Applied Statistical Methods - Exercise 5

Peter von Rohr

2023-04-24

Problem 1: Interactions

Use the following dataset on `Breed`, `Breast Circumference` and `Body Weight` and fit a fixed linear effects model with `Body Weight` as response and `Breed` and `Breast Circumference` as predictors and include an interaction term between the two predictors. Compute the expected difference in `Body Weight` for two animals which differ in `Breast Circumference by $1cm$ for every`Breed‘.

The dataset is available under

```
## [1] "https://charlotte-ngs.github.io/asmss2023/data/asm_bw_flem.csv"
```

Problem 2: Simulation

Use the following values for intercept and regression slope for `Body Weight` on `Breast Circumference` to simulate a dataset of size N. What is the number for N that has to be chosen such that the regression analysis of the simulated data gives the same result as the true regression slope.

The true values are:

- Intercept: -1070
- Regression slope: 8.7
- Residual standard error: 12

Hints

- Start with $N = 10$, simulate a dataset and analyse the data with `lm()`
- If the result (rounded to 1 digits after decimal point) is not the same then double the size of the dataset, hence use, $N = 20$
- Continue until you get close to the true value.
- Assume that the random resiudals follow a normal distribution with mean zero and standard devation equal to 12
- Take breast circumference to be normally distributed with a mean of 180 and a standard deviation of 2.6
- Use a linear regression model with an intercept to model expected body weight based on breast circumference.