Logistic Regression Practice

In the file Admissions.csv we have grad school admissions data for n = 400 students. The binary response variable is called admit (where 1 = admitted and 0 = not admitted). The numeric predictor variable is called gpa.

Q1: Overall, what is the estimated probability of admission? In other words, what proportion (or percentage) of students were admitted?

31.75% of students were admitted.

```
table(AdmitData$admit)
```

```
##
##   0   1
## 273 127
```

```
mean(AdmitData$admit)
```

```
## [1] 0.3175
```

Q2: Find the mean and standard deviation of gpa.

Mean gpa is 3.39 with a standard deviation of 0.38.

Q3: Run the logistic regression to relating probability of admission to gpa.

```
Model <- glm(admit ~ gpa, data = AdmitData, family=binomial(logit))
summary(Model)$coef
```

```
##              Estimate Std. Error  z value     Pr(>|z|)
## (Intercept) -4.357587  1.0353170 -4.20894 2.565715e-05
## gpa          1.051109  0.2988694  3.51695 4.365354e-04
```

Q4: Interpret the estimated odds ratio in the context of this study.

A one unit increase in gpa is associated with a multiplicative increase of 2.86 in the odds of being admitted to graduate school.

```
exp(coef(Model))
```

```
## (Intercept)         gpa
##  0.01280926  2.86082123
```

Q5: Give a 95% CI for odds ratio from the logistic regression. Using this confidence interval, can we conclude that there is an association between admission and gpa?

The 95% CI for the odds ratio is (1.607, 5.196). Since the confidence interval is completely above 1, we can conclude that there is a positive association between gpa and admission.

```
exp(confint(Model))
```

```
## Waiting for profiling to be done...
```

```
##                    2.5 %     97.5 %
## (Intercept) 0.001606939 0.09372126
## gpa         1.606773662 5.19636490
```

Q6: For a student with gpa = 3.5, give the estimated probability that student will be admitted.

With a gpa of 3.5, the estimated probability of admissions is 0.337.

```
#"By Hand"
exp(-4.3576 + 1.0511*3.5)/(1+exp(-4.3576 + 1.0511*3.5))
```

```
## [1] 0.3365403
```

```
#Using predict
predict(Model, list(gpa = 3.5), type = "response")
```

```
##       1
## 0.33655
```

Q7: Give the value of gpa for which the probability of admission is 0.40.

With a gpa of 3.759, the estimated probability of admissions is 0.40.

```
library("MASS")
dose.p(Model, cf=1:2, p=0.40)
```

```
##              Dose        SE
## p = 0.4: 3.759956 0.1371783
```