

1 One-way ANOVA for independent samples

1.1 Overview

A one-way ANOVA is a way to test the equality means for a variable over three or more independent groups (i.e groups that do not share any members or contain matching). The null hypothesis is that all the group means are equal and the alternative hypothesis is that at least two of the means are different.

Here is an example of where the test is used: a lecturer is interested whether four different degree subjects affect the mean earnings of students 5 years after leaving university. The predictor variable is subject with four levels and the response variable is earnings.

The assumptions are:

- The response variable must be normally or approximately normally distributed on the population. However, there is a rule of thumb that for sample sizes (individual sample sizes; not total sample) larger than 30 the t-test can still be used. (This is due to the central limit theorem).
- The samples must be independent.
- The variances of the populations must be equal. A rule of thumb for this is that the largest standard deviation should not be larger than two times the smallest standard deviation. Unequal variances become more of a problem if you have very unequal sample sizes or not normal data. If you have non-normal data and unequal variances you may consider transforming your data before analysis.

If your data is non-normal then you should consider a Kruskal-Wallis test.

If the samples are not independent you should perform a one-way repeated measures ANOVA.

1.2 Analysis plan

For the descriptive statistics, split your data up into the levels given by the categorical predictor. For example, if your categorical predictor is race, split the sample into the race categories. Then you can calculate the sample size, sample mean, sample variance and standard error for each level. You can also draw side by side box plot to compare the different levels.

If you find a significant result then a possible follow up is to carry out a Tukey HSD test. If the result is not significant you should find out the power, to determine the chance that you have missed a difference.

Here are some examples of a one-way anova being carried out:

<http://www.youtube.com/watch?v=51QZa7b0Ozk> (by hand)

<http://www.statstutor.ac.uk/types/case-study-video/introduction-to-analysis-of-variance/> (by hand and SPSS)

http://calcnet.mth.cmich.edu/org/spss/V16_materials/Video_Clips_v16/16one_way_anova/16one_way_anova.swf (in SPSS)

<http://www.youtube.com/watch?v=T0Lmyz6EscY> (in R)