As part of a larger analysis, Ghosh et al. (2009; Remote Sens.) needed to estimate urban population size based on the lighted area of cities visible from satellite imagery. To determine if this was possible, the researchers found the total population size (in 100,000 people) and the lighted area from satellite images (in 10,000 $km^2$) for urban areas in the 48 contiguous United States. A variety of analyses of these data are shown in the attached handout. Use this background information and the R analytical results to answer the following questions. Make sure to answer each question as thoroughly as possible and by citing supporting evidence where appropriate (you may want to label output on the handout).

Use the background information and the analytical results from ***R Handout Results #2*** to answer the following questions. Make sure to answer each question as thoroughly as possible and by citing supporting evidence where appropriate (you may want to label output on the handout).

a) **[8 pts]** Assess all assumptions (with the exception of independence) on the original scale. State whether you will interpret results on the original or transformed scale (you should examine, but you do not need to describe, the tests of assumptions on the transformed scale).

b) **[6 pts]** Is there a statistically significant relationship? If so, specifically describe that relationship.

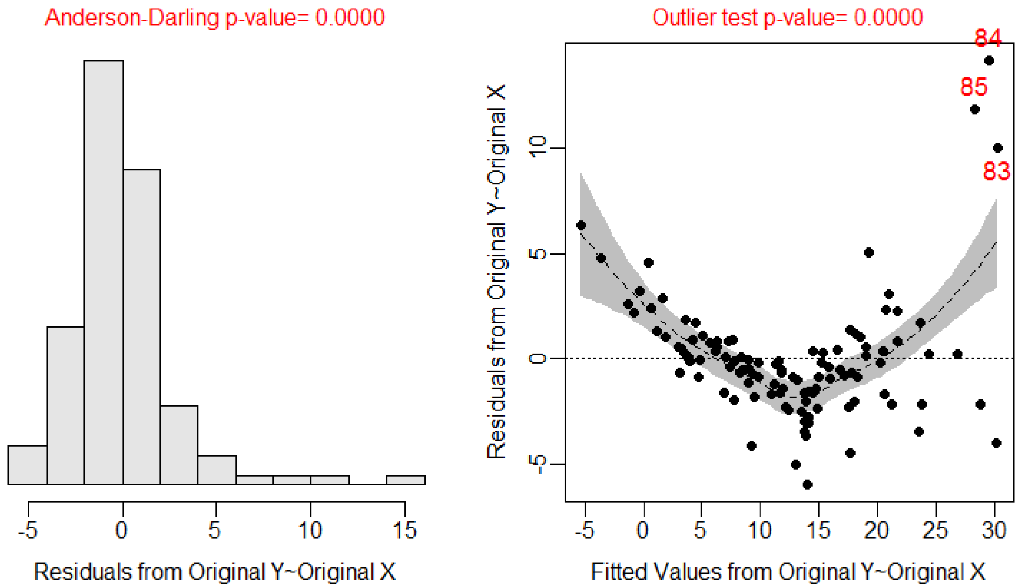
c) **[4 pts]** Make the prediction (using the example on the handout) that corresponds to what the authors wanted to predict (stated in the background).

d) **[2 pts]** Is straight carapace length a "good" (not necessarily a significant) predictor of body weight for these sea turtles? Provide specific evidence.

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 hoped to develop a model to predict the weight of an individual turtle from the straight carapace length measurement. The data were entered, manipulated, and analyzed below.

