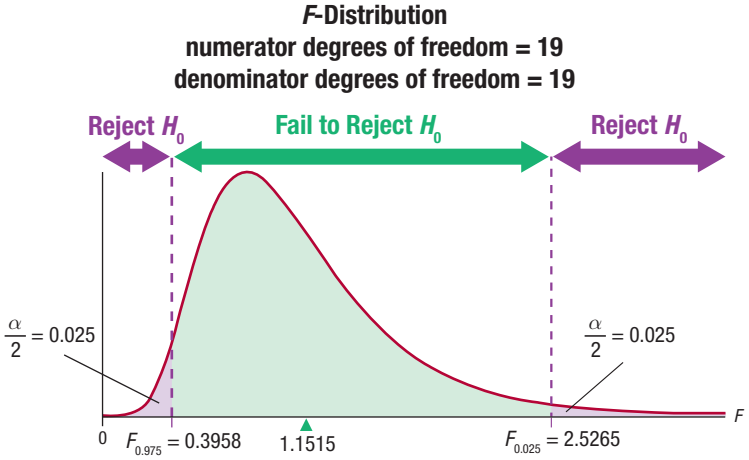
$F_{(1-\alpha/2)} = F_{0.975} = 0.3958$. Using the section of Table H for an area of $\alpha/2 = 0.025$ gives us $F_{\alpha/2} = F_{0.025} = 2.5265$. Therefore, we will reject the null hypothesis if either $F < 0.3958$ or $F > 2.5265$.

Because $F \approx 1.1515$ is not in the rejection region, we must fail to reject the null hypothesis.



Method 2: *p*-Values

P-values for the *F*-test must be found using technology. We will show the calculator method here. Other methods of technology can be found at stat.hawkeslearning.com.

TI-83/84 Plus: The *p*-value shown in the output screenshot in Step 3 is approximately 0.7616. Because this is greater than $\alpha = 0.05$, we fail to reject the null hypothesis.

Interpretation: Failing to reject the null hypothesis means that, at the 0.05 level of significance, there is not sufficient evidence to say that the scores on the two versions of the test have different variances.

11.5 Section Exercises

Null and Alternative Hypotheses for Hypothesis Tests for Two Population Variances

State the null and alternative hypotheses for each scenario.

1. A medical researcher believes that the variance in the lung capacities of smokers is less than that of nonsmokers. Let σ_1^2 represent the population variance for smokers.
2. A professor believes that the variance of SAT scores of honor students is less than that of all students who take the SAT. Let σ_1^2 represent the population variance for honor students.
3. A quality control inspector believes that the variance in the diameters of soda cans produced by Machine 1 is greater than the variance in the diameters of soda cans produced by Machine 2. Let σ_1^2 represent the population variance for Machine 1.
4. A psychologist is interested if the variance of the fastest speed driven by current college students, σ_1^2, is greater than the variance of the fastest speed driven by those with a college degree.
5. A golf pro believes that the variances of his driving distances are not the same when he uses different brands of golf balls. He is especially interested in comparing Titleist golf balls to a generic store brand. Let σ_1^2 represent the population variance for Titleist golf balls.

6. A paint technician believes that the variance of the thickness of the special coating in one tank is not the same as the variance of the thickness of the coating in another tank. Let σ_1^2 represent the population variance for Tank 1.

Test Statistics for Hypothesis Tests for Two Population Variances

Calculate the test statistic for a hypothesis test for two population variances using the given information. Assume that both population distributions are approximately normal.

7. $n_1 = 15, \quad s_1^2 = 3.007, \quad n_2 = 16, \quad s_2^2 = 2.897$

8. $n_1 = 4, \quad s_1^2 = 0.961, \quad n_2 = 6, \quad s_2^2 = 0.899$

9. $n_1 = 31, \quad s_1^2 = 46.821, \quad n_2 = 28, \quad s_2^2 = 57.024$

10. $n_1 = 23, \quad s_1^2 = 35,679, \quad n_2 = 24, \quad s_2^2 = 39,018$

Rejection Regions for Hypothesis Tests for Two Population Variances

State the critical value(s) of the test statistic, and determine the rejection region for the hypothesis test for the two population variances using the given information. Then give the appropriate conclusion for the hypothesis test. Assume that both population distributions are approximately normal.

