Laboratory Exercise Week 14

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*Directions*:

* Write your R code inside the code chunks after each question.
* Write your answer comments after the # sign.
* To generate the word document output, click the button Knit and wait for the word document to appear.
* RStudio will prompt you (only once) to install the knitr package.
* Submit your completed laboratory exercise using Blackboard’s Turnitin feature. Your Turnitin upload link is found on your Blackboard Course shell under the Laboratory folder.

For this exercise, you will need to use the packages mosaic and dplyr to find numerical and graphical summaries.

# install packages if necessary  
if (!require(mosaic)) install.packages(`mosaic`)  
if (!require(dplyr)) install.packages(`dplyr`)  
# load the package in R  
library(mosaic) # load the package mosaic to use its functions  
library(dplyr) # load the package dplyr to use data management functions

1. Researchers found that the speed of a prey (twips/s) and the length of prey (twips x 100) are good predictors of the time (s) required to catch a prey. (A twip is a measure of distance used by programmers). Data were collected in an experiment in which subjects were asked to “catch” an animal prey moving across his or her computer screen by clicking on it with the mouse. The investigators varied the length of the prey and the speed with which prey moved across the screen.

prey <- read.csv("https://www.siue.edu/~jpailde/prey.csv")  
prey

## Prey.Length Prey.Speed Catch.Time  
## 1 7 20 1.1  
## 2 6 20 1.2  
## 3 5 20 1.2  
## 4 4 20 1.4  
## 5 3 20 1.5  
## 6 3 40 1.4  
## 7 4 40 1.4  
## 8 6 40 1.3  
## 9 7 40 1.3  
## 10 7 80 1.4  
## 11 6 60 1.4  
## 12 5 80 1.4  
## 13 7 100 1.4  
## 14 6 100 1.4  
## 15 7 120 1.7  
## 16 5 80 1.5  
## 17 3 80 1.4  
## 18 6 100 1.5  
## 19 3 120 1.9

1. Fit a multiple regression model for predicting catch time using prey length and speed as predictors.
2. Construct 95% confidence interval for the regression slopes of each predictor. Interpret your result. Will the interpretation change if you change the confidence level to 90% and 99%?
3. Predict the catch time for two animals whose lengths are 4 and 6; and whose speeds are 30 and 60, respectively. State your result in paragraph form including the associated prediction intervals.
4. Is the multiple regression model useful for predicting catch time? Use R2, adj-R2, and test the relevant hypothesis using alpha = 0.05. State your conclusion.
5. The primary researchers suggest that a simple regression model with the single predictor x = length/speed might be a better model for predicting catch time. Calculate and add the x values to the data using the function mutate in the package dplyr. Fit a simple linear regression model using the new variable/column x.
6. Which of the two models considered (the multiple regression model in part (i) or the simple regression model in part (v)) would you recommend for predicting catch time? Justify your choice.

### Code chunk

# start your code  
model3 <- lm(Prey.Length ~ Prey.Speed,   
 data = prey)  
model3

##   
## Call:  
## lm(formula = Prey.Length ~ Prey.Speed, data = prey)  
##   
## Coefficients:  
## (Intercept) Prey.Speed   
## 4.861566 0.006466

confint(model3, level = 0.95) #yes, it will change.

## 2.5 % 97.5 %  
## (Intercept) 3.33182221 6.39131076  
## Prey.Speed -0.01500988 0.02794249

predict(model3, interval = "prediction",  
 level = 0.95,  
 newdata = data.frame(Prey.Length = c(4, 6),  
 Prey.Speed = c(30, 60)))

## fit lwr upr  
## 1 5.055556 1.635298 8.475813  
## 2 5.249545 1.899202 8.599887

# lower and upper bounds for first prediction are 1.635298 and 8.475813 while for the second prediction are 1.899202 and 8.599887. Also, their fit being 5.055556 and 5.249545 respectively.  
confint(model3, level = 0.05)

## 47.5 % 52.5 %  
## (Intercept) 4.81542436 4.907708608  
## Prey.Speed 0.00581851 0.007114095

#yes multiple regression model is useful for predicting catchtime  
  
model3 <- lm(Prey.Length ~ Prey.Speed,   
 data = prey)  
model3

##   
## Call:  
## lm(formula = Prey.Length ~ Prey.Speed, data = prey)  
##   
## Coefficients:  
## (Intercept) Prey.Speed   
## 4.861566 0.006466

msummary(model3)

## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 4.861566 0.725061 6.705 3.7e-06 \*\*\*  
## Prey.Speed 0.006466 0.010179 0.635 0.534   
##   
## Residual standard error: 1.548 on 17 degrees of freedom  
## Multiple R-squared: 0.02319, Adjusted R-squared: -0.03427   
## F-statistic: 0.4035 on 1 and 17 DF, p-value: 0.5337

# last R code line