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Stats 110 - HW1

1 – (a). Randomized experiment since there are two randomly assigned groups: those taking magnesium; and those taking placebo.

1 – (b). Explanatory variables are mg of magnesium and time. Response variable is amount of blood pressure.

1 – (c). This depends if the subjects were grouped by similarity. For example, if the subjects were all around a similar age, exercise activity, diet, and so on; were all very similar. Also the subjects have to be a good representation of the population, then you can say that taking magnesium can result in lower blood pressure.

2 – (a). Observational since the amount of time parents or care-givers spent reading to the child during the first four years of the child's life is not controlled by the researcher.

2 – (b). Explanatory variables is the amount of time parents read to the child. The response variable is the child's score on placement test.

2 – (c). No, since correlation does not imply causation.

2 – (d). A possible confounding variable would be the child's IQ.

3 – (a). Explanatory: handedness (categorical). Binary
Response: gender (categorical). Binary

3 – (b). Explanatory: sleeping time (quantitative); exam1 score (quantitative); number of quizzes (quantitative)
Response: time on final exam (quantitative)

3 – (c). Explanatory: gender (categorical). Binary
Response: major (categorical)

3 – (d). Explanatory: political inclination (categorical. can be binary if only consider liberal and conservative); time sleeping (quantitative).
Response: gender (categorical). Binary.

4 – (a). $Y = 300 + 5X + \text{epsilon}$

4 – (b). Statistical since each member has varying visiting patterns, hence there is a random component.

5. Yes. From visual inspection, there seems to be linear relationship between weight and wing length.

6 – (a). Intercept: 1.3655
The data of sparrows have a starting weight of 1.3655. It was no meaningful interpretation.

6 – (b). Slope: 0.4674.
There is a positive linear relationship between wing length and weight.

7 – (a). Predicted weight is: 15.38761

7 – (b). Residual is: 0.6123911

8.

```
# read in data set
sparrow <- read.csv("data/Sparrows.csv")

# create full model
fit <- lm("Weight ~ WingLength", data = sparrow)

# plot the data and regression line
plot(sparrow$WingLength, sparrow$Weight)
abline(fit, col='red')

# print out coefficience
print(fit)
```

```
Call:
lm(formula = "Weight ~ WingLength", data = sparrow)

Coefficients:
(Intercept)   WingLength
     1.3655       0.4674
```

```
* Results from R code is the same as in the book.
```

9 .

```
# filter sparrow for control treatment only
sparrow_control <- sparrow[sparrow$Treatment == 'control', ]

# create model for control data
fit_control <- lm("Weight ~ WingLength", data=sparrow_control)

# plot control data and regression line
plot(sparrow_control$WingLength, sparrow_control$Weight)
abline(fit_control, col='red')

# print out coeffs
print(fit_control)
```

```
Call:
lm(formula = "Weight ~ WingLength", data = sparrow_control)

Coefficients:
(Intercept)   WingLength
     0.5789       0.4961
```

9 – (a). Full equation: Y_full = 1.3655 + 0.4674 * X_full + epsilon
Control equation: Y_ctrl = 0.5789 + 0.4961 * X_ctrl + epsilon
Compare: slopes are similar, but the intercepts are different.

9 – (b). Predicted: 15.46241
Residual: 0.5375944

9 – (c). The control gave a better predicted weight. This can be seen by comparing the residuals.