

Assignment ON4

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Due at 3:55 PM on Monday 23 March 2020

SET YOUR WORKING DIRECTORY!

```
setwd("C:/Users/1/Dropbox/00 - Working Folder/Teaching/DPH112/2019-2020/Week ON4")
```

Data

```
IGE.LN <- c(24.87, 12.9, 9.87, 8.74, 6.88, 5.9, 4.85, 3.53, 2.25, 2.14,
            1.94, 1.29, 0.94, 0.91, 0.55, 0.3, 0.14, 0.11, 0.1, 0.1,
            0.1, 0.1, 0.1)
SKIN.LN <- c(0.055, 0.041034, 0.050909, 0.046, 0.039032,
            0.050909, 0.042142, 0.055, 4.333333, 0.55,
            0.050909, 0.446153, 0.4, 0.475, 4.461538,
            4.103448, 7.428571, 4.461538, 6.625, 49.13043,
            36.47058, 52.85714, 47.5)
REACTIVITY <- data.frame(IGE.LN, SKIN.LN)
str(REACTIVITY)
```

```
## 'data.frame':   23 obs. of  2 variables:
##  $ IGE.LN : num  24.87 12.9 9.87 8.74 6.88 ...
##  $ SKIN.LN: num  0.055 0.041 0.0509 0.046 0.039 ...
```

```
head(REACTIVITY)
```

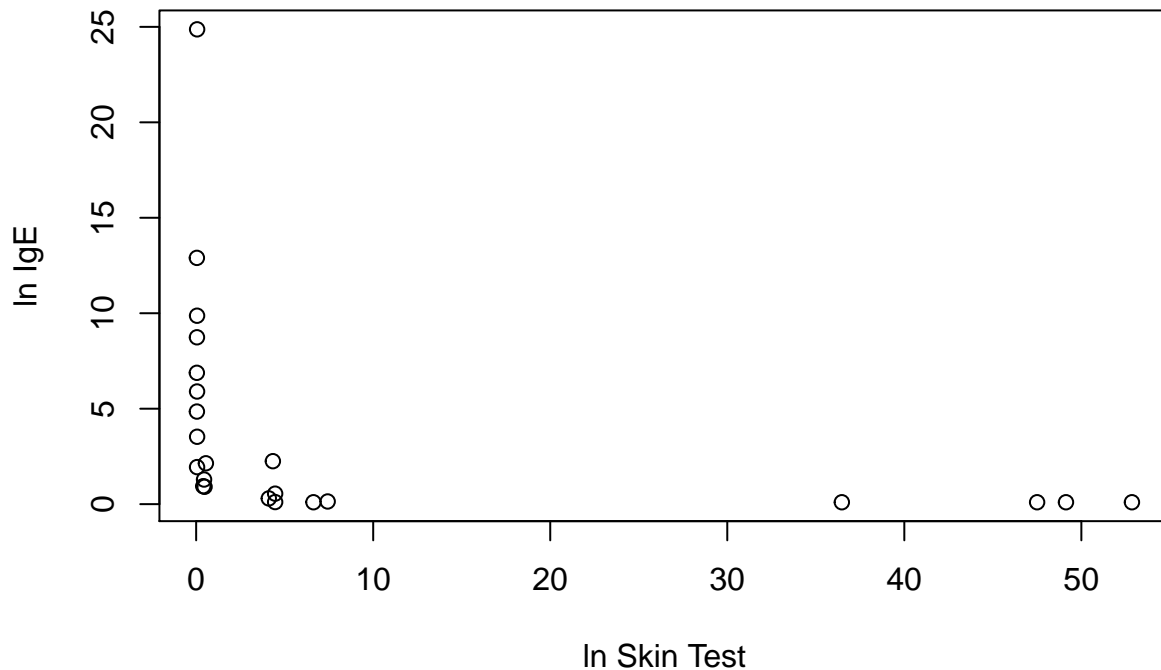
```
##   IGE.LN  SKIN.LN
## 1  24.87 0.055000
## 2  12.90 0.041034
## 3   9.87 0.050909
## 4   8.74 0.046000
## 5   6.88 0.039032
## 6   5.90 0.050909
```

Questions

1. (10 marks) Construct a properly-formatted scatterplot of the data.

```
plot(IGE.LN ~ SKIN.LN, data = REACTIVITY,
     main = "IgE and Skin Test Reactivity",
     ylab = "ln IgE",
     xlab = "ln Skin Test")
```

IgE and Skin Test Reactivity



2. (10 marks) Conduct the simple linear regression and interpret the intercept and slope estimates.

```
REACTIVITY.LM <- lm(IGE.LN ~ SKIN.LN, data = REACTIVITY)
summary(REACTIVITY.LM)
```

```
##
## Call:
## lm(formula = IGE.LN ~ SKIN.LN, data = REACTIVITY)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -4.339 -3.930 -1.436   1.129  19.904
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)   4.97247    1.33380   3.728  0.00124 **
## SKIN.LN       -0.11725    0.06754  -1.736  0.09722 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 5.599 on 21 degrees of freedom
## Multiple R-squared:  0.1255, Adjusted R-squared:  0.08385
## F-statistic: 3.014 on 1 and 21 DF, p-value: 0.09722
```

When skin reactivity is zero, the mean IgE level will be 4.972 natural logarithm units. In addition, for every natural log unit increase in skin reactivity, IgE levels will decrease by 0.117 natural logarithm units.