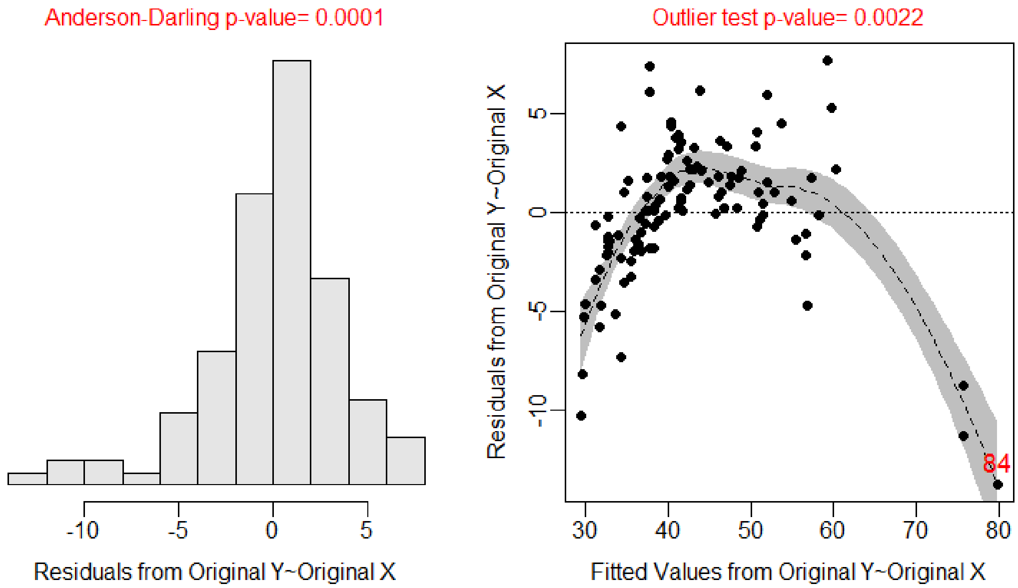
```
> kr <- read.table("KempsRidley.txt",header=TRUE)
> kr$logwt <- log(kr$wt)
> kr$logscl <- log(kr$scl)

> str(kr)
 'data.frame': 110 obs. of  5 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 ...
  $ logwt : num  0.0392 0.1044 0.2311 0.3436 1.0613 ...
  $ logscl: num  2.95 3.06 3.2 3.23 3.25 ...
```

```
> ##############################################
> slr1 <- lm(wt~scl,data=kr)
> transChooser(slr1)
```



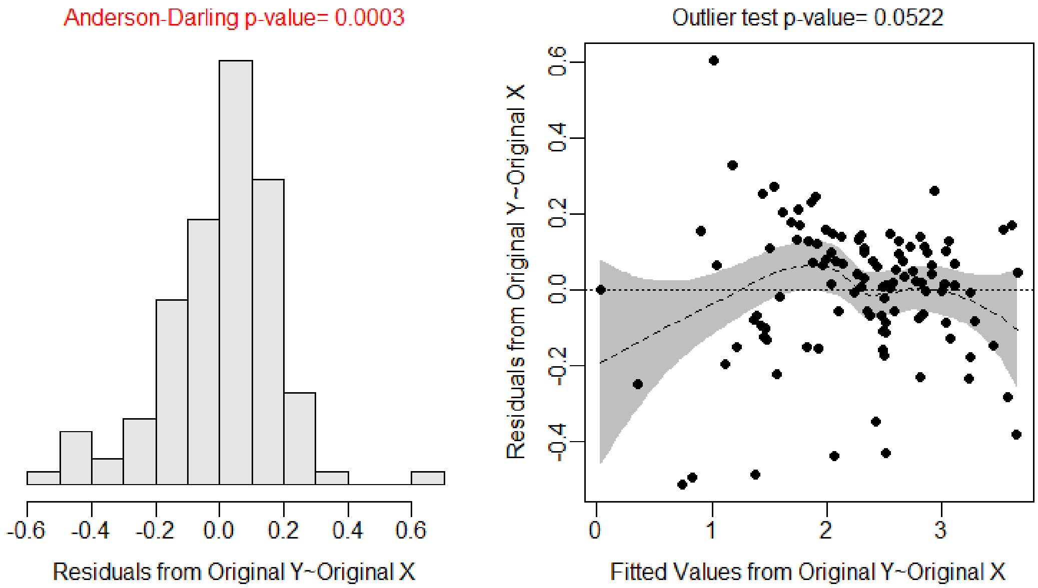

```
> summary(slr1)
 Coefficients:
              Estimate Std. Error t value Pr(>|t|)
 (Intercept) -19.58204    1.18038  -16.59   <2e-16
 scl           0.74445    0.02682   27.76   <2e-16

 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(slr1)
                  2.5 %      97.5 %
 (Intercept) -21.9217588 -17.2423176
 scl           0.6912915   0.7976006

> predict(slr1,data.frame(scl=40),interval="prediction")
       fit      lwr      upr
 1 10.1958 4.447414 15.94419

> predict(slr1,data.frame(scl=40),interval="confidence")
       fit      lwr      upr
 1 10.1958 9.630369 10.76124

> ##############################################
```

```
> ##############################################
> slr2 <- lm(scl~wt,data=kr)
> transChooser(slr2)
```



