Applied Statistical Methods – Exercise 2

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Problem 1: Multiple Linear Regression Model

During the lecture the regression model was explained using the dataset on body weight and breast circumference. To improve the regression model for body weight, two additional conformation traits `BCS` and `HEI` are also considered. The new dataset is given in Table 1.

Table 1: Dataset for Multiple Linear Regression of Body Weight on Breast Circumference and two Conformation Traits for ten Animals

Animal	Breast Circumference	Body Weight	BCS	HEI
1	176	471	5.0	161
2	177	463	4.2	121
3	178	481	4.9	157
4	179	470	3.0	165
5	179	496	6.8	136
6	180	491	4.9	123
7	181	518	4.4	163
8	182	511	4.4	149
9	183	510	3.5	143
10	184	541	4.7	130

The same dataset is also available from the website at https://charlotte-ngs.github.io/gelasmss2021/data/asm_w03_ex02_bw_mult_reg.csv.

Your Task

- Setup the linear regression model with an intercept for the data given in Table 1
- Compute the solution for the unknown parameter b
- Verify the result with the output from the function `lm()` in R

Problem 2: Prediction

Given the measurement of the trait `Breast Circumference` for two additional animals. The measurements are shown in the following table

Table 2: Breast Circumference Measurements For Two Animals Used To Predict Body Weight

Animal	Breast Circumference
Animal 11	181.2
Calf 12	99.5

We want to use the results of the simple linear regression of body weight (BW) on breast circumference (BC), as shown in Problem 2 of Exercise 1 to computed the predicted values for `Body Weight` for the two animals. The observed value for `Breast Circumference` of "Calf 12" is outside of the range of the values used in Problem 1. Predicting values of response variables based on predictors that are outside of the range of values used for the parameter estimation is called **extrapolation**. Based on the result of the predicted value of the trait `Body Weight` for "Calf 12" what can be said about the process of extrapolation?

Your Tasks

- Compute the predicted value of `Body Weight` for "Animal 11"
- Compute the predicted value of `Body Weight` for "Calf 12"
- Make a statement about the validity of the extrapolated value of `Body Weight` for "Calf 12"