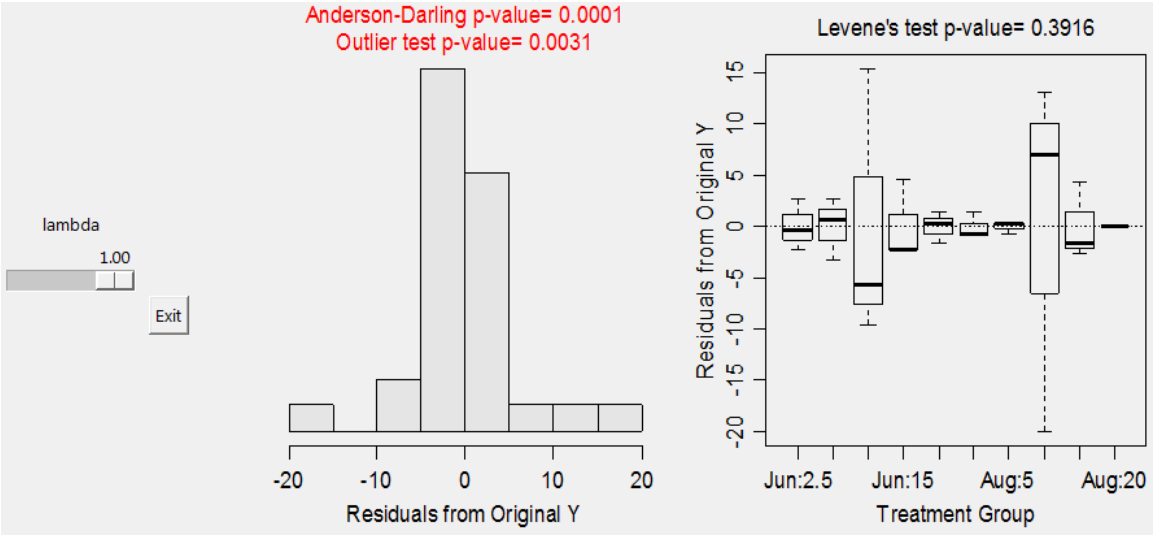
Biometry Quiz #2 R Handout Results #1

Data on the catch-per-unit-effort (CPE; number of fish per net per hour) of yellow perch (*Perca flavescens*) captured with gill nets in a Midwestern lake were obtained during midday at five depths during two months with three randomly selected sites sampled at each depth during each month. The data are loaded, manipulated, and analyzed below.

```
> library(NCStats)
> library(multcomp)
> setwd("C:/aaaWork/Class Materials/MTH207/Year_Specific/W13/Assessments")
> d75 <- read.table("box7_5.txt",header=TRUE)
> d75$Month <- factor(d75$Month,levels=c("Jun","Aug"))
> d75$Depth <- factor(d75$Depth)
> d75$comb <- d75$Month:d75$Depth
> str(d75)
  'data.frame':  30 obs. of  4 variables:
   $ Month: Factor w/ 2 levels "Jun","Aug": 1 1 1 1 1 1 1 1 1 1 ...
   $ Depth: Factor w/ 5 levels "2.5","5","10",..: 1 1 1 2 2 2 3 3 3 4 ...
   $ CPE  : int  2 4 7 6 10 12 8 12 33 10 ...
   $ comb : Factor w/ 10 levels "Jun:2.5","Jun:5",..: 1 1 1 2 2 2 3 3 ...
```

