BIOLOGY 1001 LAB 6 BIOLOGICAL DATA I F22

MARKING SCHEME

INSTRUCTIONS:

1. During this lab it is important to have RStudio (or RStudio Cloud), the "Quantitative skills for biology" guide and the Lab 6 Worksheet all open on your computer at the same time.

2. The 9 questions in the worksheet come from the **TRY IT!,** EXERCISE and **HAND IN** activities found within Chapters 4 and 10 of the "Quantitative skills for biology" guide. We are presenting them in this worksheet to lessen confusion and for ease of grading.

3. DO NOT copy and paste information directly from "Quantitative skills for biology" 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.)

4. SAVE your document frequently. Once completed, save your assignment as a PDF document and upload to the Assignment Folder entitled "Lab 6 Biological Data I" in the pull-down menu under Assessments. **Your worksheet is due 48 hours after your labs ends.**

6. 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

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."

Chapter 4 Introduction to R

1. **Section 4.5 Comments HAND IN (answers in section 4.3)**

   What does the assignment operator do? (1 mark)
   When executed it instructs R to assign whatever is on the right (0.5) of the command to the variable on the left (0.5).

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

   How do you write a comment in your code? (0.5 marks)
   #put your comment to the right of the # symbol

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)

Use the commands:

class (y) to get type
length (y) to get length

VECTOR Y		
TYPE	*numeric*	**(0.5)**
LENGTH	*4*	**(0.5)**

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)

Use the command:

? seq
The help page that pops up will give them most of the examples below

```
y <-  c(seq(0, 20, by = 5))
y <- seq(from = 0, to = 20, by = 5)
y <- seq(0, 20, 5)
y <- seq(0, 20, 5)
```

All the above are correct and acceptable. Other commands may be acceptable. I would suggest when in doubt you try them in R.
NOTE: If students do not use the seq function and give you something like y <- c(0, 5, 10, 15, 20) they only get 0.5. If "y" is missing, -0.25.

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)

Exact same as the example in 4.9 Matrices, except numbers are 1-9 and rows and columns are changed to 3 (like in example 1 below)

1. ***y <- matrix(c(1, 2, 3, 4, 5, 6, 7, 8, 9), nrow = 3, ncol = 3)***
2. ***y <- matrix(seq(1, 9), 3, 3)***
   (Quick learners could use the seq command from item 3)
3. ***y<-matrix(c(1:9, nrow = 3, byrow = TRUE)***
4. ***y <-seq(1, 9)***
   y <- matrix(x, nrow = 3, ncol = 3)

There are a few ways to get the correct answer. I expect different codes from the marking scheme and to have RStudio open while grading so you can check them.

Code: (1.0, 0.25 for "y" or any other letter, 0.75 for rest of code) and Output: (1.0)

```
     [,1] [,2] [,3]
[1,]    1    4    7
[2,]    2    5    8
[3,]    3    6    9
```

(NOTE: Depending on how they make their code for the matrix, the resulting matrix may not have the numbers in the exact order as the one above, but it is fine as long as the student code matched how the matrix appeared. Meaning the code leads to the same output.)

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

State the length of the object `my_list`. (0.5 mark)

Use the command:

length(my_list)

The length of `my_list` is 4.

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)

Use the command:

```
nrow(df)
ncol(df)
head(df)
tail(df)
```

a) `nrow()`

```
[1] 10
```

b) `ncol()`

```
[1] 3
```

c) `head()`

```
   id  x y
1   a 1 11
2   b 2 12
3   c 3 13
4   d 4 14
5   e 5 15
6   f 6 16
```

d) `tail()`

```
   id x y
5   e 5 15
6   f 6 16
7   g 7 17
8   h 8 18
9   i 9 19
10  j 10 20
```

Chapter 10 Making graphs in R

7. **10.2 Scatter plots with plot(x, y) EXERCISE 10.1**

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)`

To create a vector, the c() funk is used (from chat 4.9, vectors)
In order to create a plot, the vectors have to contain the same number of values

Answer: Vector #1 & Vector #4

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

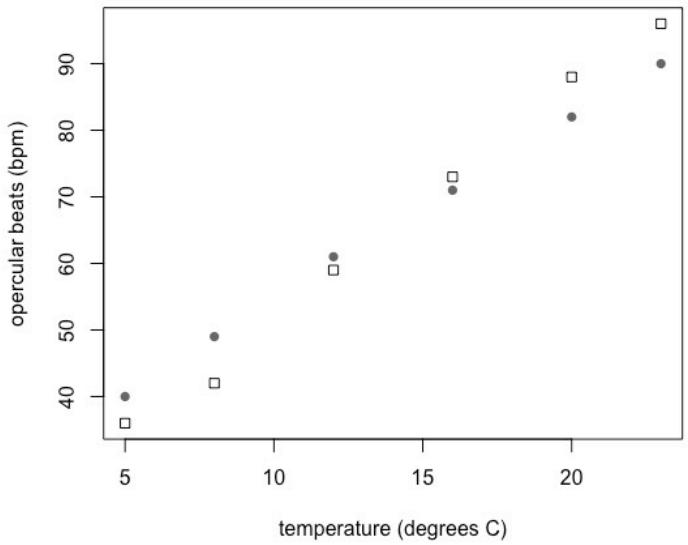
```
a <- c(1, 2, 3)
b <- c(2, 4, 6)
plot(x, y)
```

