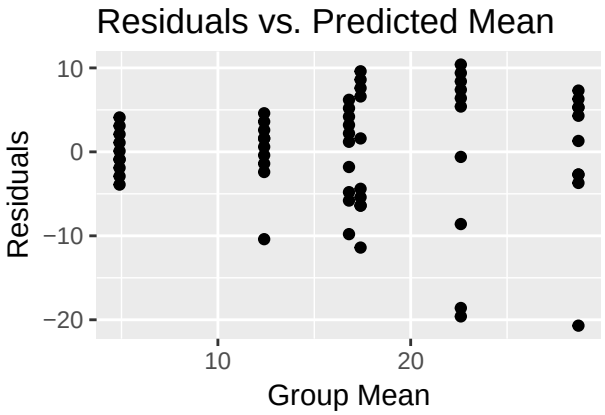
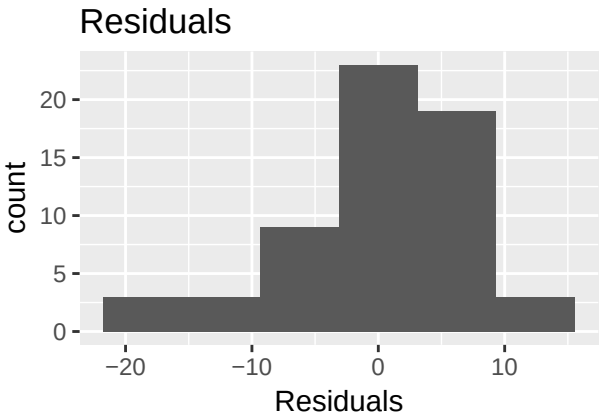
Chapter 14 and 15 HW

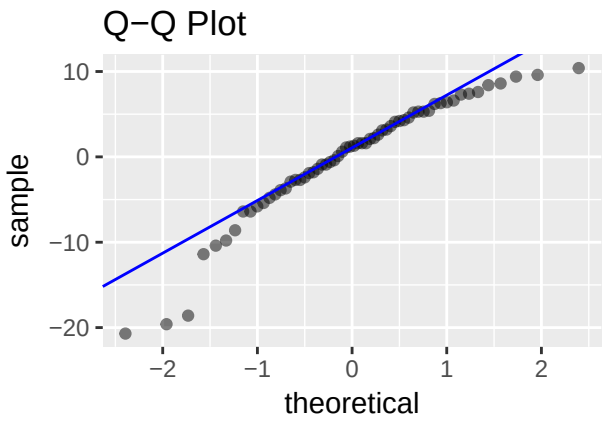
Kyle Ligon

March 30, 2018

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







14.8 (b) Perform an ANOVA to determine if there is an interaction between the age group and types of products;

```
## [1] 3.168246
```

```
## [1] 3.161861
```

```
## [1] 4.012973
```

(e) Report significantly different pairs using Tukey's W and $\alpha = 0{:}05$; REMEMBER: if there is an interaction present, we must account for that when performing post-hoc testing

```
# if there was an interaction, we would do this.
frame_Tukey <- frame %>%
                mutate(Combination = paste0(ageGroup, "-", products))
new_anova_mod <- aov(data = frame_Tukey, formula = att_spans ~ Combination)

TukeyHSD(new_anova_mod)
```

```
##   Tukey multiple comparisons of means
```

