This assignment is the first of two based on data visualization and quantitative training. Quantitative training refers to computational biology, data science, electronic data archiving, data cleaning and manipulation, statistics, mathermatical modelling, effective data visualization (including maps and phylogenies), and interpreatation of graphs and figures. These terms may sound overwheklming, but this assignment will focus only on material that is at the most introductory level. The goal is to introduce students to the basics of using a free software program, R and RStudio, as an environment for statistical computing and graphics. RStudio is a graphical interface software package which works in conjunction with R. Both will run on a Windows, Mac or Unix machine, but not on a tablet. Additionally, a web-based program called RStudio Cloud can be used as an alternative to downloading the software.

During this assignment it is helpful to have RStudio (or RStudio Cloud), the “Quantitative skills for biology” guide and the assignment worksheet all open on your computer at the same time. Once completed, save your assignment as a PDF document and upload to the assignment folder entitled “R Assignment 1” in the pull-down menu under assessments in the Brigthspace course shell. The worksheet is due 48 hours after your R help session ends.

**TIP: SAVE** your document frequently.

**DO NOT copy and paste information directly from** [“Quantitative skills for biology”](https://ahurford.github.io/quant-guide-all-courses/) or other online materials when answering your questions. **This will be considered plagiarism and you will receive a grade of zero with possible further disciplinary action as per the University Calendar.** Your answers must be in your own words. (This, of course, does not include the cutting and pasting of code and outputs from your R script or console.)

If you experience technical difficulties with your upload, contact the Client Support Team of the Centre for Innovation in Teaching and Learning at [www.citl.mun.ca/support](http://www.citl.mun.ca/support)

***Notice from Memorial University:***

***You agree to the following; “All members of the Memorial University of Newfoundland community, including students, faculty, and staff, shall treat others with respect and fairness, be responsible and honest, and uphold the highest standards of academic integrity.***

***By submitting this assignment, I unequivocally state that all work is entirely my own and does not violate Memorial University's Academic Integrity policy.”***

**INSTRUCTIONS:**

1. Open the “Quantitative skills for biology” guide found at (https:// ahurford.github.io/quant-guide-all-courses/ )
2. Read through the first chapter totiled as “Overview”
3. Work through chapters 2 (“R and R Studio”) and 3 (“Finding your way around RStudio”) to download and install the softaware, and become familiar with its layout.
4. Work through Chapter 4 (“Introduction to R”) and complete all of the TRY IT! Exercises and HAND IN activities. These are included as some of the questions to be submitted for the assignment.
5. Work through Chapter 10 (“Making Graphs in R”) and complete all of the TRY IT! Exercises and HAND IN activities. These are included as some of the questions to be submitted for the assignment.
6. Complete the questions below and submit.

**QUESTIONS:**

**Chapter 4: Introduction to R**

1. **Section 4.5 Comments HAND IN**

What does the assignment operator do? (1 mark)

What is the command for the assignment operator? (0.5 marks)

How do you write a comment in your code? (0.5 marks)

2. **4.9 Data structures - VECTORS HAND IN**

What is the type and length of vector y (y <- c(2, 3, 5, 7)). (1.0 mark)

3. **4.9 Data structures - VECTORS HAND IN**

Copy the line of code you used to create a vector with a sequence of numbers from 0-20, increasing by 5. **(Hint: You must use the seq function to generate your vector.)** (1.0 mark)

4. **4.9 Data structures - Matrices HAND IN**

Hand in a copy of the code you used to create the above matrix (3 by 3 matrix in which the elements are the numbers from one to nine). **ALSO, copy-paste the resulting matrix from the console into this document.** (2.0 marks)

5. **4.9 Data structures - Lists HAND IN**

State the length of the object my\_list. (0.5 mark)

6. **4.9 Data structures - Data frames HAND IN**

Write down what information you can get from the functions nrow(), ncol(), head(), and tail() that describe the data frame df you just created. **(HINT: Write or copy-past what is returned in the console when the above functions are executed.)** (2.0 marks, 0.5 each)

**Chapter 10 Making graphs in R**

7. **10.2 Scatter plots with plot(x, y) HAND IN**

1. Which two vectors below will generate a plot if executed before plot(a,b)? (1.0 mark)

*1. a <- c(1, 3, 5)*

*2. a <- c(2, 4, 5, 6, 7)*

*3. b <- c(2, 2, 4, 6)*

*4. b <- c(2, 4, 6)*

2. A friend has written the code below, but it will not run. What do you think the problem could be? (1.0 mark)

a <- c(1, 2, 3)

b <- c(2, 4, 6)

plot(x, y)

8. **10.3.1 Getting a bit more sophisticated HAND IN**

Re-create the graph above on your own, but this time, make the symbol for fishA an open square and the symbol for fishB a filled circle **(HINT look at the pch cheat sheet in section 9.7). Export this plot and paste it below.** (2.5 marks)

9. **10.4 Line graphs HAND IN**

Re-create the graph above on your own, but this time, also add a line for fishB which joins the points as is shown above for fishA. Just as in section 10.3, where we used the points() function to an existing plot, we can use the lines() function to add a line to an existing plot. To select the line type, use lty = 2 (or another value), just as you would use pch in the points() function. **Export this plot and paste it below.** (2.0 marks)