3. (10 marks) Test the null hypotheses that the intercept and slope estimates are zero at $\alpha = 0.10$.

Interpret the p-values without recourse to statistical significance.

Both intercept and slope have p-values smaller than α . Thus, both null hypotheses are rejected. I leave you to interpret the p-values.

4. (10 marks) Construct 90% confidence intervals for the intercept and slope estimates and interpret them.

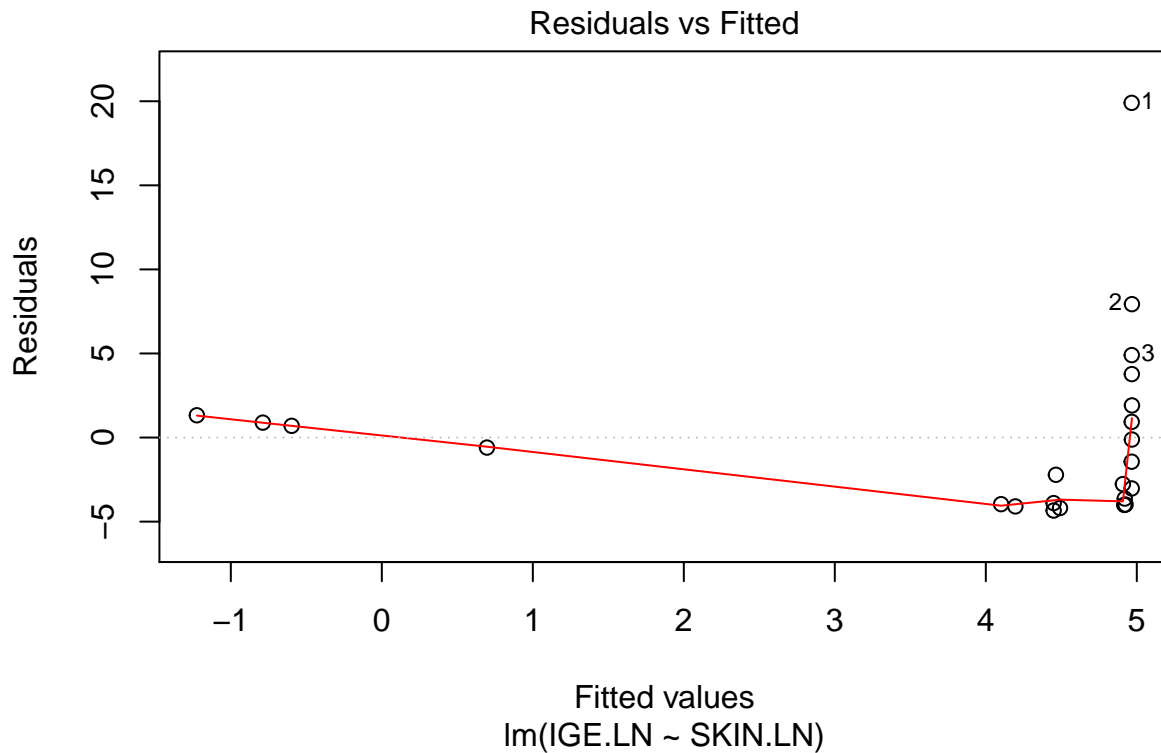
```
confint(REACTIVITY.LM, level = 0.90)
```