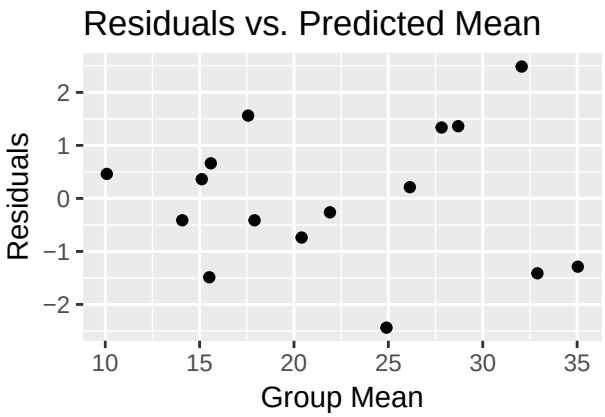
```
##     95% family-wise confidence level
##
## Fit: aov(formula = att_spans ~ Combination, data = frame_Tukey)
##
## $Combination
##              diff         lwr       upr     p adj
## a1-p2-a1-p1 12.5   2.9317963 22.068204 0.0039408
## a2-p1-a1-p1  7.5  -2.0682037 17.068204 0.2056830
## a2-p2-a1-p1 17.7   8.1317963 27.268204 0.0000174
## a3-p1-a1-p1 11.9   2.3317963 21.468204 0.0069038
## a3-p2-a1-p1 23.8  14.2317963 33.368204 0.0000000
## a2-p1-a1-p2 -5.0 -14.5682037  4.568204 0.6380006
## a2-p2-a1-p2  5.2  -4.3682037 14.768204 0.5984868
## a3-p1-a1-p2 -0.6 -10.1682037  8.968204 0.9999680
## a3-p2-a1-p2 11.3   1.7317963 20.868204 0.0118661
## a2-p2-a2-p1 10.2   0.6317963 19.768204 0.0302869
## a3-p1-a2-p1  4.4  -5.1682037 13.968204 0.7509637
## a3-p2-a2-p1 16.3   6.7317963 25.868204 0.0000807
## a3-p1-a2-p2 -5.8 -15.3682037  3.768204 0.4800463
## a3-p2-a2-p2  6.1  -3.4682037 15.668204 0.4231404
## a3-p2-a3-p1 11.9   2.3317963 21.468204 0.0069038
```

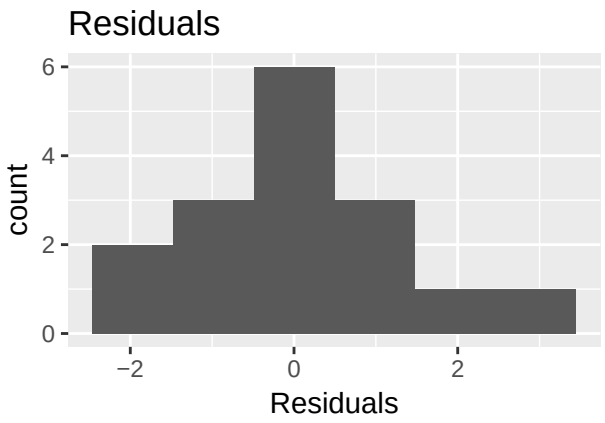
```
#but since there's not, we can just do the Tukey W on the old ANOVA model
TukeyHSD(anova_mod_noI)
```

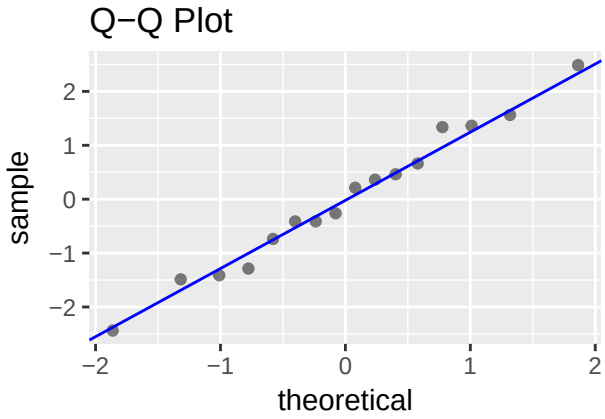
```
##   Tukey multiple comparisons of means
##     95% family-wise confidence level
##
## Fit: aov(formula = att_spans ~ ageGroup + products, data = frame)
##
## $ageGroup
##        diff        lwr      upr     p adj
## a2-a1  6.35  0.9224517 11.77755 0.0180817
## a3-a1 11.60  6.1724517 17.02755 0.0000105
## a3-a2  5.25 -0.1775483 10.67755 0.0599740
##
## $products
##           diff      lwr      upr p adj
## p2-p1 11.53333 7.845991 15.22068 1e-07
```

From this we can tell that a2 and a3 differes from a1. Additionally, p2 is different from p1.

