

# Regression Modelling

(STAT2008/STAT4038/STAT6038)

## Solutions to Tutorial 3 – Multiple Linear Regression

### Question One

For the questions involving **R** in this tutorial, I have created an **R** commands file called **Tutorial3.R** (available on Wattle). This includes all the **R** code you will need to answer the questions along with extensive comments, which include the answers to the questions. To follow these solutions, you will need to download a copy of this file from Wattle and run the code (preferably line by line), so that you can see the **R** output and then read the associated comments.

### Question Two

(a) First we rearrange the model as:

$$\begin{aligned}Y + Y e^{\beta_0 + \beta_1 x_1 + \beta_2 x_2} &= e^{\beta_0 + \beta_1 x_1 + \beta_2 x_2} \\Y &= e^{\beta_0 + \beta_1 x_1 + \beta_2 x_2} - Y e^{\beta_0 + \beta_1 x_1 + \beta_2 x_2} \\ \frac{Y}{1 - Y} &= e^{\beta_0 + \beta_1 x_1 + \beta_2 x_2}\end{aligned}$$

Taking logarithms then gives us our linear form:

$$\ln\left(\frac{Y}{1 - Y}\right) = \beta_0 + \beta_1 x_1 + \beta_2 x_2$$

The first term above is called the “logit” of  $Y$ . Note that this transformation has the important property that it takes a response variable  $Y$  which must lie between 0 and 1 (and thus is not much use in an ordinary linear model) and produces a transformed variable which takes values over the entire real line (more like the usual variable we use in regression).

(b) Taking reciprocals shows that the model can be re-written as:

$$\begin{aligned}\frac{1}{Y} &= \frac{\beta_0 + \beta_1 x_1 + \beta_2 x_2}{x_1 x_2} \\ \frac{1}{Y} &= \beta_0 \frac{1}{x_1 x_2} + \beta_1 \frac{1}{x_2} + \beta_2 \frac{1}{x_1}\end{aligned}$$

Notice that the roles of the  $\beta$ 's appear to have changed and this model has no “intercept” term.

### Questions Three (Question 2 of Sample Assignment 2)

There is a separate file of **R** commands for this old assignment available in the Assessment topic on Wattle. This file is essentially the “appendix” mentioned in the assignment instructions. There is also a carefully edited file of the output from these **R** commands, which contains the solutions to the assignment question.

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