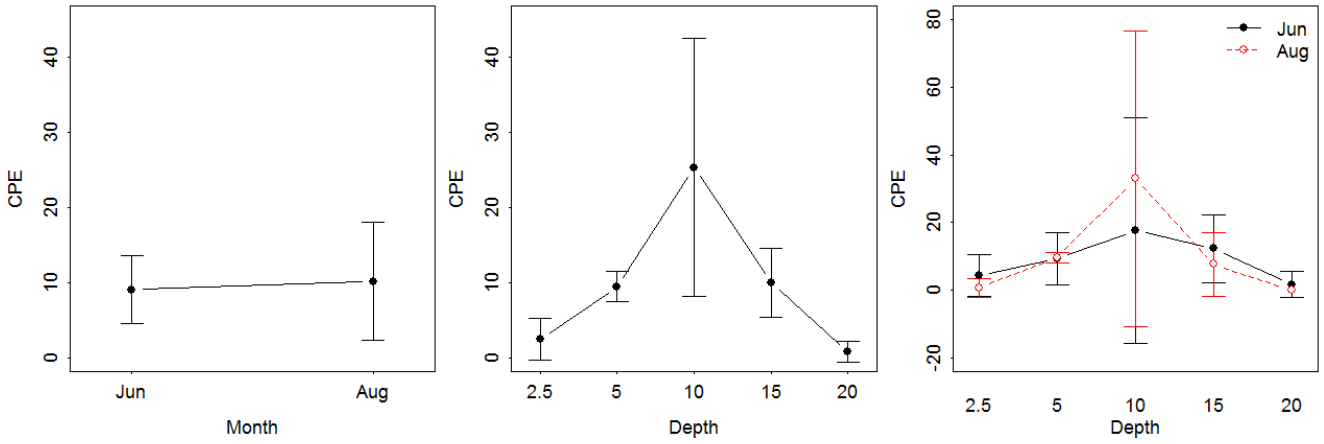
```
> lm1 <- lm(CPE~Month*Depth,data=d75)
> transChooser(lm1)
```

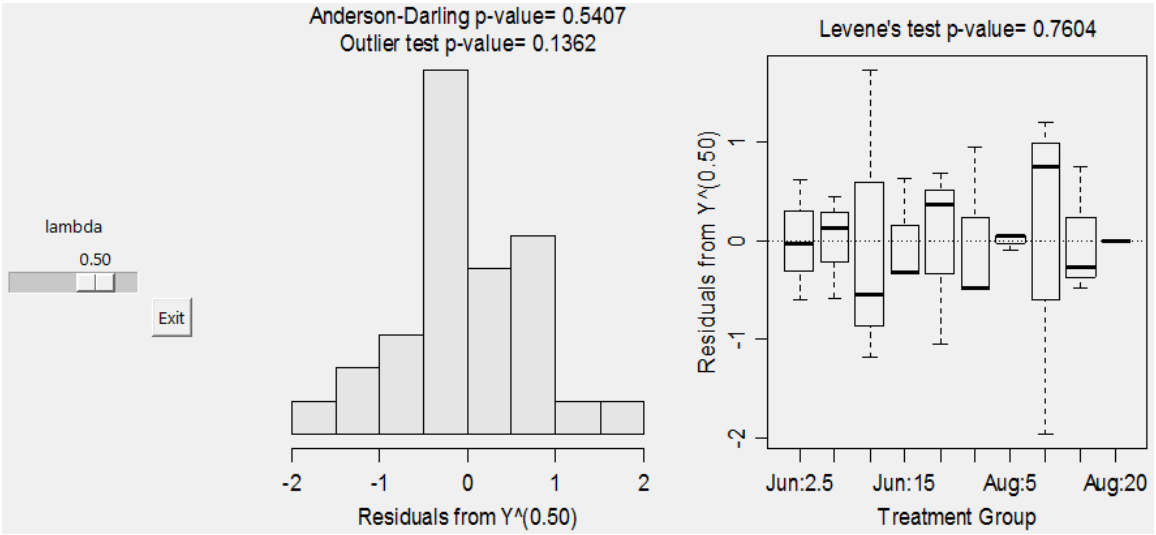



```
> anova(lm1)
              Df Sum Sq Mean Sq F value    Pr(>F)
Month          1    9.6    9.63  0.1785    0.6772
Depth          4 2249.8  562.45 10.4222 9.954e-05 ***
Month:Depth    4  400.2  100.05  1.8539    0.1582
Residuals     20 1079.3   53.97
Total         29 3739.0
```

