

MA 315 – Lab – ANOVA

Multiple variables

In ordinary single-factor ANOVA, we can test whether or not there is a significant difference between several different samples. For example, we might study tomato plants, measuring the total weight of the tomatoes produced by each plant. Suppose the plants are randomly separated into different groups, with each group receiving different daily amounts of water (low, medium, and high) and each group also receives a different type of fertilizer (strong and weak). We could study these two factors separately:

```
summary(aov(plant$weight ~ plant$water))
```

```
summary(aov(plant$weight ~ plant$fertilizer))
```

We can also run a two-way ANOVA, studying both factors together:

```
summary(aov(plant$weight ~ plant$water * plant$fertilizer))
```

This will produce a more complex ANOVA table, with one row for the `plant$water` factor, one row for the `plant$fertilizer` factor, and one row for the interaction between the two `plant$water:plant$fertilizer`. We do not need to know the tedious details of how all these numbers are calculated. Instead, all we need to know is that the column on the right contains P-values, and these are all based on the null hypothesis that there is no difference in the population means.

The assignment

In this laboratory assignment, you will analyze a series of data sets and write a paragraph about each, presenting the results of your calculations and any relevant figures, explaining their meaning in this context.

1. `ratdiet.csv` In this experiment, rats were fed different diets and the resulting weight gains from these diets were measured (in grams). The amount of food given to each rat was either “H” a high amount or “L” a low amount. The type of food given to each rat was either “B” beef, “P” pork, or “C” cereal.
2. `helmets.csv` In this experiment, four different models of Lacrosse helmets were tested with both front and rear impacts, with the results measured by the Gadd Severity index scores. (Source: S.V. Caswell, R.G. Deivert (2002). "Lacrosse Helmet Designs and the Effects of Impact Forces", *Journal of Athletic Training*, 37(2):164-171.)
3. `dentalgold.csv` In this experiment, dental gold, as used for fillings, was prepared in several different ways and the resulting hardness was measured using the diamond pyramid method, also known as the Vickers Pyramid Number. The samples varied in the dentist that prepared them, the method of preparation, the alloy used, and the temperature of preparation (A = 1500, B = 1600, C = 1700 degrees).