Advanced Regression – Exercise 1

Cats and Mice

Once again you changed your job. You have gone back into academia working for a biology department. Your task is to analyze the success of cats: your research group believes that fatter cats are worse at catching mice and skinnier mice are better at avoiding cats. In addition, younger cats seem to catch more mice (maybe they are faster or have better eyes), unless they are very young and inexperienced. Your colleagues have conducted a number of experiments already, using a few cats and a lot of mice, and generated the following table showing how often a mouse managed to escape cats of certain weights.

c: Weight of Cat (kg)	2,5	2,3	2,8	1,9	3,1
m: Weight of Mouse (g)	123	232	111	265	198
a: Age of Cat (Years)	2	5	13	4	8
e: Escape Rate (count)	15	8	24	1	15

You already know that a (multiple) linear model with independent variables c, m and a does not fit the data well (this should be easy to see from the relationship between escape rate and age of the cat – first it goes down, then it goes up again), so you have decided to try a polynomial model of degree 3.

a) State the regression function this model uses.

b) How many parameters does this model use?

c) How many independent variables does the multiple linear regression have that this polynomial model can be transformed into?

d) Frame this polynomial problem as a multiple regression problem in vector form $y = X\beta + \varepsilon$.