Worksheet for Two Populations: Variance

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On this page we will see a number of situations with related questions. In each case, this page will give the answers to those questions. Your task is to find those same answers by inspecting the given information and/or by using a calculator or computer to produce those desired values.

Case 1:

We have two populations, both known to be approximately normally distributed. We want to generate a 88.00% confidence level for the ratio of the variances σ_1^2/σ_2^2. We take a sample of each population. The sample from the first population has 26 items with a standard deviation of 12.480. The sample from the second population has 38 items with a standard deviation of 11.250. Find the desired confidence interval.

(1) Give the quotient of the two sample variances. **(Answer: quotient = 1.2306)**
(2) Give the degrees of freedom to be used with the F distribution. **(Answer: numerator df = 25 denominator df = 37)**
(3) Using the appropriate degrees of freedom, give the F value that 0.0600 as the area to the left of that value. **(Answer: F_{left} = 0.5500)**
(4) Using the appropriate degrees of freedom, give the F value that 0.0600 as the area to the right of that value. **(Answer: F_{left} = 1.7483)**
(5) Give the left end of the confidence interval. **(Answer: ci_{left} = 0.7039)**
(6) Give the right end of the confidence interval. **(Answer: ci_{right} = 2.2375)**

Case 2:

We have two populations, both known to be approximately normally distributed. We want to generate a 85.00% confidence level for the ratio of the variances σ_1^2/σ_2^2. We take a sample of each population. The sample from the first population has 41 items with a standard deviation of 24.060. The sample from the second population has 34 items with a standard deviation of 22.530. Find the desired confidence interval.

(7) Give the quotient of the two sample variances. **(Answer: quotient = 1.1404)**
(8) Give the degrees of freedom to be used with the F distribution. **(Answer: numerator df = 40 denominator df = 33)**
(9) Using the appropriate degrees of freedom, give the F value that 0.0750 as the area to the left of that value. **(Answer: F_{left} = 0.6206)**
(10) Using the appropriate degrees of freedom, give the F value that 0.0750 as the area to the right of that value. **(Answer: F_{left} = 1.6352)**
(11) Give the left end of the confidence interval. **(Answer: ci_{left} = 0.6974)**
(12) Give the right end of the confidence interval. **(Answer: ci_{right} = 1.8377)**

Case 3:

We have two populations, both known to be approximately normally distributed. We want to generate a 98.50% confidence level for the ratio of the variances σ_1^2/σ_2^2. We take a sample of each population. The sample from the first population has 23 items with a standard deviation of 45.390. The sample from the second population has 45 items with a standard deviation of 42.980. Find the desired confidence interval.

(13) Give the quotient of the two sample variances. **(Answer: quotient = 1.1153)**
(14) Give the degrees of freedom to be used with the F distribution. **(Answer: numerator df = 22 denominator df = 44)**
(15) Using the appropriate degrees of freedom, give the F value that 0.0075 as the area to the left of that value. **(Answer: F_{left} = 0.3733)**
(16) Using the appropriate degrees of freedom, give the F value that 0.0075 as the area to the right of that value. **(Answer: F_{left} = 2.3645)**

(17) Give the left end of the confidence interval. **(Answer: ci_{left} = 0.4717)**
(18) Give the right end of the confidence interval. **(Answer: ci_{right} = 2.9879)**

Case 4:

We have two populations, both known to be approximately normally distributed. We want to test the hypothesis that the variance of the first is greater than the variance of the second. We want to run this test at the 0.0100 level of significance. We take a sample of size 27 from the first population and we find the sample standard is 16.320. We take a sample of size 31 from the second population. The standard deviation of that sample is 9.931.