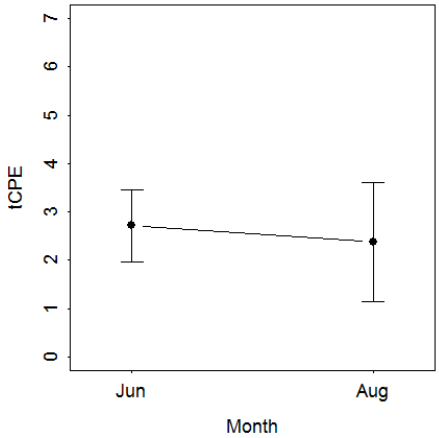
```
> mc1a <- glht(lm1,mcp(Month="Tukey"))
> confint(mc1a)
                 Estimate lwr      upr
Aug - Jun == 0  -3.6667 -16.1786   8.8453
```

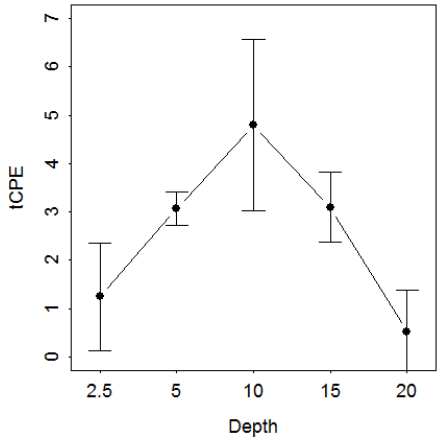
```
> mc1b <- glht(lm1,mcp(Depth="Tukey"))
> confint(mc1b)
                 Estimate lwr      upr
5 - 2.5 == 0      5.0000 -12.9484  22.9484
10 - 2.5 == 0    13.3333  -4.6151  31.2818
15 - 2.5 == 0     8.0000  -9.9484  25.9484
20 - 2.5 == 0    -2.6667 -20.6151  15.2818
10 - 5 == 0       8.3333  -9.6151  26.2818
15 - 5 == 0       3.0000 -14.9484  20.9484
20 - 5 == 0      -7.6667 -25.6151  10.2818
15 - 10 == 0     -5.3333 -23.2818  12.6151
20 - 10 == 0    -16.0000 -33.9484   1.9484
20 - 15 == 0    -10.6667 -28.6151   7.2818

> lm2 <- lm(CPE~comb,data=d75)
> mc2 <- glht(lm1a,mcp(comb="Tukey"))
> glhtSig(mc2)
 [1] "Aug:10 - Aug:2.5" "Aug:10 - Aug:5"   "Aug:15 - Aug:10"
 [4] "Aug:20 - Aug:10"  "Jun:2.5 - Aug:10" "Jun:5 - Aug:10"  "Jun:20 - Aug:10"

> fitPlot(lm1,which="Month",ylim=c(0,45),main="")          # below left
> fitPlot(lm1,which="Depth",ylim=c(0,45),main="")          # below center
> fitPlot(lm1,change.order=TRUE,ylim=c(-20,80),main="")    # below right
```

