An ANOVA test is a way to find out if survey or experiment results are [significant](https://www.statisticshowto.com/what-is-statistical-significance/). In other words, they help you to figure out if you need to [reject the null hypothesis](https://www.statisticshowto.com/support-or-reject-null-hypothesis/) or accept the [alternate hypothesis](https://www.statisticshowto.com/what-is-an-alternate-hypothesis/).

Basically, you’re testing groups to see if there’s a difference between them. Examples of when you might want to test different groups:

A group of psychiatric patients are trying three different therapies: counseling, medication and biofeedback. You want to see if one therapy is better than the others.

A manufacturer has two different processes to make light bulbs. They want to know if one process is better than the other.

Students from different colleges take the same exam. You want to see if one college outperforms the other.

What Does “One-Way” or “Two-Way Mean?

One-way or two-way refers to the number of [independent variables](https://www.statisticshowto.com/independent-variable-definition/) (IVs) in your Analysis of Variance test.

One-way has one independent variable (with 2 [levels](https://www.statisticshowto.com/levels-in-statistics/)). For example: brand of cereal,

Two-way has two independent variables (it can have multiple levels). For example: brand of cereal, calories.

**What are “Groups” or “Levels”?**

Groups or levels are different groups within the same [independent variable](https://www.statisticshowto.com/independent-variable-definition/). In the above example, your levels for “brand of cereal” might be Lucky Charms, Raisin Bran, Cornflakes — a total of three levels. Your levels for “Calories” might be: sweetened, unsweetened — a total of two levels.

Let’s say you are studying if an alcoholic support group and individual counseling combined is the most effective treatment for lowering alcohol consumption. You might split the study participants into three groups or levels:

Medication only,

Medication and counseling,

Counseling only.

Your [dependent variable](https://www.statisticshowto.com/dependent-variable-definition/) would be the number of alcoholic beverages consumed per day.

If your groups or levels have a hierarchical structure (each level has unique subgroups), then use a [nested ANOVA](https://www.statisticshowto.com/nested-model-anova-factors/#anova) for the analysis.

What Does “Replication” Mean?

It’s whether you are replicating (i.e. duplicating) your test(s) with multiple groups. With a two way ANOVA with replication , you have two groups and individuals within that group are doing more than one thing (i.e. two groups of students from two colleges taking two tests). If you only have one group taking two tests, you would use without replication.

**Types of Tests.**

There are two main types: one-way and two-way. Two-way tests can be with or without replication.

One-way ANOVA between groups: used when you want to test two groups to see if there’s a difference between them.

Two way ANOVA without replication: used when you have one group and you’re double-testing that same group. For example, you’re testing one set of individuals before and after they take a medication to see if it works or not.

Two way ANOVA with replication: Two groups, and the members of those groups are doing more than one thing. For example, two groups of patients from different hospitals trying two different therapies.

**One Way ANOVA**

A one way ANOVA is used to compare two means from two independent (unrelated) groups using the [F-distribution](https://www.statisticshowto.com/probability-and-statistics/f-statistic-value-test/#Fdist). The [null hypothesis](https://www.statisticshowto.com/probability-and-statistics/null-hypothesis/) for the test is that the two [means](https://www.statisticshowto.com/probability-and-statistics/statistics-definitions/mean-median-mode/#mean)are equal. Therefore, a [significant](https://www.statisticshowto.com/what-is-statistical-significance/)result means that the two means are unequal.

**Examples of when to use a one way ANOVA**

**Situation 1**: You have a group of individuals randomly split into smaller groups and completing different tasks. For example, you might be studying the effects of tea on weight loss and form three groups: green tea, black tea, and no tea.
**Situation 2**: Similar to situation 1, but in this case the individuals are split into groups based on an attribute they possess. For example, you might be studying leg strength of people according to weight. You could split participants into weight categories (obese, overweight and normal) and measure their leg strength on a weight machine.