Homework 3

MacKenzie Ullman

3/2/2021

Fit a logistic regression model that assumes the probability of success is an additive function of variables x1 and x2.

```
setwd("F:/Quant Eco")
getwd()
```

```
## [1] "F:/Quant Eco"
```

```
HW3 <- read.csv(file ='HW3.csv')
head(HW3)
```

```
##   y         x1 x2
## 1 1 0.52827024  a
## 2 1 0.79095078  a
## 3 0 1.69829751  b
## 4 0 0.01721882  a
## 5 0 1.00095008  b
## 6 1 0.84884529  a
```

```
summary(HW3)
```

```
##        y             x1           x2
##  Min.   :0.0   Min.   :0.007509   a:52
##  1st Qu.:0.0   1st Qu.:0.331344   b:48
##  Median :0.5   Median :0.653911
##  Mean   :0.5   Mean   :0.780439
##  3rd Qu.:1.0   3rd Qu.:1.211934
##  Max.   :1.0   Max.   :2.336703
```

```
fit <- glm( y~ x1+x2, family= binomial, data= HW3)
summary(fit)
```

```
##
## Call:
## glm(formula = y ~ x1 + x2, family = binomial, data = HW3)
##
## Deviance Residuals:
##      Min        1Q    Median        3Q       Max
## -1.43687  -1.00592   0.01992   1.00818   1.50526
##
## Coefficients:
##             Estimate Std. Error z value Pr(>|z|)
## (Intercept)   0.5948     0.3950   1.506   0.1321
## x1           -0.1680     0.3648  -0.460   0.6452
## x2b          -0.9679     0.4136  -2.340   0.0193 *
```

```
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##     Null deviance: 138.63  on 99  degrees of freedom
## Residual deviance: 132.59  on 97  degrees of freedom
## AIC: 138.59
##
## Number of Fisher Scoring iterations: 4
```

Interpret the effect of variable x1 on the log odds of success. Verify your interpretation in R.

when x1 changes by 1 unit, the log odds of success change by -0.1679

```
betas <- coef(fit)
betas
```

```
## (Intercept)          x1         x2b
##   0.5948499  -0.1679760  -0.9679244
```

```
yx<- betas[1]+betas[2]*0
yx
```

```
## (Intercept)
##   0.5948499
```

```
yx1 <-betas[1]+betas[2]*1
yx1
```

```
## (Intercept)
##   0.4268739
```

```
yx1-yx
```

```
## (Intercept)
##   -0.167976
```

Interpret the effect of variable x2 on the log odds of success. Verify your interpretation in R.

when the x2 variable changes by one unit, the log odds of success change by -0.9679

```
betas <- coef(fit)
betas
```

```
## (Intercept)          x1         x2b
##   0.5948499  -0.1679760  -0.9679244
```

```
yx2 <- betas[1] + betas[3]*0
yx2
```

```
## (Intercept)
##   0.5948499
```

```
yx21 <- betas [1] + betas[3]*1
yx21
```

```
## (Intercept)
##  -0.3730744
```

```
yx21-yx2
```

```
## (Intercept)
##  -0.9679244
```

Duplicate the Wald Test and p-values for variables x1 and x2 performed by the glm() function. Do you reject or fail to reject your null hypothesis?

```
#wald test for x1
betas[2] / summary(fit)[['coefficients']]['x1', 'Std. Error']
```

```
##         x1
## -0.4604971
```

```
summary(fit)[['coefficients']]['x1', 'z value']
```

```
## [1] -0.4604971
```

```
#wald test for x2
betas[3] / summary(fit)[['coefficients']]['x2b', 'Std. Error']
```

```
##       x2b
## -2.340366
```

```
summary(fit)[['coefficients']]['x2b', 'z value']
```

```
## [1] -2.340366
```

```
# p-values
#test statistic for x1
tsx1 <- betas[2] / summary(fit)[['coefficients']]['x2b', 'Std. Error']
tsx1
```

```
##         x1
## -0.406153
```

```
#test statistic for x2
tsx2 <- betas[3] / summary(fit)[['coefficients']]['x2b', 'Std. Error']
tsx2
```

```
##       x2b
## -2.340366
```

```
#p-value for x1
2 * pnorm(-1 * abs(tsx1), mean = 0, sd = 1)
```

```
##         x1
## 0.6846302
```

```
#p-value for x2
2 * pnorm(-1 * abs(tsx2), mean = 0, sd = 1)
```

```
##         x2b
## 0.01926485
```

We reject the null hypothesis for x1. We fail to reject the null hypothesis for x2.

Predict and plot the mean probability of success over the range of values of x1.

```
plogis(yx2)
```

```
## (Intercept)
##   0.6444772
```

```r
x1 <- seq(from = min(HW3$x1), to = max(HW3$x1),length.out = 100)

y <- betas[1] + betas[2] * x1
plot(x = x1, y = plogis(y), ylab = 'Probability of Success over Range of x1',
xlab = 'x1', cex.axis = 1.5, cex.lab = 1.5, type = 'l')
```