets, he now wants to know if the amounts of weight lost are consistent for the two diets. In other words, he wants to estimate the ratio of the variances of the amounts of weight lost by people on the two diets. Group A consists of six people on Diet A, and after two months on the diet, the sample variance of the amounts of weight lost (measured in pounds) is 26.041. Group B consists of seven people on Diet B, and after the same two months on their diet, the sample variance of the amounts of weight lost by this group is 25.084. Construct and interpret a 99% confidence interval for the ratio of the population variances of the amounts of weight lost by people on these two diets.

23. A new brand of golf balls claims that using these golf balls can increase your precision. A golf pro tests this claim by hitting 45 golf balls of the old brand and 30 golf balls of the new brand from the same tee on the driving range and measuring the distance, in yards, that each ball travels. The sample variance of the driving distances for the old brand was 29.752 and the sample variance for the new brand was 15.910. Construct and interpret a 90% confidence interval for the ratio of the population variances.

24. A professor wants to make sure that two different versions of a test are equivalent. He decides to compare the variances of the test scores from each version. A sample of 19 scores on Version A has a sample variance of 2.450, while a sample of 20 scores from Version B has a sample variance of 2.391. Construct and interpret a 95% confidence interval for the ratio of the population variances of the scores on the two versions of the test.

25. A graduate student walking around a large college campus notices that students, not faculty, often own the more expensive cars. He collects data from 25 professors and 28 students on the prices of their cars and calculates the variance of the car prices from each sample. The sample variance for the sample of professors' cars is 7849.38 and the sample variance for the sample of students' cars is 3567.90. Construct and interpret a 95% confidence interval for the ratio of the population variances of prices of professors' and students' cars for this college.

26. A researcher wants to compare the consistency with which two marksmen hit the bull's-eye of a target. The first marksman hits an average of 4.5 bull's-eyes per session with a variance of 2.78. The second marksman hits an average of 5.3 bull's-eyes per session with a variance of 2.34. If 20 sessions were recorded for each marksman, construct and interpret a 95% confidence interval for the ratio of the population variances of the numbers of times per session that these two marksmen hit the bull's-eye.

27. A paint technician for an oil company has to make sure that the painted coatings on the insides of the oil tankers have a consistent thickness. He measures the thickness of the coating (in millimeters) at 15 spots inside the first tanker and calculates a sample variance of 0.3918. He then measures the thickness of the coating at 15 spots inside a second tanker sprayed using the same equipment and calculates a sample variance of 0.4231. Construct and interpret a 99% confidence interval for the ratio of the population variances to help determine if there was a significant difference in how consistently the equipment applied the coating in one tanker versus the other.

28. When shopping for a new car, Emily became interested in how consistently cars are priced in her area; she was planning to buy either a Honda Accord or a Toyota Camry. She priced ten different Accords with similar features at several dealerships in her area. The sample variance of the prices for the Accords was 273,529. Emily then priced nine different Camrys with similar features at several different dealerships in her area. The sample variance of the prices for the Camrys was 231,361. Construct and interpret a 99% confidence interval for the ratio of the population variances of the prices for the two different car models.