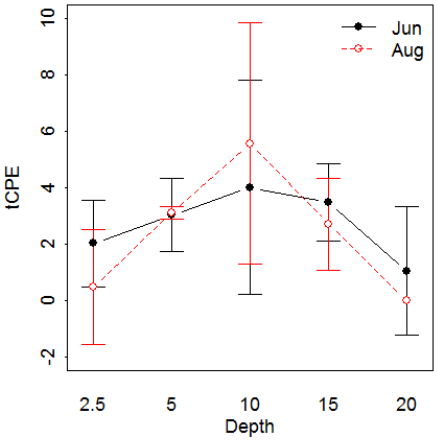




```
> d75$tCPE <- d75$CPE^(0.5)
> lm3 <- lm(tCPE~Month*Depth,data=d75)
> anova(lm3)
              Df Sum Sq Mean Sq F value    Pr(>F)
Month          1  0.890  0.8896  1.0828   0.31048
Depth          4 68.388 17.0970 20.8113 6.743e-07 ***
Month:Depth    4  8.891  2.2228  2.7056   0.05969 .
Residuals     20 16.430  0.8215
Total         29 94.599

> mc3a <- glht(lm3,mcp(Month="Tukey"))
> confint(mc3a)
                 Estimate  lwr       upr
Aug - Jun == 0 -1.548584 -3.092313 -0.004854

> mc3b <- glht(lm3,mcp(Depth="Tukey"))
> confint(mc3b)
                Estimate lwr     upr
5 - 2.5 == 0    1.0053  -1.2092  3.2198
10 - 2.5 == 0   1.9924  -0.2222  4.2069
15 - 2.5 == 0   1.4626  -0.7520  3.6771
20 - 2.5 == 0  -0.9712  -3.1858  1.2433
10 - 5 == 0     0.9871  -1.2275  3.2016
15 - 5 == 0     0.4573  -1.7573  2.6718
20 - 5 == 0    -1.9765  -4.1911  0.2380
15 - 10 == 0   -0.5298  -2.7444  1.6847
20 - 10 == 0   -2.9636  -5.1782 -0.7491
20 - 15 == 0   -2.4338  -4.6483 -0.2193

> lm4 <- lm(CPE~comb,data=d75)
> mc4 <- glht(lm4,mcp(comb="Tukey"))
> glhtSig(mc4)
 [1] "Aug:10 - Jun:2.5" "Aug:10 - Jun:5"   "Aug:10 - Jun:20"
 [4] "Aug:10 - Aug:2.5" "Aug:10 - Aug:5"   "Aug:15 - Aug:10" "Aug:20 - Aug:10"

> fitPlot(lm3,which="Month",ylim=c(0,7),main="")          # below left
> fitPlot(lm3,which="Depth",ylim=c(0,7),main="")          # below center
> fitPlot(lm3,change.order=TRUE,ylim=c(-2,10),main="")    # below right
```