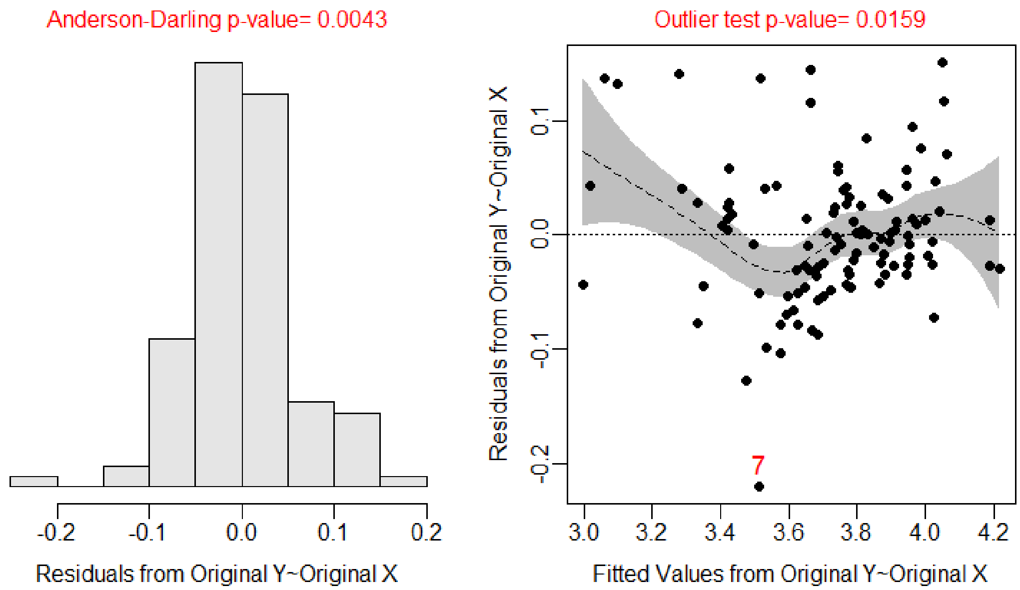

```
> summary(slr2)
 Coefficients:
              Estimate Std. Error t value Pr(>|t|)
 (Intercept) 28.33229    0.62578   45.27   <2e-16
 wt           1.17817    0.04244   27.76   <2e-16

 Residual standard error: 3.631 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(slr2)
                2.5 %    97.5 %
 (Intercept) 27.09188 29.572694
 wt           1.09405  1.262297

> predict(slr2,data.frame(wt=40),interval="prediction")
        fit      lwr      upr
 1 75.45924 67.86338 83.05511

> predict(slr2,data.frame(wt=40),interval="confidence")
        fit      lwr      upr
 1 75.45924 73.02878 77.88971

> ##############################################
```

```
> ##############################################
> slr3 <- lm(logwt~logscl,data=kr)
> transChooser(slr3)
```




```
> summary(slr3)
 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(slr3)
                  2.5 %    97.5 %
 (Intercept) -9.011413 -7.999835
 logscl       2.756495  3.027342

> predict(slr3,data.frame(logscl=log(40)),interval="prediction")
       fit      lwr      upr
 1 2.162315 1.805003 2.519626

> predict(slr3,data.frame(logscl=log(40)),interval="confidence")
       fit      lwr      upr
 1 2.162315 2.128024 2.196606

> ##############################################
```

```
> ##############################################
> slr4 <- lm(logscl~logwt,data=kr)
> transChooser(slr4)
```




```
> summary(slr4)
  Coefficients:
  Error t value Pr(>|t|)
  (Intercept) 2.985814   0.018417  162.13   <2e-16
  logwt       0.326133   0.007705   42.33   <2e-16

  Residual standard error: 0.06026 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(slr4)
                  2.5 %    97.5 %
  (Intercept) 2.9493096 3.0223192
  logwt       0.3108603 0.3414049

> predict(slr4,data.frame(logwt=log(40)),interval="prediction")
        fit      lwr      upr
  1 4.188878 4.06696 4.310796

> predict(slr4,data.frame(logwt=log(40)),interval="confidence")
        fit      lwr      upr
  1 4.188878 4.164412 4.213345

> ##############################################
```