(19) State the null hypothesis in terms of comparing σ_1^2 to σ_2^2. **(Answer: $\sigma_1^2 = \sigma_2^2$)**
(20) Re-state the null hypothesis in terms of the ratio σ_1^2/σ^2_2. **(Answer: $\sigma_1^2/\sigma_2^2 = 1$)**
(21) State the alternative hypothesis in terms of comparing σ_1^2 to σ_2^2. **(Answer: $\sigma_1 > \sigma_2$)**
(22) Re-state the alternative hypothesis in terms of the ratio σ_1^2/σ_2^2. **(Answer: $\sigma_1/^2\sigma_2^2 > 1$)**
(23) Give the variance of the first sample. **(Answer: σ_1^2 = 266.342)**
(24) Give the variance of the second sample. **(Answer: σ_2^2 = 98.625)**
(25) Give the quotient of the two variances, first/second. **(Answer: σ_1^2/σ_2^2 = 2.7006)**
(26) Give the degrees of freedom to be used with the F distribution. **(Answer: numerator df = 26 denominator df = 30)**
(27) Give the F value that has 0.0100 as the area to its right. **(Answer: F_{right} = 2.4374)**
(28) Give the attained significance for the quotient. **(Answer: attained = 0.0049)**
(29) Using either the critical value or the attained significance approach, based on our samples do we reject or not reject the null hypothesis? **(Answer: reject)**

Case 5:

We have two populations, both known to be approximately normally distributed. We want to test the hypothesis that the variance of the first is less than the variance of the second. We want to run this test at the 0.0175 level of significance. We take a sample of size 53 from the first population and we find the sample standard is 23.810. We take a sample of size 30 from the second population. The standard deviation of that sample is 31.615.

(30) State the null hypothesis in terms of comparing σ_1^2 to σ_2^2. **(Answer: $\sigma_1^2 = \sigma_2^2$)**
(31) Re-state the null hypothesis in terms of the ratio σ_1^2/σ^2_2. **(Answer: $\sigma_1^2/\sigma_2^2 = 1$)**
(32) State the alternative hypothesis in terms of comparing σ_1^2 to σ_2^2. **(Answer: $\sigma_1 < \sigma_2$)**
(33) Re-state the alternative hypothesis in terms of the ratio σ_1^2/σ_2^2. **(Answer: $\sigma_1/^2\sigma_2^2 < 1$)**
(34) Give the variance of the first sample. **(Answer: σ_1^2 = 566.916)**
(35) Give the variance of the second sample. **(Answer: σ_2^2 = 999.508)**
(36) Give the quotient of the two variances, first/second. **(Answer: σ_1^2/σ_2^2 = 0.5672)**
(37) Give the degrees of freedom to be used with the F distribution. **(Answer: numerator df = 52 denominator df = 29)**
(38) Give the F value that has 0.0175 as the area to its left. **(Answer: F_{left} = 0.5119)**
(39) Give the attained significance for the quotient. **(Answer: attained = 0.0371)**
(40) Using either the critical value or the attained significance approach, based on our samples do we reject or not reject the null hypothesis? **(Answer: not reject)**

Case 6:

We have two populations, both known to be approximately normally distributed. We want to test the hypothesis that the variance of the first is not equal to the variance of the second. We want to run this test at the 0.0625 level of significance. We take a sample of size 23 from the first population and we find the sample standard is 13.900. We take a sample of size 32 from the second population. The standard deviation of that sample is 9.865.

(41) State the null hypothesis in terms of comparing σ_1^2 to σ_2^2. **(Answer: $\sigma_1^2 = \sigma_2^2$)**
(42) Re-state the null hypothesis in terms of the ratio σ_1^2/σ^2_2. **(Answer: $\sigma_1^2/\sigma_2^2 = 1$)**
(43) State the alternative hypothesis in terms of comparing σ_1^2 to σ_2^2. **(Answer: $\sigma_1 \neq \sigma_2$)**
(44) Re-state the alternative hypothesis in terms of the ratio σ_1^2/σ_2^2. **(Answer: $\sigma_1/^2\sigma_2^2 \neq 1$)**

