Chapter 8 and 9 Homework

Due 3-18-2018

Problem 9.13

a) Assess ANOVA assumptions using the graph from PROC MIXED.

In order to proceed with ANOVA, we must check for the following pieces:

- No obvious pattern in our Residual Scatterplot
- Normal shape to the Residual Histogram.
- Residuals fit along the linear prediction of our Actual "Normality" to the Theoretical Normal Model.

Since there is no readily see-able pattern in our residuals, our distribution is mound shaped despite collection of residuals near positive 1, and our Residuals fit the along the Q-Q plot(although, there may be evidence of a right skew), we will proceed with ANOVA to see if at least one mean is different.

b) Perform ANOVA to determine if there is a difference among the five weight-reducing agents, $\alpha = 0.05$.

Table 1: ANOVA Table for Weight Loss Study

Row Names	SS	df	MS	F	P-Value
Treatments (T)	61.618	4	15.4045	15.6805	$4.16\text{x}10^{-8}$
Error (E)	44.207	45	0.9824		
Total	105.825	49			

Hypotheses:

H_0: $\mu_{a1} = \mu_{a2} = \mu_{a3} = \mu_{a4} = \mu_s$
H_1: At least one mean is different.

Test Statistic:

F = 15.6805

Rejection Region:

Reject H_0 if $F_0 > F_{\alpha,4,45}$
$F_{0.95,4,45} = 5.72$

Conclusion/Interpretation:

Since our $F_0 > 5.72$, there is strong enough evidence to support rejecting the null hypothesis that the means are the same. The data provided does suggest at least one mean is different from the rest.

c) Determine significantly different pairs using Tukey's W with $\alpha = 0.05$

To find which groups are different from each other, we will utilize Tukey's W to check which means are different from one another. We will verify this by checking which one's p-values are less than 0.05 after using the TukeyHSD test on our ANOVA Model in R.

Conclusion/Interpretation

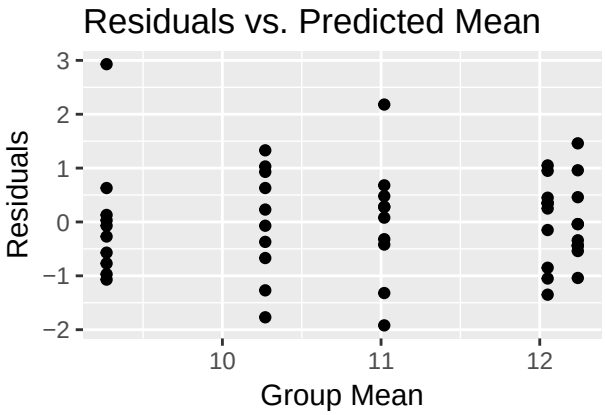
With our Tukey W test being run, the differences lie in the following means:

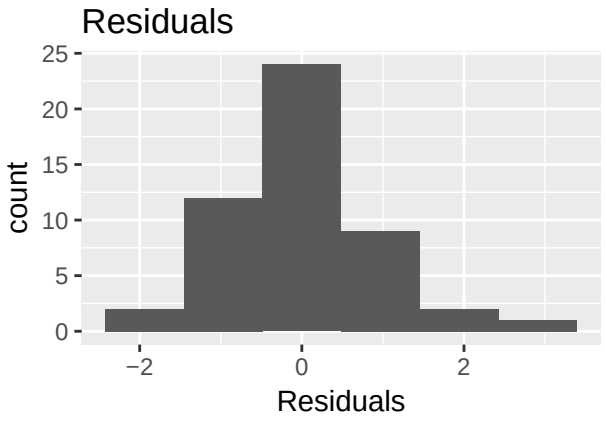
- s differs with a_1, a_2, and a_4
- a_1 differs with a_3

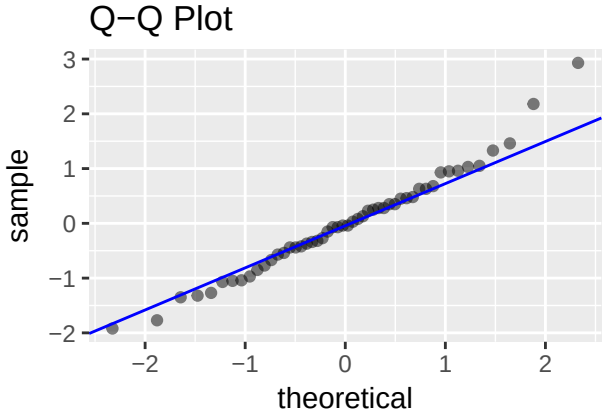
Chapter 8 And 9

Kyle Ligon

9.13 a) Checking the results from Proc Mixed in order to do ANOVA







9.13 b) Perform ANOVA test on the data: Show ANOVA Table First, then Run the Test

```
anova_mod
```

```
## Call:
##    aov(formula = wt_loss ~ treatment, data = gather_frame)
##
## Terms:
##                 treatment Residuals
## Sum of Squares     61.618    44.207
## Deg. of Freedom         4        45
##
## Residual standard error: 0.9911497
## Estimated effects may be unbalanced
```

```
summary(anova_mod)
```

```
##             Df Sum Sq Mean Sq F value   Pr(>F)
## treatment    4  61.62  15.405   15.68 4.16e-08 ***
## Residuals   45  44.21   0.982
## ---
```

```
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

9.13 c) Perform Tukey's W on the significant pairs

```
real_w <- TukeyHSD(anova_mod)
real_w
```

```
##   Tukey multiple comparisons of means
##     95% family-wise confidence level
##
## Fit: aov(formula = wt_loss ~ treatment, data = gather_frame)
##
## $treatment
##          diff        lwr        upr     p adj
## a_2-a_1 -1.03 -2.2894887  0.2294887 0.1563263
## a_3-a_1 -1.78 -3.0394887 -0.5205113 0.0019803
## a_4-a_1  0.19 -1.0694887  1.4494887 0.9927171
## s-a_1   -2.78 -4.0394887 -1.5205113 0.0000012
## a_3-a_2 -0.75 -2.0094887  0.5094887 0.4490082
## a_4-a_2  1.22 -0.0394887  2.4794887 0.0617607
## s-a_2   -1.75 -3.0094887 -0.4905113 0.0024286
## a_4-a_3  1.97  0.7105113  3.2294887 0.0005243
## s-a_3   -1.00 -2.2594887  0.2594887 0.1784060
## s-a_4   -2.97 -4.2294887 -1.7105113 0.0000003
```