PSC 103B

Homework 5

Winter 2025

**Instructions**

Please use R/RStudio to complete the following questions. You will submit your filled-out version of this document **as a PDF** on Canvas. Make sure your PDF looks as expected before submitting. Unless otherwise specified, please **always** **include the code you used to generate your answer for each question, or the steps you used to calculate the answer (when relevant), as well as the final answer and/or relevant output** (output is what comes out in the console when you run an R command, e.g., the results of the model when you run summary(fit1)).It’s a good idea to organize your R code in the R script and save it, so if you need to modify or recalculate one of the questions, that’s easy to do (see the R scripts provided in previous weeks for tips on how to organize your code). If you copy and paste code or output into this document (screenshots are also acceptable), **please format the code and output using a fixed-width font** (e.g., Courier) so it’s easier to read.

You may consult with your classmates while working on the assignment, but **you must do all the work yourself – everything you turn in must be your own code and words**. Academic dishonesty will not be tolerated.

Please submit **a pdf version of this document** with your answers on Canvas by **4:00pm on Thursday, February 27.**

**The Data**

This week, we will be moving away from the NPAS dataset and using the version of the penguins dataset that we have been using in lab. Download this dataset from the Homework 5 assignment page on Canvas.

The variables we will be using today are:

* species: The species of the penguin (Adelie, Chinstrap, or Gentoo)
* sex: The sex of the penguin (male or female)
* bill\_length\_mm: The bill length of the penguin, measured in mm

**Question 1**

Suppose we were interested in conducting a factorial ANOVA with species and sex as our grouping variables, and bill length as the outcome.

Write out the 3 sets of null and alternative hypotheses for the factorial ANOVA – one for each main effect and one for the interaction. (3 points)

**Question 2**

Conduct the factorial ANOVA. Show your code and output. (1 point)

**Question 3**

*If the main effect of species is significant*: Conduct the Tukey Honest Significant Difference post-hoc test. Show your code.

*If the main effect of species is not significant*: State “The main effect of species was not significant”. (1 point)

**Question 4**

*If you conducted the Tukey HSD test in the previous question*: Which groups were significantly different from each other? What was the difference (e.g., which group had the larger/smaller bill length)? (1 point)

**Question 5**

*If the main effect of sex is significant*: Calculate the means for each group. Show your code and output.

*If the main effect of sex is not significant*: State “The main effect of sex was not significant”. (1 point)

**Question 6**

*If you calculated the means in the previous question*: Which group (males or females) had the longer bill length? (1 point)

**Question 7**

Was the interaction significant? What does this tell us (e.g., does the main effect of species depend on sex)? (1 point)

**Question 8**

Even if the interaction was not significant, create an interaction plot. Put species on the x-axis and sex as the line type. Show your code and include the plot. Use the function we learned in lab. (1 point)