# What is Bartlett’s Test for Homogeneity of Variances, and can you provide an example of how it is used?

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April 26, 2024

Bartlett's Test for Homogeneity of Variances is a statistical test used to determine if the variances of two or more data sets are equal. This test is commonly used in analyses of variance (ANOVA) to ensure that the assumption of equal variances between groups is met. It is based on the chi-square distribution and compares the sum of squared deviations from the mean for each data set. The null hypothesis for this test is that the variances are equal, and a significant result indicates that the variances are not equal, therefore requiring a different statistical approach. For example, Bartlett's Test can be used to compare the variances of test scores between different schools to determine if there is a significant difference in the variation of scores.

## Bartlett's Test for Homogeneity of Variances (Definition & Example)

**Bartlett's Test is a statistical test that is used to determine whether or not the variances between several groups are equal.**

**Many statistical tests (like a ) assume that variances are equal across samples. Bartlett's test can be used to verify that assumption.**

**The following steps explain how to perform Bartlett's test.**

***Note: Don't confuse this test with , which is used to compare an observed correlation matrix to the identity matrix.***

### Steps to Perform Bartlett's Test

**Bartlett's Test uses the following null and alternative :**

**H0: The variance among each group is equal.**

**HA: At least one group has a variance that is not equal to the rest.**

**The test statistic can be calculated as follows:**

**B = (n-k)lns2 - Σ(nj-1)lnsj2 / c**

**where:**

**n: The total number of observations across all groupsk: The total number of groupsln: This stands for "natural log"s2: The pooled variancenj: The number of observations in group jsj2: The variance of group j**

**And where *c* is calculated as:**

**c = 1 + (1/3(k-1))*(Σ(1/(nj-1)) - (1/(n-k))**

**This test statistic follows a Chi-Square distribution with k-1 degrees of freedom. That is, B ~ X2(k-1).**

**If the that corresponds to the test statistic is less than some significance level (like α = 0.05) then we can reject**

**the null hypothesis and conclude that not all groups have the same variance.**

### Example: Bartlett's Test

**She randomly assigns 10 students to use each technique for one week, then makes each student take an exam of equal difficulty.**

**The exam scores of the 30 students are shown below:**

| Group 1 | Group 2 | Group 3 |
|---|---|---|
| 85 | 91 | 79 |
| 86 | 92 | 78 |
| 88 | 93 | 88 |
| 75 | 85 | 94 |
| 78 | 87 | 92 |
| 94 | 84 | 85 |
| 98 | 82 | 83 |
| 79 | 88 | 85 |
| 71 | 95 | 82 |
| 80 | 96 | 81 |



**The professor wants to conduct a one-way ANOVA to see if the three techniques lead to different average exam scores, but she first must conduct Bartlett's Test to verify that the three groups have equal variances.**

**It's cumbersome to perform Bartlett's Test by hand, so**

## we'll enter the following data values into the :

| Sample 1 | Sample 2 | Sample 3 | Sample 4 | Sample 5 |
|---|---|---|---|---|
| 85, 86, 88, 75, 78, 94, 98, 79, 71, 80 | 91, 92, 93, 85, 87, 84, 82, 88, 95, 96 | 79, 78, 88, 94, 92, 85, 83, 85, 82, 81 | | |

CALCULATE

Test Statistic B: 3.30244

p-value: 0.19182



## The test returns the following results:

## Test statistic *B*: 3.30244P-value: 0.19182

## Since the p-value is not less than 0.05, the professor will fail to reject the null hypothesis. In other words, she

**doesn't have sufficient evidence to say that the three groups have different variances.**

**Thus, she can proceed to perform the one-way ANOVA.**