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12/9/18

Homework 9

16 randomly selected catfish from Brazil were used to see if body temperature (°C) can predict heart rate (beats per min). I conducted a least squares linear regression analysis on RStudio (version 1.1.456) to test this predictive relationship hypothesis, with α set to 0.05. By inspecting residuals of heart rate and plotting them against normal scores and body temperature, I found no violation of the assumption for linearity or homoscedesticity of residuals, respectively (Fig. 2 and Fig. 3). I also used a Shapiro-Wilks test to see if there was any violation against normality of variances of residuals and found no evidence that this was violated (Table 2). Lastly, I used a density ellipse option on R to determine the presence of outliers and I did find one catfish with a body tempterature of 37.6°C and heart rate of 2 beats per min was an outlier (Fig. 4).

The linear regression analysis on Table 1 showed that there was a positive nonsignificant relationship between heart rate and body temperature ($F = 0.714$, $N = 16$, $p = 0.412$). I failed to reject the null hypothesis that there is no relationship between heart rate and body temperature. The r^2 value was 0.049 and the regression equation was heart rate (beats per min) = 2.197 + 0.145(body temperature in °C). The relationship between these variables are illustrated in Fig. 1, which displays 95% confidence bands around the regression line. Due to a low sample size, I would repeat this experiment with a larger sample size. With a small sample size, this study may have been highly susceptible to outliers which may have caused the nonsignificant result. I would also check to see if the health condition of the catfish outlier is abnormal and if he or she should have even been included in this study. It is also possible to check how influential the outlier is by analyzing studentized residuals and Cook's D.

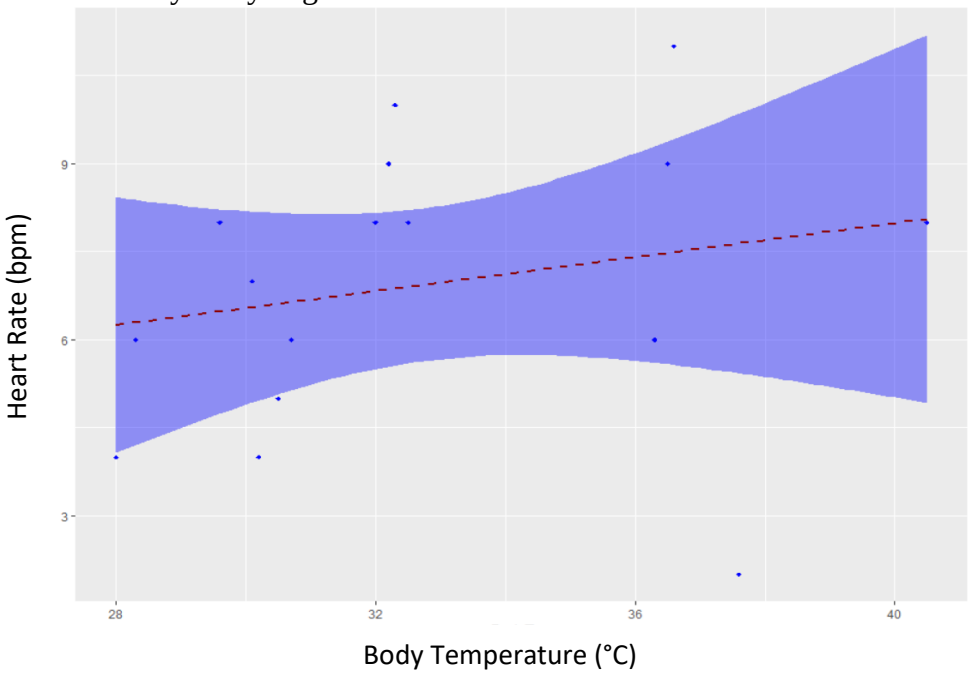

Figure 1 Relationship between heart rate and body temperature of catfish with a least squares regression line and 95% confidence bands.

