CIND 123 Summer 2018 - Assignment #1 Solution

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Use RStudio for this assignment. Edit the file `assignment-1.Rmd` and insert your R code where wherever you see the string "INSERT YOUR ANSWER HERE"

When you click the **Knit** button a document will be generated that includes both content as well as the output of any embedded R code chunks within the document.

Sample Question and Solution

Use `seq()` to create the vector $(1, 2, 3, \ldots, 10)$.

seq(1,10) "'

Question 1

a) Use the `seq()` function to create the vector $(1, 7, 13, \ldots, 61)$. Note that each term in this sequence is of the form $1 + 6n$ where $n = 0, \ldots, 10$.

```
seq(1,61,6)
```

```
##  [1]  1  7 13 19 25 31 37 43 49 55 61
```

b) Use `seq()` and `c()` to create the vector $(1, 2, 3, \ldots, 10, 9, 8, \ldots, 3, 2, 1)$.

```
c(1:10,9:1)
```

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

c) Use `rep()` to create the vector $(2, 3, 4, \ldots, 2, 3, 4)$ in which the sequence $(2, 3, 4)$ is repeated 5 times.

```
a<-c(2,3,4)
rep(a,5)
```

```
##  [1] 2 3 4 2 3 4 2 3 4 2 3 4 2 3 4
```

d) Use `rep()` to create the vector $(1, 1, \ldots, 1, 2, 2, \ldots, 2, 3, 3, \ldots, 3)$ where each number is repeated 7 times.

```
rep(1:3,c(7,7,7))
```

```
##  [1] 1 1 1 1 1 1 1 2 2 2 2 2 2 2 3 3 3 3 3 3 3
```

e) Use `rep()` to create the vector $(10, 20, 20, 30, 30, 30, \ldots, 100, \ldots, 100)$ where $10n$ is repeated n times.

```
rep(seq(10,100,10),c(1:10))
```

```
##  [1]  10  20  20  30  30  30  40  40  40  40  50  50  50  50  50  60  60
## [18]  60  60  60  60  70  70  70  70  70  70  70  80  80  80  80  80  80
## [35]  80  80  90  90  90  90  90  90  90  90  90 100 100 100 100 100 100
## [52] 100 100 100 100
```

Question 2

a) Compute:

$$\sum_{n=1}^{100} n$$

```
sum(1:100)
```

```
## [1] 5050
```

b) Compute:

$$\sum_{n=10}^{100} n^3$$

```
a<-10:100
sum(a^3)
```

```
## [1] 25500475
```

c) Compute:

$$\sum_{n=1}^{10} \left(\frac{2^n}{n} + \frac{4^n}{n^4} \right)$$

```
x<-1:10
sum(((2^x)/x)+((4^x)/x^4))
```

```
## [1] 416.5333
```

d) Compute:

$$\sum_{n=0}^{10} \frac{1}{n!}$$

Hint: Use `factorial(n)` to compute $n!$

```
x<-0:10
sum(1/factorial(x))
```

```
## [1] 2.718282
```

e) Compute:

$$\sum_{n=1}^{20} \left(2n + \frac{1}{\sqrt{n}} \right)$$

```
d<-1:20
sum((2*d)+1/sqrt(d))
```

```
## [1] 427.5953
```

Question 3

a) Create an empty list `mylist`.

```
mylist<-list()
```

b) Add a component named `aa` whose value is 42.

```
aa<-42
mylist<-list(aa=aa)
```

c) Add a component named `bb` whose value is the numeric vector $(1, 2, \ldots, 10)$.

```
bb<-1:10
mylist<-list(aa=aa,bb=bb)
```

d) Add a component named `cc` whose value is the character vector ("Hello", "CIND 123").

```
cc<-c("Hello","CIND 123")
mylist<-list(aa=aa,bb=bb,cc=cc)
```

