Assignment-05

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2022-11-22

Question 1)

1.a)

Maximum Likely Hood of Beta0 and Beta1 are -10.30893 and 0.01891.

The stated response function is :

Pihat=(1+exp(10.30893-0.01891X))^-1

```
Data=read.table("C:/Users/SRINU/Desktop/Fall 2022/Stats/Asn 5 Q1.txt", quote="\"", comment.char="")

colnames(Data) = c('Y', 'X')

Fit= glm(formula = Y~X, family = binomial(link = "logit"), data = Data)

Beta0=coef(Fit)[[1]]
Beta1=coef(Fit)[[2]]

Beta0
```

```
## [1] -10.30893
```

```
Beta1
```

```
## [1] 0.01891983
```

1.b)

The fitted logistic response function fits the model well, from lowess smooth superimposed

```
prob <- predict.glm(object = Fit, type = 'response')

plot(x = Data$X, y = prob, type = 'p' , xlab = 'Emotional Stability Score', ylab ='Probability')
lines(lowess(Data$X, Data$Y))
```

1.c)

Interpretation of Exp(Beta):

It is the odds ratio of probability of X increased by 1 with X

We know that,

exp(Beta1)=odds(PiHat(X+1))/odds(PiHat(X)).

The value of exp_beta1 is 1.0191

```
exp_beta1=exp(Beta1)
exp_beta1
```

```
## [1] 1.0191
```

1.d)

The estimated probability that employees with an emotional stability test score 550 will be able to perform in a task group is 0.524.

```
new_df = data.frame(550)
colnames(new_df) = 'X'
Prob_550 = predict.glm(object = Fit, newdata = new_df, type = 'response')
Prob_550
```

```
##         1
## 0.5242263
```

1.e)

The emotional stability test score for which 70 percent of employees with this test score are expected to be able to perform in a task group is 589.65.

```
logit <- log(0.7/0.3)
X <- (logit - Beta0)/Beta1
X
```

```
## [1] 589.6577
```

Question 2)

2.a)

Maximum Likely Hood of Beta0 and Beta1 are -6.374 and 0.0116.

The stated response function is :

Pihat=(1+exp(6.374-0.0116X))^-1

```
Probit_fit <- glm(formula = Y~X, family = binomial(link = "probit"), data = Data)
Beta0 <- coef(Probit_fit)[[1]]
Beta1 <- coef(Probit_fit)[[2]]

Beta0
```

```
## [1] -6.374398
```

```
Beta1
```

```
## [1] 0.01169507
```

Question 3)

3.a)

Maximum Likely Hood of Beta0,Beta1 and Beta2 are -4.739, 0.067 and 0.598

The stated response function is :

Pihat=(1+exp(4.739-0.067X1-0.598X2))^-1

```
Data=read.table("C:/Users/SRINU/Desktop/Fall 2022/Stats/Asn 5 Q4.txt", quote="\"", comment.char="")

colnames(Data) <- c('Y', 'X1', 'X2')

Fit <- glm(formula = Y ~ X1 + X2, family = binomial(link = 'logit'), data = Data)
Beta0 <- coef(Fit)[[1]]
Beta1 <- coef(Fit)[[2]]
Beta2 <- coef(Fit)[[3]]

Beta0
```

```
## [1] -4.739309
```

```
Beta1
```

```
## [1] 0.06773256
```

```
Beta2
```

```
## [1] 0.5986317
```

3.b)

Interpretation of Exp(Beta):

It is the odds ratio of probability of X increased by 1 with X

We know that,

exp(Beta1)=odds(PiHat(X1+1))/odds(PiHat(X1)).

exp(Beta2)=odds(PiHat(X2+1))/odds(PiHat(X2)).

The values of exp(Beta1) and exp(Beta2) is 1.070 and 1.819

```
exp_beta1 <- exp(Beta1)
exp_beta2 <- exp(Beta2)

exp_beta1
```

```
## [1] 1.070079
```

```
exp_beta2
```

```
## [1] 1.819627
```

3.c)

The estimated probability that a family with annual income of 50 thousand dollars and an oldest car of 3 years will purchase a new car next year is 0.609

```
Pi_Hat <- (1 + exp(-Beta0 - Beta1 * 50 - Beta2 * 3)) ^ (-1)

Pi_Hat
```

```
## [1] 0.6090245
```

Question 4)

4.a)