(45) Give the variance of the first sample. **(Answer: $\sigma_1^2 = 193.210$)**
(46) Give the variance of the second sample. **(Answer: $\sigma_2^2 = 97.318$)**
(47) Give the quotient of the two variances, first/second. **(Answer: $\sigma_1^2/\sigma_2^2 = 1.9853$)**
(48) Give the degrees of freedom to be used with the F distribution. **(Answer: numerator df = 22 denominator df = 31)**
(49) Give the two F values that have 0.0313 as the area outside of their interval. **(Answer: $F_{left} = 0.4606$ and $F_{right} = 2.0655$)**
(50) Give the attained significance for the quotient. **(Answer: attained = 0.078)**
(51) Using either the critical value or the attained significance approach, based on our samples do we reject or not reject the null hypothesis? **(Answer: not reject)**

Case 7:

We have two populations, both known to be approximately normally distributed. We want to test the hypothesis that the variance of the first is not equal to the variance of the second. We want to run this test at the 0.0875 level of significance. We take a sample of size 17 from the first population and we find the sample standard is 20.050. We take a sample of size 22 from the second population. The standard deviation of that sample is 13.179.

(52) State the null hypothesis in terms of comparing σ_1^2 to σ_2^2. **(Answer: $\sigma_1^2 = \sigma_2^2$)**
(53) Re-state the null hypothesis in terms of the ratio σ_1^2/σ^2_2. **(Answer: $\sigma_1^2/\sigma_2^2 = 1$)**
(54) State the alternative hypothesis in terms of comparing σ_1^2 to σ_2^2. **(Answer: $\sigma_1 \neq \sigma_2$)**
(55) Re-state the alternative hypothesis in terms of the ratio σ_1^2/σ_2^2. **(Answer: $\sigma_1/^2\sigma_2^2 \neq 1$)**
(56) Give the variance of the first sample. **(Answer: $\sigma_1^2 = 402.003$)**
(57) Give the variance of the second sample. **(Answer: $\sigma_2^2 = 173.686$)**
(58) Give the quotient of the two variances, first/second. **(Answer: $\sigma_1^2/\sigma_2^2 = 2.3145$)**
(59) Give the degrees of freedom to be used with the F distribution. **(Answer: numerator df = 16 denominator df = 21)**
(60) Give the two F values that have 0.0437 as the area outside of their interval. **(Answer: $F_{left} = 0.4274$ and $F_{right} = 2.2230$)**
(61) Give the attained significance for the quotient. **(Answer: attained = 0.0729)**
(62) Using either the critical value or the attained significance approach, based on our samples do we reject or not reject the null hypothesis? **(Answer: reject)**

Case 8:

We have two populations, both known to be approximately normally distributed. We want to test the hypothesis that the variance of the first is not equal to the variance of the second. We want to run this test at the 0.0875 level of significance. We take a sample of size 22 from the first population and we find the sample standard is 13.179. We take a sample of size 17 from the second population. The standard deviation of that sample is 8.444.

(63) State the null hypothesis in terms of comparing σ_1^2 to σ_2^2. **(Answer: $\sigma_1^2 = \sigma_2^2$)**
(64) Re-state the null hypothesis in terms of the ratio σ_1^2/σ^2_2. **(Answer: $\sigma_1^2/\sigma_2^2 = 1$)**
(65) State the alternative hypothesis in terms of comparing σ_1^2 to σ_2^2. **(Answer: $\sigma_1 \neq \sigma_2$)**
(66) Re-state the alternative hypothesis in terms of the ratio σ_1^2/σ_2^2. **(Answer: $\sigma_1/^2\sigma_2^2 \neq 1$)**
(67) Give the variance of the first sample. **(Answer: $\sigma_1^2 = 173.686$)**
(68) Give the variance of the second sample. **(Answer: $\sigma_2^2 = 71.301$)**
(69) Give the quotient of the two variances, first/second. **(Answer: $\sigma_1^2/\sigma_2^2 = 2.4360$)**
(70) Give the degrees of freedom to be used with the F distribution. **(Answer: numerator df = 21 denominator df = 16)**
(71) Give the two F values that have 0.0437 as the area outside of their interval. **(Answer: $F_{left} = 0.4499$ and $F_{right} = 2.3396$)**
(72) Give the attained significance for the quotient. **(Answer: attained = 0.0739)**
(73) Using either the critical value or the attained significance approach, based on our samples do we reject or not reject the null hypothesis? **(Answer: reject)**

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