e) Add a component named `dd` whose value is a 4x3 matrix whose elements are $(1, 2, \ldots, 12)$ in row-wise order.

```
dd<-matrix(1:12,nrow=3,byrow=T)
mylist<-list(aa=aa,bb=bb,cc=cc,dd=dd)
```

f) Display `mylist` on the screen.

```
mylist<-list(aa=aa,bb=bb,cc=cc,dd=dd)
mylist
```

```
## $aa
## [1] 42
##
## $bb
##  [1]  1  2  3  4  5  6  7  8  9 10
##
## $cc
## [1] "Hello"    "CIND 123"
##
## $dd
##      [,1] [,2] [,3] [,4]
## [1,]    1    2    3    4
## [2,]    5    6    7    8
## [3,]    9   10   11   12
```

Question 4

If you have not already done so, install the ISwR package on your computer using the command `install.packages("ISwR")`.

Load the `ISwR` package into your session.

```
library(ISwR)
```

a) Display the last 6 rows of the `thuesen` data frame.

```
tail(thuesen,6)
```

```
##    blood.glucose short.velocity
## 19          12.5           1.19
## 20          16.1           1.05
## 21          13.3           1.32
## 22           4.9           1.03
## 23           8.8           1.12
## 24           9.5           1.70
```

b) Compute the mean of each variable using `sapply()` function.

Hint: You might need to consider removing the `NA` values, otherwise the average will not be computed.

```
sapply(thuesen,mean,na.rm=TRUE)
```

```
##  blood.glucose short.velocity
##      10.300000       1.325652
```

c) Create a numeric vectors `v1`, `v2`, and `v3` whose elements are the numbers from 1 to 20, their squares, and their square-roots respectiverly.

```
mylist2<-list(as.numeric(c(1:20)),(c(1:20)**2),sqrt(c(1:20)))
mylist2
```

```
## [[1]]
##  [1]  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20
##
## [[2]]
##  [1]   1   4   9  16  25  36  49  64  81 100 121 144 169 196 225 256 289
## [18] 324 361 400
##
## [[3]]
##  [1] 1.000000 1.414214 1.732051 2.000000 2.236068 2.449490 2.645751
##  [8] 2.828427 3.000000 3.162278 3.316625 3.464102 3.605551 3.741657
## [15] 3.872983 4.000000 4.123106 4.242641 4.358899 4.472136
```

d) Create a new data frame `iData` by combining the `v1`, `v2`, and `v3` together in a column-wise perspective.

```
iData<-data.frame(do.call(cbind,mylist2))
print(iData,row.names=FALSE)
```

```
##  X1  X2       X3
##   1   1 1.000000
##   2   4 1.414214
##   3   9 1.732051
##   4  16 2.000000
##   5  25 2.236068
##   6  36 2.449490
##   7  49 2.645751
##   8  64 2.828427
##   9  81 3.000000
##  10 100 3.162278
##  11 121 3.316625
##  12 144 3.464102
##  13 169 3.605551
##  14 196 3.741657
##  15 225 3.872983
##  16 256 4.000000
##  17 289 4.123106
##  18 324 4.242641
##  19 361 4.358899
##  20 400 4.472136
```

e) Display the first quartile of `iData`.

```
sapply(iData, function(x) quantile(x, probs = 0.25))
```

```
##    X1.25%    X2.25%    X3.25%
##  5.750000 33.250000  2.396134
```

f) Create a 5x5 empty matrix, i.e. all elements equal to NA, and fill the diagonal from the top left corner

to the bottom right corner of 'mat1' with the values 'This' 'is' 'the' 'diagonal' then display mat1.

```
m <- matrix(nr=5,nc=5)
diag(m) <- c("This","is","the","diagonal","mat1")
m
```

```
##      [,1]   [,2] [,3]  [,4]       [,5]
## [1,] "This" NA   NA    NA         NA
## [2,] NA     "is" NA    NA         NA
## [3,] NA     NA   "the" NA         NA
## [4,] NA     NA   NA    "diagonal" NA
## [5,] NA     NA   NA    NA         "mat1"
```

END of Assignment #1.