

Statistics Kingdom

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ANOVA Calculator

One-Way ANOVA Calculator and Tukey HSD

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Significance level (α):

0,05

Outliers:

Included

Effect:

Medium

Effect type:

f

Effect Size:

0.25

Rounding:

4

- ☒ Enter raw data directly
- ☐ Enter raw data from excel

Enter sample data directly

Groups:

Conventional

Assertiveness-based

Data:

5
5
4
4
4
4
4
5
4
5
5
5
5
5
5

5
5
5
4
5
5
5
5
5
5
5
5
5

Skewness:

-1.065157

-0.858293

Excess kurtosis:

0.48602

-1.315476

Normality

5.272e-8

5.987e-11

Outliers

2

Mean

4.38462

4.69231

S

0.77089

0.46604

Calculate

Validate

Insert column

Delete column

Clear

Load last run

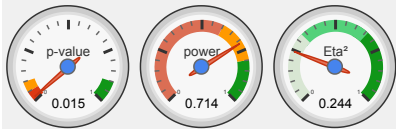
Header: You may change groups' names to the real names.
Data: When entering data, press **Enter** or **,** (comma) after each value.
You may paste full column from excel.
The calculator ignores empty cells or non-numeric cells.

Group1 contains 52 values
Group2 contains 52 values
validation:success

Hover over the cells for more information.

Source	DF	Sum of Square	Mean Square	F Statistic	P-value
Groups (between groups)	1	2.4615	2.4615	6.0669	0.01545
Error (within groups)	102	41.3846	0.4057		
Total	103	43.8461	0.4257		

[R code.](#)



One Way ANOVA test, using F distribution df(1,102) (right tailed)

1. **H₀ hypothesis**

Since $p\text{-value} < \alpha$, H_0 is rejected.
Some of the groups' averages consider to be not equal.

In other words, the difference between the averages of some groups is big enough to be statistically significant.

2. **P-value**

p-value equals **0.0154476**, [$p(x \leq F) = 0.984552$]. It means that the chance of type1 error (rejecting a correct H_0) is small: 0.01545 (1.54%)
The smaller the p-value the stronger it support H_1

3. **The statistics**

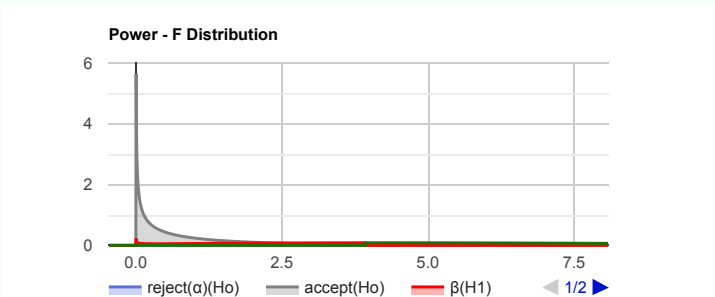
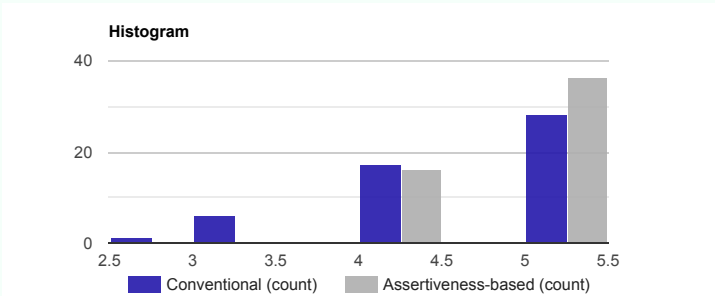
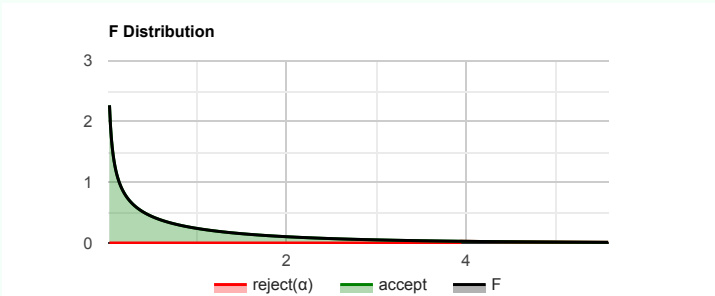
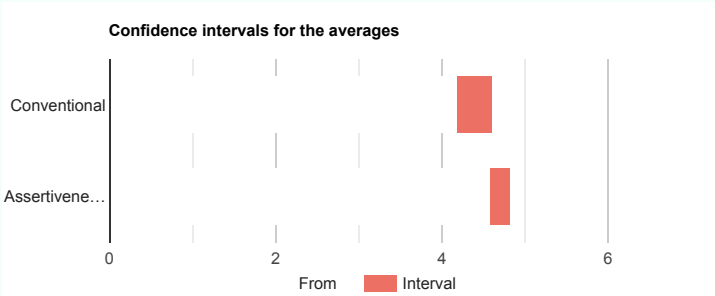
The test statistic F equals **6.066946**, which is not in the 95% region of acceptance: $[-\infty : 3.9343]$

4. **Effect size**

The observed effect size f is **medium** (0.24). That indicates that the magnitude of the difference between the averages is medium.
The η^2 equals 0.056. It means that the **group** explains 5.6% of the variance from the average (similar to R^2 in the linear regression)

5. **Tukey HSD / Tukey Kramer**

The means of the following pair are significantly different: **x1-x2**.



Validation

Test power

Although the priori power is medium (0.7141), the H_0 is rejected.

Equality of variances

The tool used the Levene's test to assess the equality of variances.
The population's variances consider to be **not equal**. (p-value = 0.0154).
Levene's test power consider to be medium (0.71).
The groups' size consider similar. (The ratio between the bigger group and the smaller group is: 1)
The ANOVA test consider to be robust to the homogeneity of variances assumption when the groups' sizes are similar.

It is suggested to consider the **Kruskal-Wallis ANOVA**. non-parametric test.

Normality assumption

The assumption was checked based on the [Shapiro-Wilk Test](#). ($\alpha=0.05$)
It is assumed that all the groups distribute normally or have a big sample size, at least 30.

Tukey HSD / Tukey Kramer

Pair	Difference	SE	Q	Lower CI	Upper CI	Critical Mean	p-value
x1-x2	0.3077	0.08833	3.4834	0.05991	0.5555	0.2478	0.01545