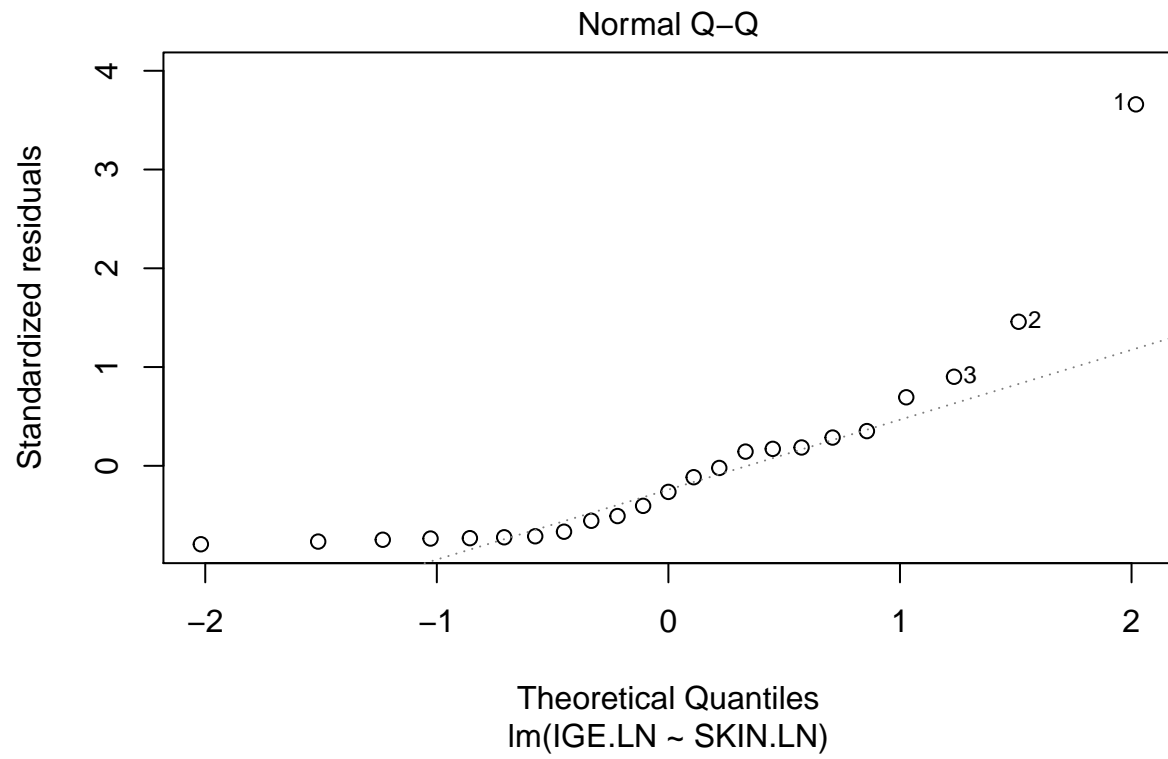
```
##              5 %              95 %  
## (Intercept) 2.6773390 7.267596558  
## SKIN.LN     -0.2334721 -0.001028099
```

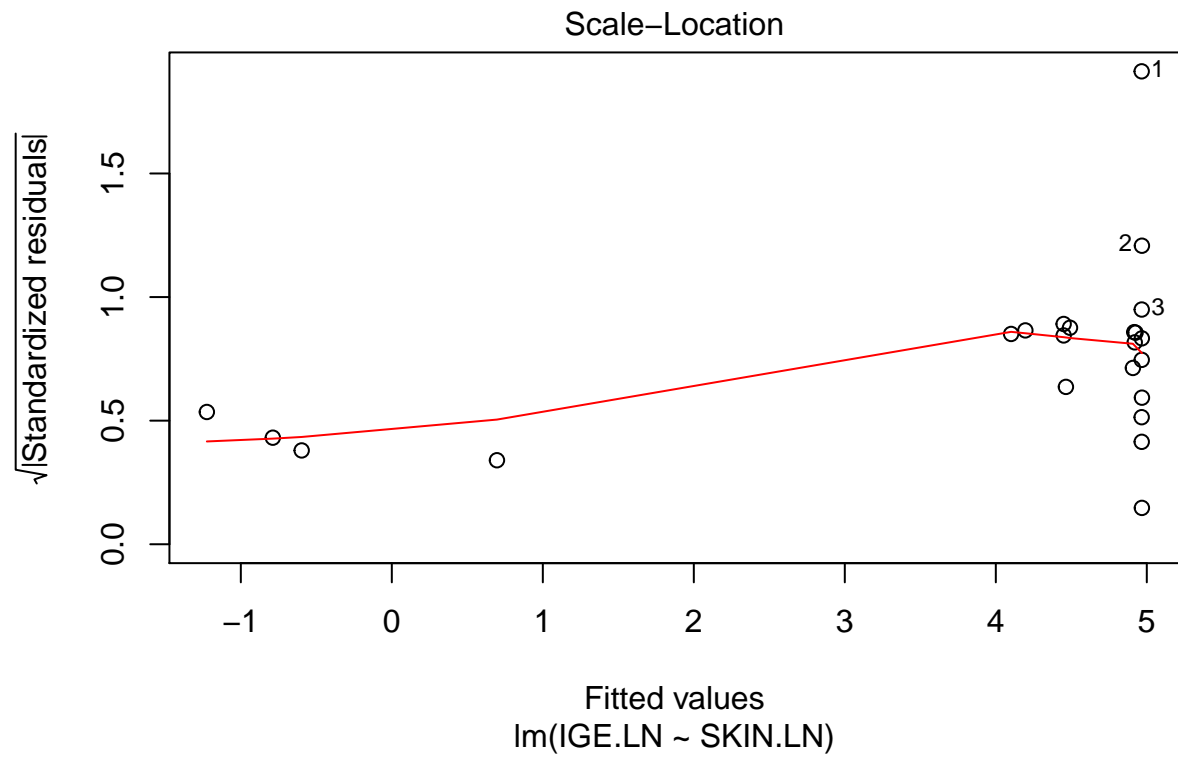
The 90% confidence intervals for the intercept and slope are (2.677, 7.268) and (-0.233, -0.001), respectively. I leave you to interpret the confidence intervals.

