

# **Predicting the Heart Weight of a Cat Based on Body Weight and Sex**

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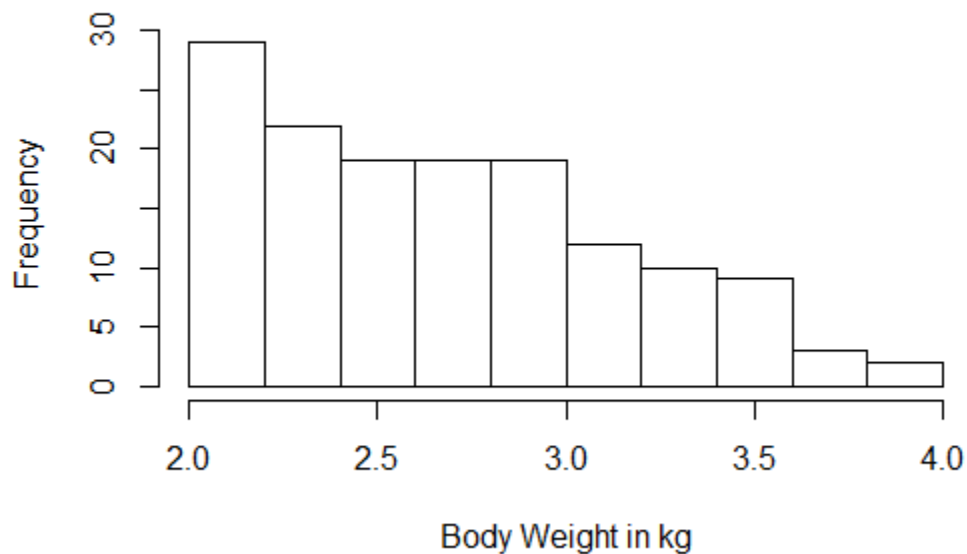
**For DBAS 3075 – Introduction to Statistical Learning**

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This document highlights the relationship between an increase in a cat's heart rate based on an increase in body weight and sex. In this report, we will examine the a sample of a cats heart weight as well as sex and body weight for cats over 2kg, based on the data found on the internet at this location:

<https://raw.githubusercontent.com/vincentarelbundock/Rdatasets/master/csv/MASS/cats.csv>

A histogram of the number of cats at each weight for all 144 cats can be seen in Figure 1. Here it is seen that this is a right skewed distribution because the body weight of the cats in this study must have been heavier than 2kg to be included.