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





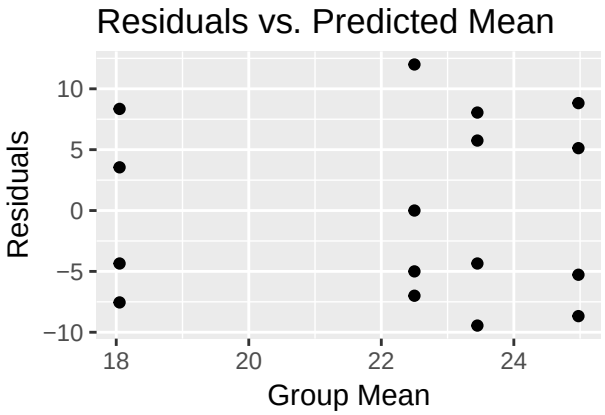


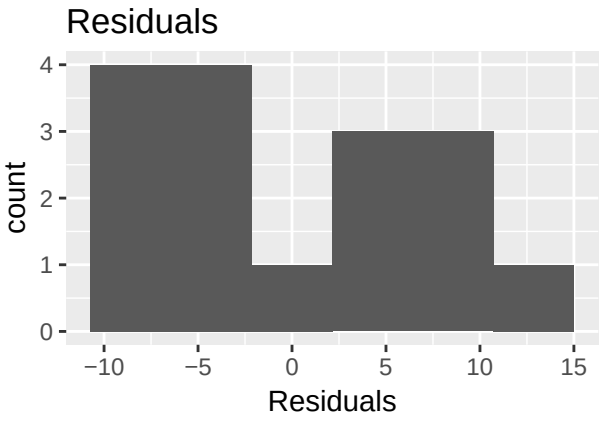
(c) If there is a difference per part (b), use Tukey's W to determine the significantly different pairs; $\alpha = 0{:}05$

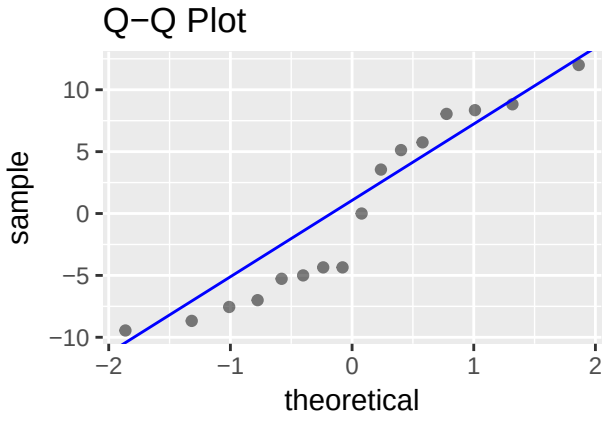
```
##   Tukey multiple comparisons of means
##     95% family-wise confidence level
##
## Fit: aov(formula = mileage ~ car_model + driver + seed, data = petrol)
##
## $car_model
##           diff       lwr      upr     p adj
## cm2-cm1 -1.975 -7.057132 3.107132 0.5709528
## cm3-cm1 -0.650 -5.732132 4.432132 0.9686626
## cm4-cm1 -0.600 -5.682132 4.482132 0.9749663
## cm3-cm2  1.325 -3.757132 6.407132 0.8045388
## cm4-cm2  1.375 -3.707132 6.457132 0.7877151
## cm4-cm3  0.050 -5.032132 5.132132 0.9999841
##
## $driver
##          diff        lwr        upr     p adj
## d2-d1  17.475  12.392868 22.5571325 0.0000896
## d3-d1   3.425  -1.657132  8.5071325 0.1921707
## d4-d1  11.775   6.692868 16.8571325 0.0008306
## d3-d2 -14.050 -19.132132 -8.9678675 0.0003106
## d4-d2  -5.700 -10.782132 -0.6178675 0.0310697
## d4-d3   8.350   3.267868 13.4321325 0.0051400
##
## $seed
##       diff         lwr        upr     p adj
```

```
## B-A  2.475  -2.6071325  7.5571325 0.4053971
## C-A -4.450  -9.5321325  0.6321325 0.0828995
## D-A  0.950  -4.1321325  6.0321325 0.9128431
## C-B -6.925 -12.0071325 -1.8428675 0.0128824
## D-B -1.525  -6.6071325  3.5571325 0.7351363
## D-C  5.400   0.3178675 10.4821325 0.0390458
```

e) Determine if there is a difference between gasoline blends using ANOVA for completely randomized designs (i.e., ignore the blocking factors); $\alpha = 0{:}05\}$








```
##             Df Sum Sq Mean Sq F value Pr(>F)
## seed         3  106.3   35.42   0.538  0.665
## Residuals   12  789.6   65.80
```

```
## [1] 3.490295
```