

Name: Peter Kurtz

Homework Assignment 03

40 Points

General Instructions

For this third homework assignment, you have to work with RMarkdown or knitr/Sweave. You can create your own RMarkdown (.Rmd) file, based on files from class and from Homework 1, copy the question numbers and the answer options into your .Rmd file, and knit that file into a pdf file. **Alternatively** (and much easier!!!), use this .Rnw file as a template, just fill in the answers into the provided spaces, and knit into a pdf file. Only the final resulting pdf file (from .Rmd or .Rnw) has to be submitted via Canvas. As previously stated, I would like to encourage potential and current MS and PhD students to work with .Rnw and L^AT_EX instead of .Rmd.

Do not forget to replace my name and include your name instead!

(i) (20 Points) **Sequences in R:**

Use `:`, `seq()`, or `rep()` and some other operators/functions appropriately, but definitely **not** `c()`, to create the following sequences:

- (a) (3 Points) 1 5 9 13 17 21 25 29 33 37 41 45 (numeric vector of length 12)

Answer:

```
seq(1,45,length=12)
```

```
[1] 1 5 9 13 17 21 25 29 33 37 41 45
```

- (b) (4 Points) 1 -20 300 -4000 50000 (numeric vector of length 5)

Answer:

```
nonNeg = seq(1,5)*rep(10,5)**(seq(0,4))
alternating=rep(seq(-1,1,by=2), times=3)*-1
nonNeg*alternating[-6]
```

```
[1] 1 -20 300 -4000 50000
```

- (c) (4 Points) "a1" "b2" "b3" "c4" "c5" "c6" (character vector of length 6)

Note: You are allowed to use `letters[...]` in this part.

Answer:

```
dec=seq(1,3)
let = rep(letters[1:3], dec)
paste(let, seq(1,6), sep="")
```

```
[1] "a1" "b2" "b3" "c4" "c5" "c6"
```

- (d) (4 Points) FALSE TRUE FALSE TRUE FALSE TRUE (logical vector of length 6)

Answer:

```
numAlt = rep(seq(0,1), 3)
numAlt %in% 1
```

```
[1] FALSE TRUE FALSE TRUE FALSE TRUE
```

- (e) (5 Points) 10 9 8 7 8 7 6 5 6 5 4 3 4 3 2 1 (numeric vector of length 16)

Answer:

```
rep(seq(10,7,by=-1), times = 4) + rep(seq(0,-6,by=-2), each = 4)
```

```
[1] 10 9 8 7 8 7 6 5 6 5 4 3 4 3 2 1
```

Show your R code and the final sequence produced from within R!

Hint: You may want to look at the help pages (and examples!) for `paste` and `paste0` how to concatenate strings. Also google how to create a letter sequence in R (you are not allowed to write `c("a", "b", "c")` in part (c) above). Create your R expressions in multiple steps. It is unlikely that you will succeed with your first attempt to do everything in one step immediately. If you are struggling look back at your L07 notes and exercises.

(ii) (20 Points) **Mammals Data:**

The data set `mammals` in the package `MASS` contains average brain weights (g) and average body weights (kg) for 62 species of land mammals. Use R expressions or functions to find the following.

Note: You are not allowed to do this by inspecting the data set or by manually typing in names or numbers that have been calculated in R.

Show your R code and the final result produced from within R!

First load the data as follows and create three new vectors:

```
data(mammals, package = "MASS")
mnames <- rownames(mammals)
mbody <- mammals$body
mbrain <- mammals$brain
```

(a) (2 Points) Show the first 10 lines of the entire mammals data set.

Answer:

```
head(mammals, 10)

##           body brain
## Arctic fox    3.385  44.5
## Owl monkey    0.480  15.5
## Mountain beaver 1.350   8.1
## Cow           465.000 423.0
## Grey wolf     36.330 119.5
## Goat          27.660 115.0
## Roe deer      14.830  98.2
## Guinea pig     1.040   5.5
## Verbet         4.190  58.0
## Chinchilla     0.425   6.4
```

Work with `mnames`, `mbody`, and `mbrain` from now on!

(b) (2 Points) Calculate the range (aka., maximum minus minimum) of brain weights among the species. I want you to do the subtraction, don't just give the interval.

Answer:

```
max(mbrain) - min(mbrain)
```

```
[1] 5711.86
```

- (c) (3 Points) List the name of the species with the heaviest brain (but do not list the weight for this species).

Answer:

```
mnames[which(mbrain == max(mbrain))]
```

```
[1] "African elephant"
```

- (d) (4 Points) List the names of the species with a brain heavier than 400g and body weight less than 500kg.

Answer:

```
mnames[mbrain > 400 & mbody < 500]
```

```
[1] "Cow" "Donkey" "Gorilla" "Human" "Okapi" [6] "Chimpanzee"
```

- (e) (4 Points) List the names of the two species with their average body weights closest to the median of the body weights. Do not list the actual body weights for these two species but make sure that your result is plausible (e.g., if an elephant is among these two species, something must be wrong).

Answer:

```
x = which(abs(mbody - median(mbody)) == min(abs(mbody - median(mbody))))
mnames[x]
```

```
[1] "Arctic fox" "Cat"
```

- (f) (5 Points) List the names of the top-3 species with the largest ratios between brain and body weights (i.e., brain / body). Sort them from highest ratio in decreasing order.

Answer:

```
largeRatio = mbrain/mbody
orderofRatio = order(largeRatio, decreasing = TRUE)
largeVector = c(orderofRatio[1:3])
mnames[largeVector]
```

```
[1] "Ground squirrel" "Owl monkey" [3] "Lesser short-tailed shrew"
```