*Figure 1: A histogram of the number of cats at each weight*

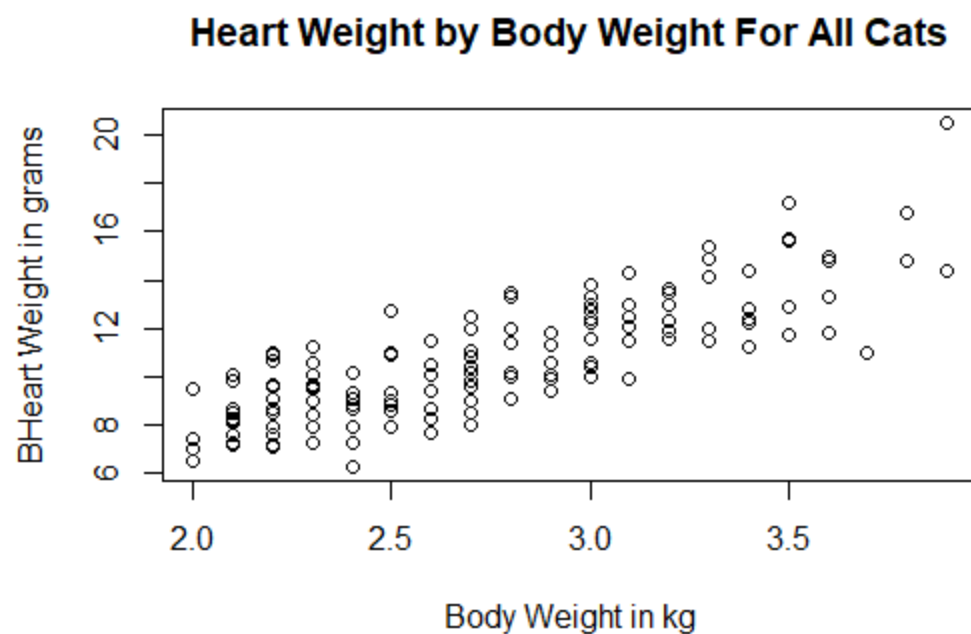


Figure 2: Heart Weight by Body Weight For All Cats

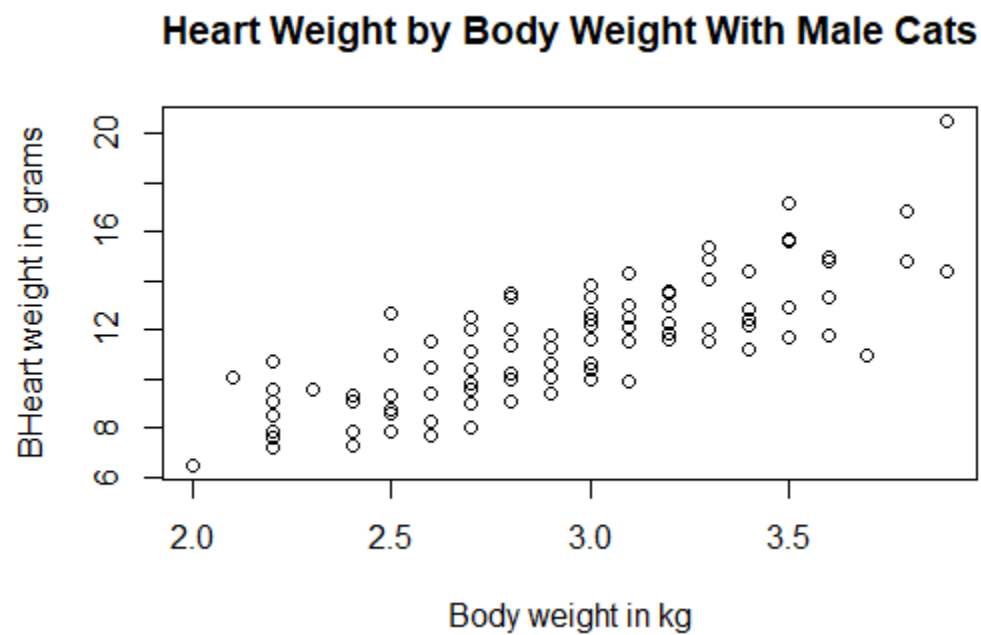


Figure 3: Heart Weight by Body Weight with Male Cats

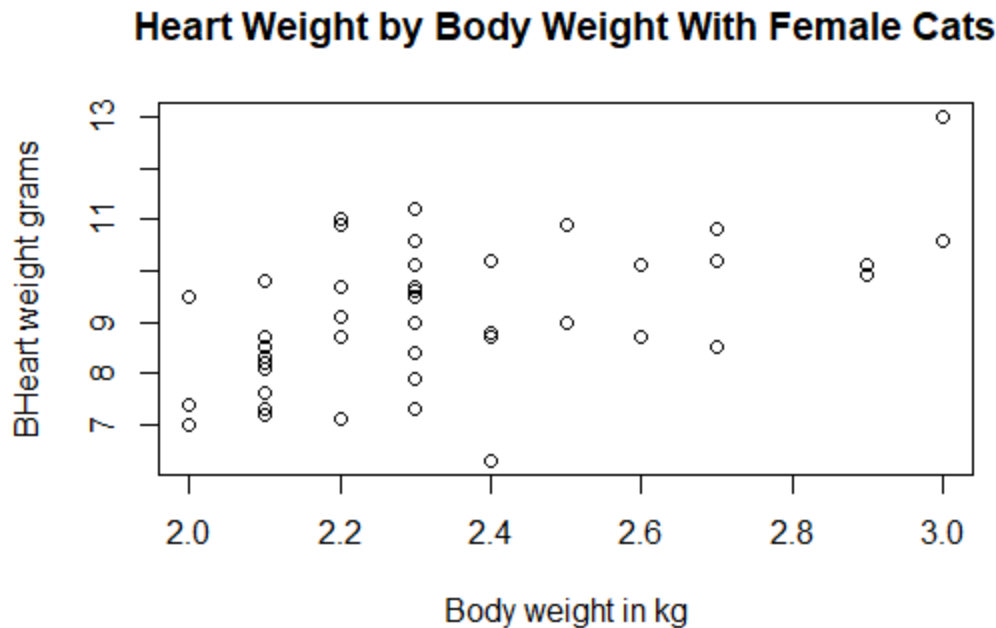


Figure 4: Heart Weight by Body Weight with Female Cats

The scatterplots shown in Figures 2,3 and 4 shows that there is a linear association between the body weight and the heart weight in cats. This gives a straight enough condition to perform linear regression on the plot. Also the body weight and heart weight are both quantitative, and differing between the female and male cats just requires two separate plots. The variance in the data seems to be quite standard and doesn't skew enough in any direction to deter performing linear regression. There also don't seem to be any outliers in the data.

Linear regression model for males:

$$H = 4.08B - 0.49$$

Linear regression model for females:

$$H = 4.08B - 0.41$$

Where  $H$  represents the heart weight in grams, and  $B$  represents the body weight in kg.

The regression model gives an  $R^2$  of value of 0.65 which that 65% of the variability in heart weight can be explained by body weight and sex. And this also shows that on average female cats will have heavier hearts than male cats with the same body weight.

A male cat that weighs 2.5kg should have an approximate heart weight of 9.69 grams.

A female cat that weighs 2.2kg should have an approximate heart weight of 8.55 grams.

Using this regression model, we would not be able to give a prediction on the heart weight of a cat that weighs 5.2kg. The reason for this is simple. We have not collected data for any cat that weighs that much, and we can only accurately predict the heart weight for cats whose body weight fits in the range of data that we have (we only have data for cats ranging from 2kg-3kg).

```
dataset =  
read.csv('https://raw.githubusercontent.com/vincentarelbundock/Rdatasets/master/csv/MASS/cats.csv'  
)  
  
dataset = dataset[, -1]  
  
plot(dataset$Bwt, dataset$Hwt, main = "Heart Weight by Body Weight For All Cats", xlab = "Body  
Weight in kg", ylab = "BHeart Weight in grams")  
  
plot(dataset$Bwt[dataset$Sex == "M"], dataset$Hwt[dataset$Sex == "M"], main = "Heart Weight by  
Body Weight With Male Cats", xlab = "Body weight in kg", ylab = "BHeart weight in grams")  
  
plot(dataset$Bwt[dataset$Sex == "F"], dataset$Hwt[dataset$Sex == "F"], main = "Heart Weight by Body  
Weight With Female Cats", xlab = "Body weight in kg", ylab = "BHeart weight grams")  
  
hist(dataset$Bwt, main="", xlab="Body Weight in kg")  
  
model2 = lm(Hwt~ . ,data = dataset)  
  
summary(model2)  
  
maleCat = 2.5 * 4.0758 - 0.0821 - 0.4149  
  
femaleCat = 2.2 * 4.0758 - 0.4149
```

*Above is all the code used to form this report.*