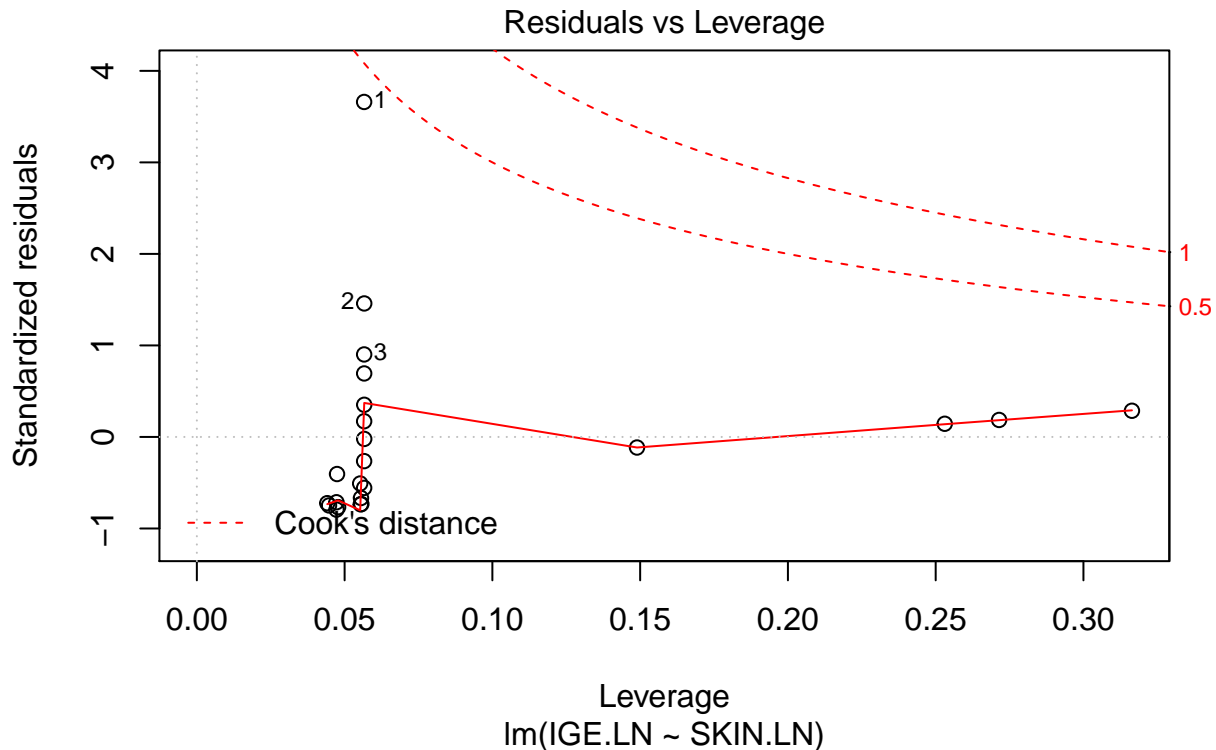
5. (40 marks) Test the assumptions of linearity, independence, normality and equal variance.

```
plot(REACTIVITY.LM)
```









The graphs show that the assumptions of linearity, normality and homoskedasticity are not met.

6. (10 marks) Predict the IgE level on an individual in natural log units if the skin test level in natural log units is 0.1. Construct 90% intervals.

```
predict(REACTIVITY.LM, data.frame(SKIN.LN = 0.1),
        interval = "prediction", level = 0.90)
```

```
##          fit      lwr      upr
## 1 4.960743 -4.94162 14.86311
```

The predicted IgE level of the individual is 4.961 (90 % CI -4.942, 14.863).

7. (10 marks) Predict the mean IgE level in natural log units if the skin test level in natural log units is 0.1. Construct 90% intervals.

```
predict(REACTIVITY.LM, data.frame(SKIN.LN = 0.1),
        interval = "confidence", level = 0.90)
```

```
##          fit      lwr      upr
## 1 4.960743  2.671212  7.250273
```

The predicted mean IgE is 4.961 (90% CI 2.671, 7.250)

THE END