Stat 509: Statistics for Engineers

Homework Assignment 8

Make sure to include the R code and graphs used in your analyses.

Fill out the following table:

Table 1: ANOVA Table

	Df	SS	MS	F	*p*-value
Treatment	2	?	?	?	0.0003
Residual	?	642.8	?		
Total	31	1126.04	?		

1. How many groups must there be?

The ANOVA table shows there are 2 degrees of freedom for treatment. This indicates that there are 3 groups.

2. How many total subjects must there be?

31 + 1 = 32

3. What specific distribution does $\frac{MST}{MSE}$ have under the null hypothesis?

MST has an F-Distribution under the null hypothesis.

4. Do large or small values of F provide evidence against the null hypothesis?

Large values of F provide evidence against the null hypothesis. This indicates that there is likely a significant difference between at least two of the groups.

5. This is the ANOVA table when testing whether the average miles per gallon (mpg) of a vehicle is dependent upon its number of forward gears (gear). Access the data by typing "attach(mtcars)" into R.

   Provide the R code which verifies your entries in the ANOVA table.
   Anova(lm(mpg~gear))

6. State the null and alternative hypotheses in the context of this problem.

   H_0 : The average miles per gallon (mpg) of a vehicle is not dependent upon its number of forward gears (gear).
   H_a : The average miles per gallon (mpg) of a vehicle is dependent upon its number of forward gears (gear).

7. At the 0.001 significance level, is there evidence that the average mpg of a vehicle differs based upon its number of forward gears?

0.0003 < 0.001. We reject the null hypothesis at the 0.001 significance level.

8. Are the assumptions satisfied?

Using the boxplot and qqnorm graphs, we can determine that we have Normality of Residuals and Homogeneity of variances. According to the data, we have independent samples.

Boxplot(mpg~gear)
Qqnorm(mpg)

9. If necessary, perform a Tukey procedure at the 99.9% family-wise confidence level and explain all information it provides.

Due to the assumptions being satisfied, a Tukey procedure is not needed.