DATA621 Extended LMR Ex 6.2

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R Markdown

Fit the orings data with a binomial response and a logit link as in Chapter 2. (a) Construct the appropriate test statistic for testing the effect of the temperature. State the appropriate null distribution and give the p-value. (b) Generate data under the null distribution for the previous test. Use the rbinom function with the average proportion of damaged O-rings. Recompute the test statistic and compute the p-value. (c) Repeat the process of the previous question 1000 times, saving the test statistic each time. Compare the empirical distribution of these simulated test statistics with the nominal null distribution stated in the first part of this question. Compare the critical values for a 5% level test computed using these two methods.

```
data(orings, package="faraway")
head(orings)
```

```
##   temp damage
## 1   53      5
## 2   57      1
## 3   58      1
## 4   63      1
## 5   66      0
## 6   67      0
```

```
summary(orings)
```

```
##       temp           damage
##  Min.   :53.00   Min.   :0.0000
##  1st Qu.:67.00   1st Qu.:0.0000
##  Median :70.00   Median :0.0000
##  Mean   :69.57   Mean   :0.4783
##  3rd Qu.:75.00   3rd Qu.:1.0000
##  Max.   :81.00   Max.   :5.0000
```

```
mod1<-glm(cbind(damage,6-damage)~temp, family = binomial, data=orings)
summary(mod1)
```

```
##
## Call:
## glm(formula = cbind(damage, 6 - damage) ~ temp, family = binomial,
##     data = orings)
##
```

```
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -0.9529  -0.7345  -0.4393  -0.2079   1.9565
##
## Coefficients:
##             Estimate Std. Error z value Pr(>|z|)
## (Intercept) 11.66299    3.29626   3.538 0.000403 ***
## temp        -0.21623    0.05318  -4.066 4.78e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##     Null deviance: 38.898  on 22  degrees of freedom
## Residual deviance: 16.912  on 21  degrees of freedom
## AIC: 33.675
##
## Number of Fisher Scoring iterations: 6
```

```
pchisq(deviance(mod1), df.residual(mod1), lower.tail = FALSE)
```

```
## [1] 0.7164099
```

The p-value is large indicating no evidence of bad fit.

```
anova(mod1, test="Chi")
```

```
## Analysis of Deviance Table
##
## Model: binomial, link: logit
##
## Response: cbind(damage, 6 - damage)
##
## Terms added sequentially (first to last)
##
##
##      Df Deviance Resid. Df Resid. Dev  Pr(>Chi)
## NULL                    22     38.898
## temp  1   21.985        21     16.912 2.747e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

The temperature is is significant.

b.

```
ilogit(predict(mod1))*6
```

```
##          1          2          3          4          5          6          7
## 3.30287290 2.04129955 1.76085411 0.74097688 0.41158626 0.33603447 0.33603447
##          8          9         10         11         12         13         14
```

```
## 0.33603447 0.27367200 0.22242848 0.18047760 0.18047760 0.18047760 0.18047760
##         15         16         17         18         19         20         21
## 0.11836301 0.09571414 0.06245930 0.06245930 0.05041596 0.05041596 0.03281202
##         22         23
## 0.02645976 0.01719653
```

```
rbinom(23,6,mean(orings$damage)/6)
```

```
##  [1] 1 0 0 1 1 1 0 0 0 0 0 1 0 0 1 2 1 0 0 0 0 0 0
```