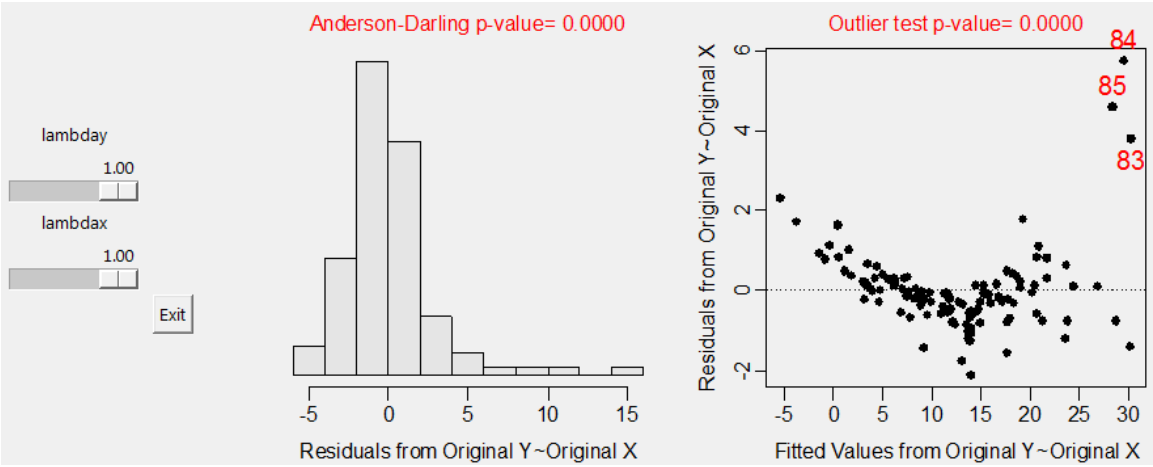




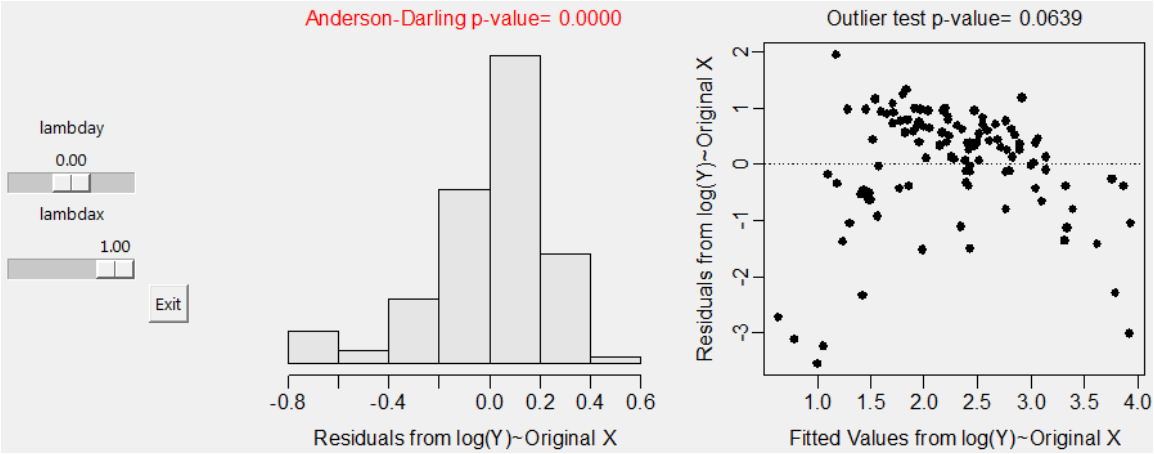
Biometry Quiz #2 R Handout Results #2

Wabnitz and Pauly (2008) examined the relationship between body weight (wt; kg) and straight carapace length (scl; cm) of populations of Kemp's Ridley sea turtles (*Lepidochelys kempi*) from Florida and Chesapeake Bay. Specifically, Wabnitz and Pauly were hoping to develop a model where they could predict the weight of an individual turtle from the straight carapace length measurement. The data were entered, manipulated, and analyzed below.

```
> kr <- read.table("KempsRidley.txt",header=TRUE)
> str(kr)
  'data.frame':       110 obs. of  3 variables:
   $ scl: num  19.2 21.4 24.5 25.3 25.9 27.2 26.9 27.9 28.8 30.5 ...
   $ wt : num  1.04 1.11 1.26 1.41 2.89 3.04 5.04 2.52 2.89 2.44 ...
   $ loc: Factor w/ 2 levels "Chesapeake","Florida": 1 1 1 1 1 1 1 1 1 1 ...

> lm5 <- lm(wt~scl,data=kr)
> transChooser(lm5)
```