Table 1 Least squares regression analysis

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Coefficients:
(Intercept)  ï..BodyTemp
     2.1964       0.1448

Residuals:
    Min      1Q  Median      3Q     Max
-5.6406 -1.4925  0.1924  1.5179  3.5041

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept)    2.1964     5.6428   0.389    0.703
ï..BodyTemp    0.1448     0.1713   0.845    0.412

Residual standard error: 2.431 on 14 degrees of freedom
Multiple R-squared:  0.04854,   Adjusted R-squared:  -0.01942
F-statistic: 0.7142 on 1 and 14 DF,  p-value: 0.4123

                  2.5 %     97.5 %
(Intercept) -9.9062188 14.2991180
ï..BodyTemp -0.2226756  0.5122607
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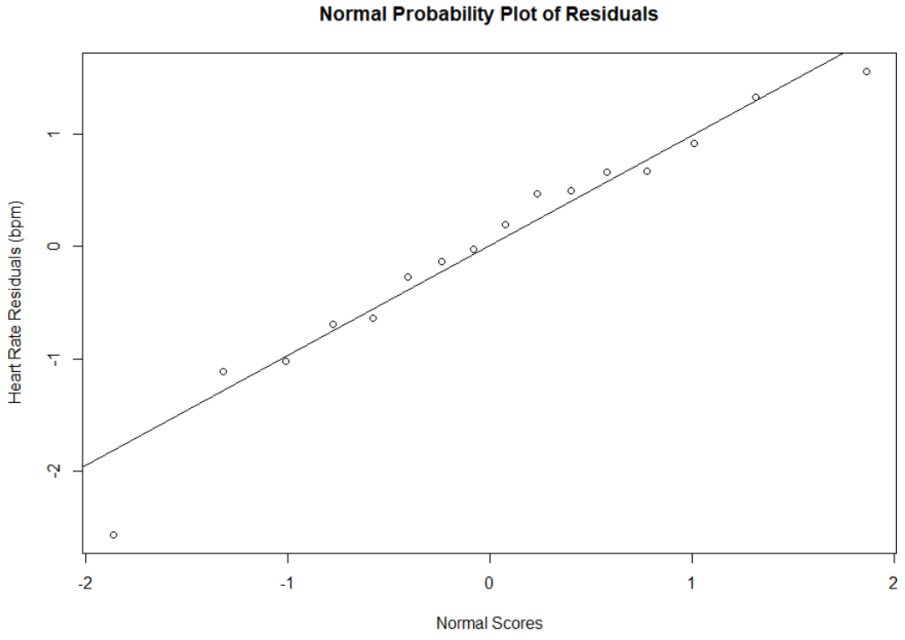

Figure 2 Normal Probability Plot of Residuals of heart rate showing linearity when plotted against normal scores.

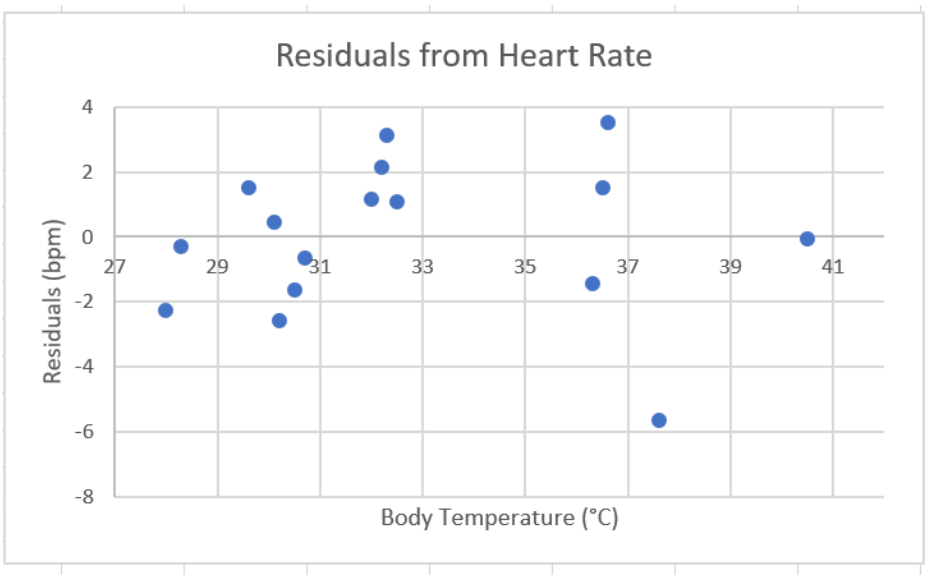

Figure 3 Residuals of heart rate (bpm) plotted against body temperature (°C) showing homoscedasticity.