Each line of code is written well and correct. However, the arguments for the plot command are mistaken. To plot vectors a and b the command should be plot(a, b)

Can use the length() query to determine the length of each vector

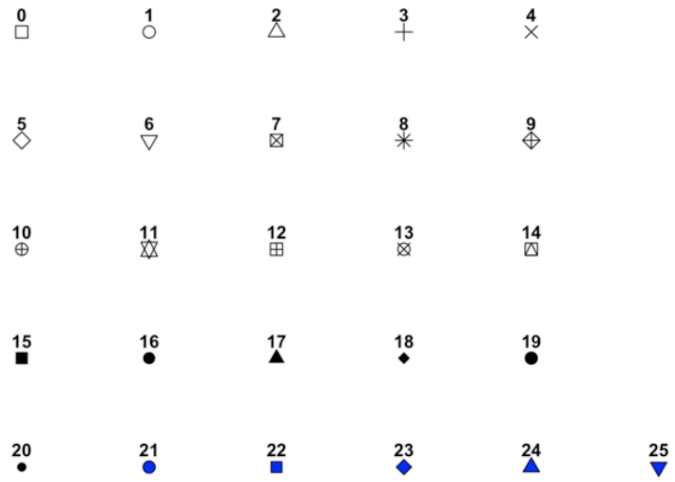
8. **10.3.1 Getting a bit more sophisticated EXERCISE 10.2**

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 mark)



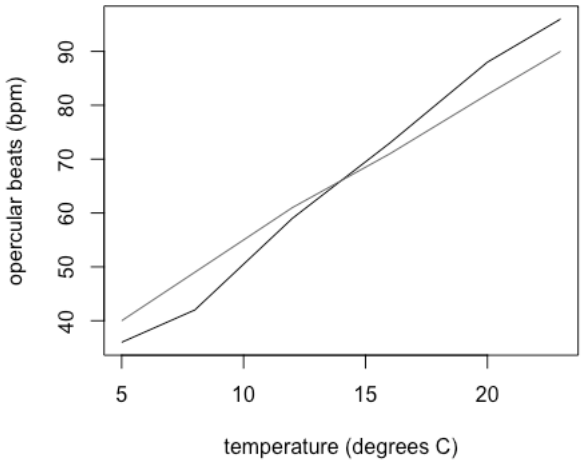
Only the order of x and y matter
Name vector x and put in values: **temp <- c(5, 8, 12, 16, 20, 23)**
Name vector y and put in values: **fishA <- c(36, 42, 59, 73, 88, 96)**
Add second set of data: **points(temp, fishB, pch = 19, col = "dimgray")**
xlab = “temperature (degrees C)”
ylab = “opercular beats (bpm)”
plot(temp, fishA, pch = 0, xlab = "temperature (degrees C)", ylab = "opercular beats (bpm)")
points(temp, fishB, pch = 19)

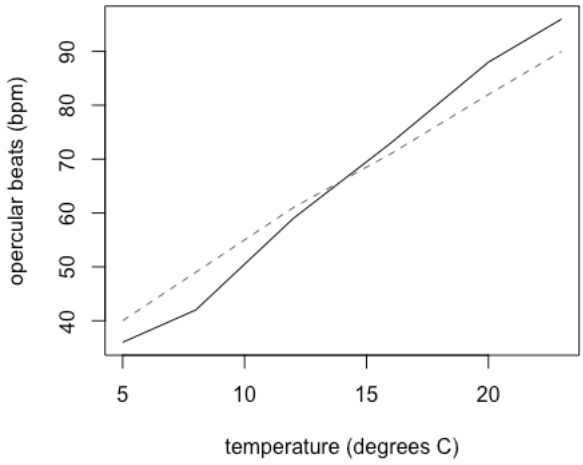
1.5 for the graph (temp on x-axis, 0.25, units on x, 0.25, opercular beats on y-axis, 0.25, units on y, 0.25, all 6 sets of points visible, 0.5)
0.5 for open square and
0.5 for filled circle.



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)





plot(temp, fishA, pch = 17, type = "l", xlab = "temperature (degrees C)", ylab = "opercular beats (bpm)")
lines(temp, fishB, lty=2)

first command is the same as above except type="l" is added
second command use the lines function [lines()] and the line type function (lty=)
for the lty value, they can ONLY use 1 (gives a straight line) if they change the color (using the color command, col="")
ex. lines(temp, fishB, lty=1, col="red")
[any type of line (colored, dotted, solid) is fine **(so, either of the above are acceptable)]**

1.0 for the graph (temp on x-axis, 0.25, units on x, 0.25, opercular beats on y-axis, 0.25, units on y)
1.0 for the new line for fishB. [any type of line (coloured, dotted, solid) is fine as long as its included)