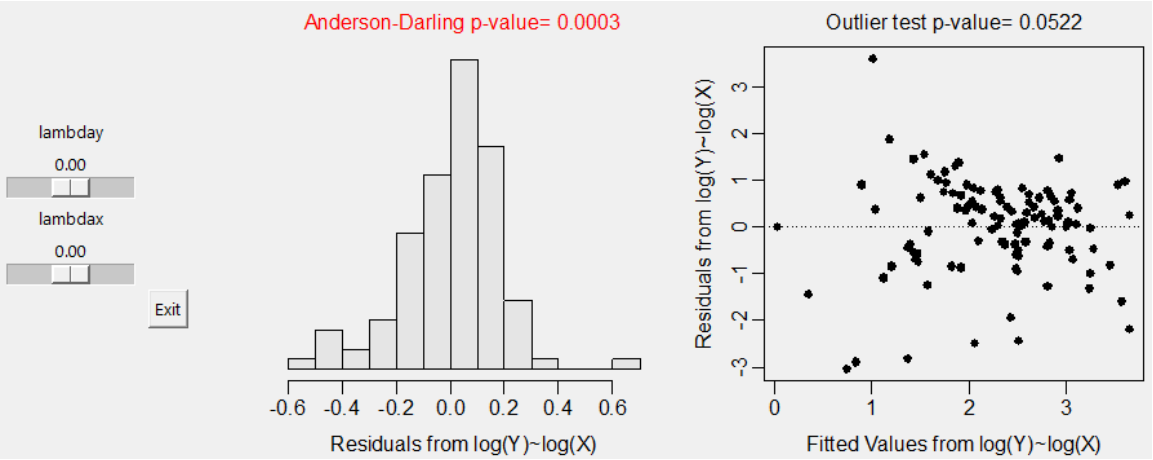



```
> summary(lm5)
  Coefficients:
               Estimate Std. Error t value Pr(>|t|)
  (Intercept) -19.58204    1.18038  -16.59   <2e-16 ***
  scl           0.74445    0.02682   27.76   <2e-16 ***
  ---
  Residual standard error: 2.886 on 108 degrees of freedom
  Multiple R-squared: 0.8771, Adjusted R-squared: 0.8759
  F-statistic: 770.7 on 1 and 108 DF,  p-value: < 2.2e-16

> confint(lm5)
                    2.5 %      97.5 %
  (Intercept) -21.9217588 -17.2423176
  scl           0.6912915   0.7976006

> predict(lm5,data.frame(scl=40),interval="prediction")
         fit      lwr      upr
  1 10.1958 4.447414 15.94419
> predict(lm5,data.frame(scl=40),interval="confidence")
         fit      lwr      upr
  1 10.1958 9.630369 10.76124
```




```
> kr$logwt <- log(kr$wt)

> lm6 <- lm(logwt~scl,data=kr)
> summary(lm6)
   Coefficients:
                Estimate Std. Error t value Pr(>|t|)
   (Intercept) -0.684290   0.096026  -7.126 1.22e-10 ***
   scl          0.069041   0.002182  31.648  < 2e-16 ***
   ---
   Residual standard error: 0.2348 on 108 degrees of freedom
   Multiple R-squared: 0.9027, Adjusted R-squared: 0.9018
   F-statistic:  1002 on 1 and 108 DF,  p-value: < 2.2e-16

> confint(lm6)
                    2.5 %      97.5 %
   (Intercept) -0.87462914 -0.49394989
   scl          0.06471697  0.07336537

> predict(lm6,data.frame(scl=40),interval="prediction")
          fit      lwr      upr
   1 2.077357 1.609718 2.544997
> predict(lm6,data.frame(scl=40),interval="confidence")
          fit      lwr      upr
   1 2.077357 2.031358 2.123356
```

(OVER)




```
> kr$logscl <- log(kr$scl)

> lm7 <- lm(logwt~logscl,data=kr)
> summary(lm7)
   Coefficients:
               Estimate Std. Error t value Pr(>|t|)
   (Intercept) -8.50562    0.25517  -33.33   <2e-16 ***
   logscl       2.89192    0.06832   42.33   <2e-16 ***
   ---
   Residual standard error: 0.1794 on 108 degrees of freedom
   Multiple R-squared: 0.9431, Adjusted R-squared: 0.9426
   F-statistic:  1792 on 1 and 108 DF,  p-value: < 2.2e-16

> confint(lm7)
                    2.5 %    97.5 %
   (Intercept) -9.011413 -7.999835
   logscl       2.756495  3.027342

> predict(lm7,data.frame(logscl=log(40)),interval="prediction")
          fit      lwr      upr
   1 2.162315 1.805003 2.519626
> predict(lm7,data.frame(logscl=log(40)),interval="confidence")
          fit      lwr      upr
   1 2.162315 2.128024 2.196606
```