Table 2 I failed to reject the null hypothesis that the samples came from a normal distribution. This confirms that the samples did come from a normal distribution.

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        Shapiro-Wilk normality test

data:  Catfish$HeartRate
W = 0.9713, p-value = 0.8591
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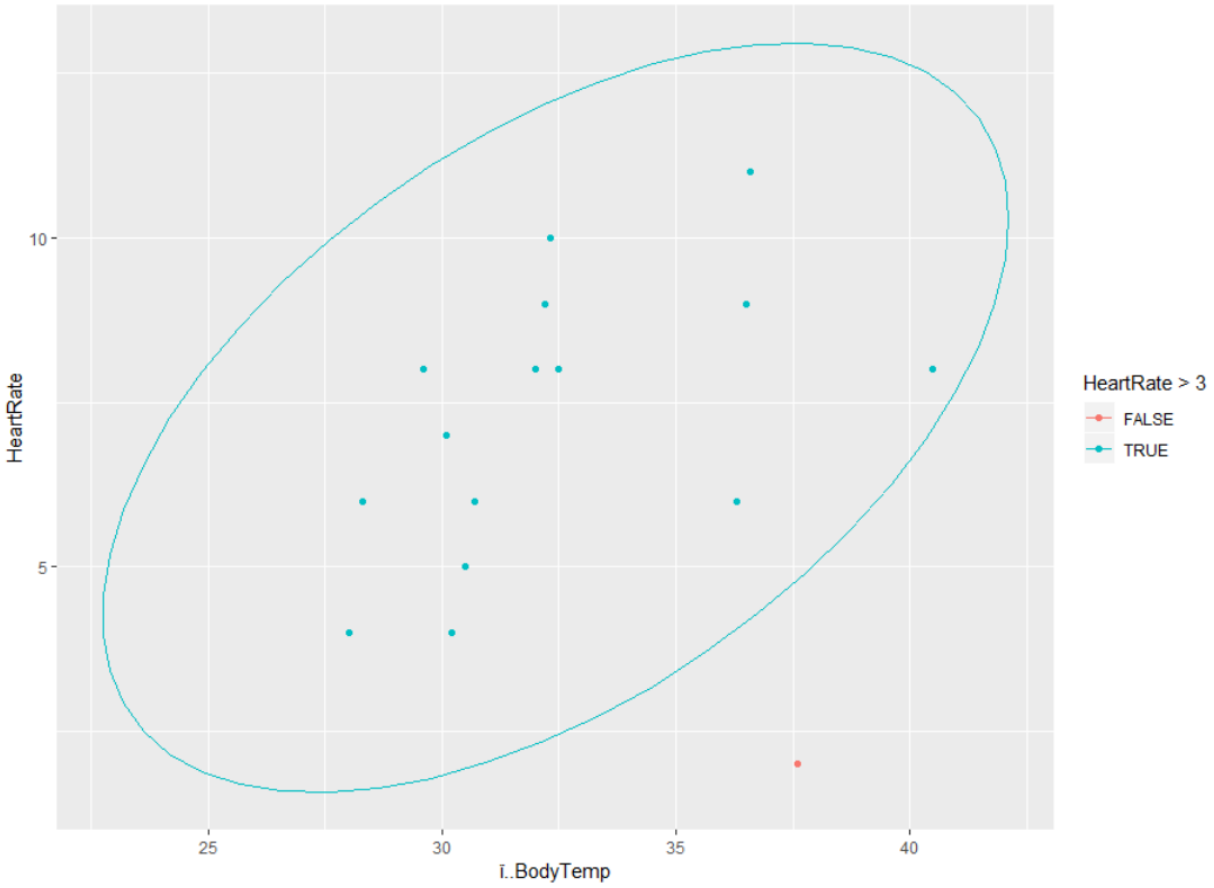

Figure 4 Density ellipse showing the one outlier at 95% confidence interval. Body temperature is measured in °C and hear rate in beats per min.