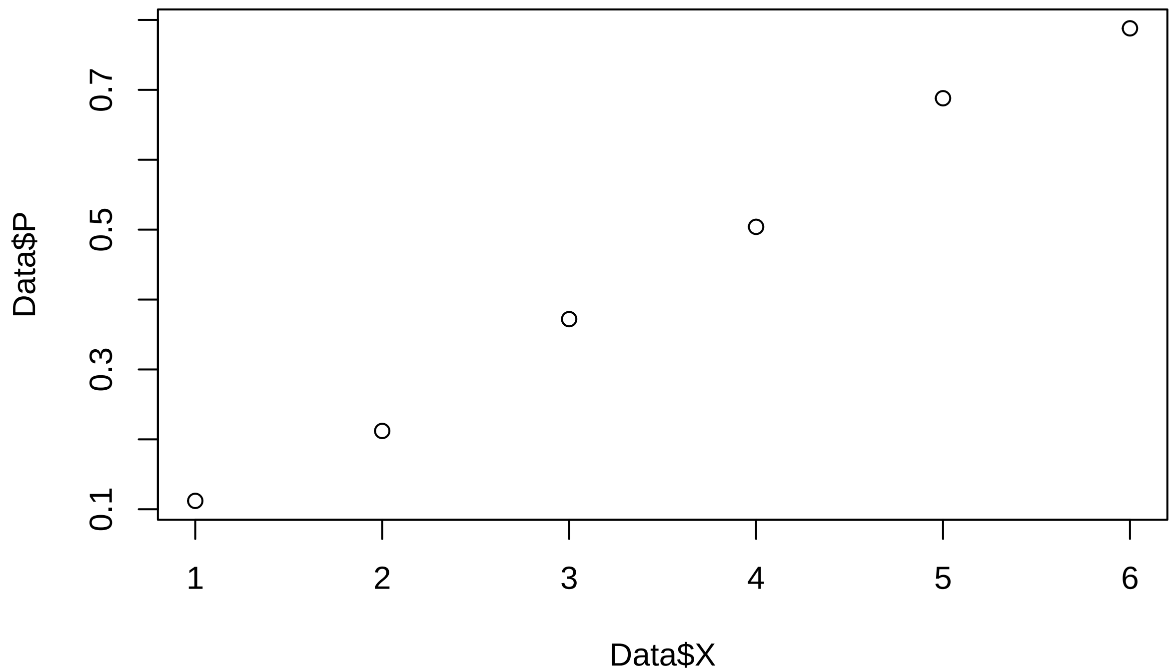
The plot supports analyst's belief that the logistic response function is appropriate

```
Data=read.table("C:/Users/SRINU/Desktop/Fall 2022/Stats/Asn 5 Q5.txt", quote="\"", comment.char="")

colnames(Data) <- c('X', 'n', 'Y')

Data$P <- Data$Y/Data$n
Data$Y2 <- Data$n - Data$Y

plot(Data$X, Data$P)
```



4.b)

Maximum Likely Hood of Beta0,Beta1 are -2.643, 0.673

The stated response function is :

Pihat=(1+exp(2.643-0.673X))^-1

```
Fit <- glm(formula = cbind(Y, Y2) ~ X, family = binomial(link = 'logit'), data = Data )
Beta0 <- coef(Fit)[[1]]
Beta1 <- coef(Fit)[[2]]
Beta0
```

```
## [1] -2.643675
```

```
Beta1
```

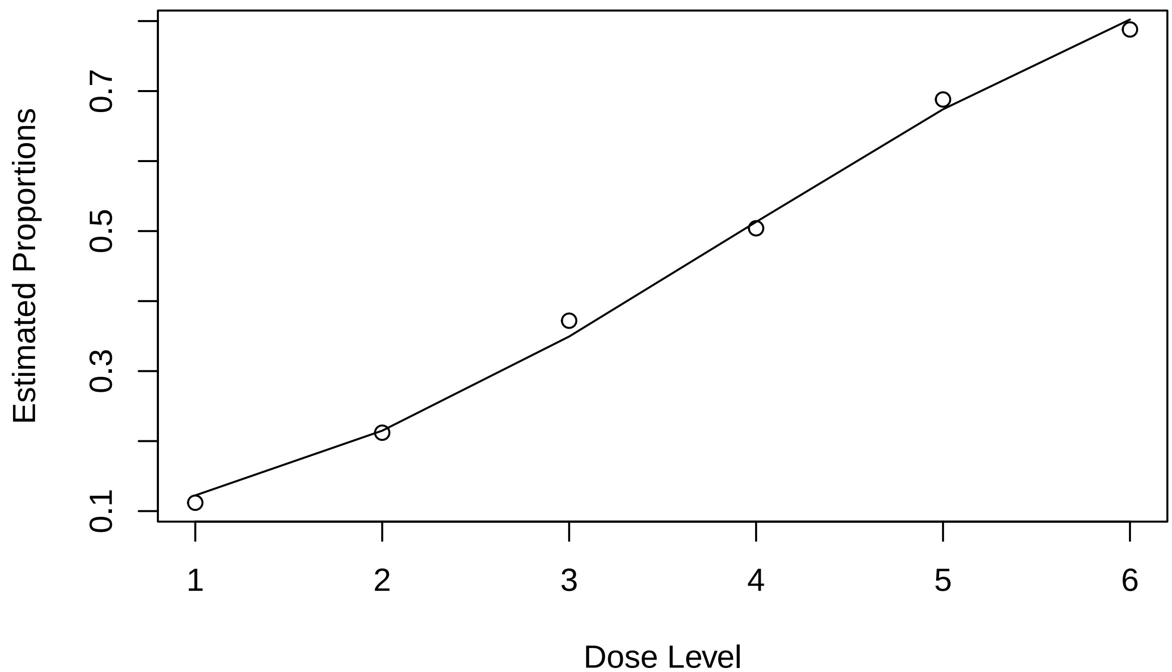
```
## [1] 0.6739928
```

4.c)

The scatter plot with the estimated parameters from (a) and super imposed fitted logic response from part (b) is as follows.

The fitted logistic response function fits well.

```r
plot(Data$X, Data$P, xlab = 'Dose Level', ylab = 'Estimated Proportions')
lines(predict.glm(object = Fit, type = 'response'))
```



4.d)

Interpretation of Exp(Beta):

It is the odds ratio of probability of X increased by 1 with X

We know that,

exp(Beta1)=odds(PiHat(X1+1))/odds(PiHat(X1)).

The value of exp(Beta1) is 1.962

```r
exp_beta1 <- exp(Beta1)
exp_beta1
```

```
## [1] 1.962056
```

4.e)

The estimated probability that an insect dies when the dose level is X=3.5 is 0.429

```r
new_df <- data.frame(3.5)
colnames(new_df) <- c('X')
prob <- predict.glm(object = Fit, newdata = new_df, type = 'response')

prob
```

```
##         1
## 0.4293018
```

4.f)

The estimated median lethal dose for which the 50 percent of experimental insects are expected to die is 3.927.

```r
X <- (log((125/250) ^ (-1) - 1 ) + 2.643)/0.673
X
```

```
## [1] 3.927192
```