# Part 1

Complete problem 3-4. from the Montgomery Text

Complete problem 3-12. from the Montgomery Text

# Part 2

### The Oneway Analysis of Variance (ANOVA)

The Oneway ANOVA is a statistical technique that allows us to compare mean differences of one outcome (dependent) variable across two or more groups (levels) of one independent variable (factor). If there are only two levels (e.g. Male/Female) of the independent (predictor) variable the results are analogous to Student's t test. It is also true that ANOVA is a special case of the GLM or regression models so as the number of levels increase it might make more sense to try one of those approaches. ANOVA also allows for comparisons of mean differences across multiple factors (Factorial or Nway ANOVA) which we will address later.

### Our scenario and data

Imagine that you are interested in understanding whether knowing the brand of car tire can help you predict whether you will get more or less mileage before you need to replace them. We'll draw what is hopefully a random sample of 60 tires from four different manufacturers and use the mean mileage by brand to help inform our thinking. While we expect variation across our sample we're interested in whether the differences between the tire brands (the groups) is significantly different than what we would expect in random variation within the groups.

Our research or testable hypothesis is then described

$$\mu_{Firestone} \neq \mu_{Bridgestone} \neq \mu_{Milestar} \neq \mu_{Falken}$$

as at least one of the tire brand populations is different than the other three. Our null is basically "brand doesn't matter in predicting tire mileage – all brands are the same".

The following data set with 60 observations is availabe in `tires.csv` (located on Canvas).

| Column | Contains | Type |
|---|---|---|
| Brands | What brand tire | factor |
| Mileage | Tire life in thousands | num |

### Oneway ANOVA Test & Results

So the heart of this post is to actually execute the Oneway ANOVA in R. There are several ways to do so but let's start with the simplest from the base R first `aov`. While it's possible to wrap the command in a `summary` or `print` statement I recommend you always save the results out to an R object in this case

`tires.aov`. It's almost inevitable that further analysis will ensue and the `tires.aov` object has a wealth of useful information. If you're new to R a couple of quick notes. The dependent variable goes to the left of the tilde and our independent or predictor variable to the right. `aov` is not limited to Oneway ANOVA so adding additional factors is possible.

ANOVA is a specialized case of a general linear model (GLM) and therefore the list object returned tires.aov is actually of both `aov` and `lm` class. The `names` command will give you some sense of all the information contained in the list object. The `summary` command gives us the key ANOVA data we need and produces a classic ANOVA table. If you're unfamiliar with them and want to know more especially where the numbers come from I recommend reviewing the Montgomery Text Ch3.

## Questions:

1.Conduct an ANOVA and interpret the result

2.Perform a proper pairwise comparison test and control for multiple comparisons.

3.Interpret your resuts and clearly state your conclusions.

*Make sure to check all assumptions. Visualize your data, and provide an interpretation of your original hypothesis.