11. $n_1 = 19, \quad s_1^2 = 0.3891, \quad n_2 = 24, \quad s_2^2 = 0.9579, \quad H_a: \sigma_1^2 < \sigma_2^2, \quad \alpha = 0.05$

12. $n_1 = 14, \quad s_1^2 = 3.152, \quad n_2 = 11, \quad s_2^2 = 9.300, \quad H_a: \sigma_1^2 < \sigma_2^2, \quad \alpha = 0.05$

13. $n_1 = 11, \quad s_1^2 = 31,207, \quad n_2 = 11, \quad s_2^2 = 38,916, \quad H_a: \sigma_1^2 < \sigma_2^2, \quad \alpha = 0.01$

14. $n_1 = 11, \quad s_1^2 = 3.007, \quad n_2 = 25, \quad s_2^2 = 2.897, \quad H_a: \sigma_1^2 > \sigma_2^2, \quad \alpha = 0.05$

15. $n_1 = 20, \quad s_1^2 = 10.453, \quad n_2 = 23, \quad s_2^2 = 3.199, \quad H_a: \sigma_1^2 > \sigma_2^2, \quad \alpha = 0.10$

16. $n_1 = 12, \quad s_1^2 = 1893, \quad n_2 = 26, \quad s_2^2 = 1066, \quad H_a: \sigma_1^2 > \sigma_2^2, \quad \alpha = 0.01$

17. $n_1 = 16, \quad s_1^2 = 18.01, \quad n_2 = 21, \quad s_2^2 = 17.07, \quad H_a: \sigma_1^2 \neq \sigma_2^2, \quad \alpha = 0.05$

18. $n_1 = 20, \quad s_1^2 = 27.08, \quad n_2 = 29, \quad s_2^2 = 11.77, \quad H_a: \sigma_1^2 \neq \sigma_2^2, \quad \alpha = 0.05$

19. $n_1 = 20, \quad s_1^2 = 8.12, \quad n_2 = 18, \quad s_2^2 = 16.78, \quad H_a: \sigma_1^2 \neq \sigma_2^2, \quad \alpha = 0.10$

20. $n_1 = 11, \quad s_1^2 = 12,047, \quad n_2 = 12, \quad s_2^2 = 18,019, \quad H_a: \sigma_1^2 \neq \sigma_2^2, \quad \alpha = 0.01$

Hypothesis Tests for Two Population Variances

Perform each hypothesis test using the method of your choice or the one assigned by your instructor. For each exercise, complete the following steps. Assume that both population distributions are approximately normal in each scenario.

a. State the null and alternative hypotheses.
b. Determine which distribution to use for the test statistic, and state the level of significance.
c. Calculate the test statistic.
d. Draw a conclusion and interpret the decision.

21. A golf pro believes that the variances of his driving distances are different for different brands of golf balls. In particular, he believes that his driving distances, measured in yards, have a smaller variance when he uses Titleist golf balls than when he uses a generic store brand. He hits 10 Titleist golf balls and records a sample variance of 201.65. He hits 10 generic golf balls and records a sample variance of 364.57. Test the golf pro's claim using a 0.05 level of significance. Does the evidence support the golf pro's claim?

22. A quality control inspector believes that the variance in the diameters of soda cans, measured in millimeters, is greater for soda cans produced by Machine A than for soda cans produced by Machine B. The sample variance of a random sample of 15 soda cans from Machine A is 2.788. The sample variance for a random sample of 17 soda cans from Machine B is 1.982. Test the inspector's claim using a 0.10 level of significance. Does the evidence support the inspector's claim?

23. A medical researcher believes that the variance of total cholesterol levels in men is greater than the variance of total cholesterol levels in women. The sample variance for a random sample of 8 men's cholesterol levels, measured in mg/dL, is 277. The sample variance for a random sample of 7 women is 89. Test the researcher's claim using a 0.10 level of significance. Does the evidence support the researcher's belief?

24. A basketball coach believes that the variance of the heights of adult male basketball players is different from the variance of heights for the general population of men. The sample variance of heights, measured in inches, for a random sample of 12 basketball players is 24.76. The sample variance for a random sample of 13 other men is 25.87. Test the coach's claim using a 0.01 level of significance. Does the evidence support the coach's claim?

25. One study claims that the variance in the resting heart rates of smokers is different than the variance in the resting heart rates of nonsmokers. A medical student decides to test this claim. The sample variance of resting heart rates, measured in beats per minute, for a random sample of 5 smokers is 545.1. The sample variance for a random sample of 5 nonsmokers is 103.7. Test the study's claim using a 0.01 level of significance. Does the evidence support the study's claim?

26. A professor believes that the variance of ACT composite scores of honor students is less than that of all students who take the ACT. The sample variance of the ACT composite scores for a random sample of 18 honors students is 12.1. The sample variance of the ACT composite scores for a random sample of 20 other students is 28.9. Test the professor's claim using a 0.05 level of significance. Does the evidence support the professor's claim?