CIND 123 Winter 2018 - Assignment #1

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Use RStudio for this assignment. Edit the file `assignment_01.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, … ,10).

```
seq(1,10)
```

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

Question 1

a) Use the `seq()` function to create the vector (5,9,13, … ,41). Note that each term in this sequence is of the form $1 + 4n$ where $n = 1, \ldots, 10$.

```
seq(5, 41, by = 4)
```

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

b) Use `seq()` and `c()` to create the vector (2,3,4, … ,10,9,8, … ,2).

```
c(2:9, seq(10,2))
```

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

c) Use `rep()` to create the vector (1,2,3, … ,1,2,3) in which the sequence (1,2,3) is repeated 5 times.

```
rep(1:3, times = 5)
```

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

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

```
rep(1:3, each = 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, … ,100, … ,100) where $10n$ is repeated n times.

```r
rep(seq(10, 100, by = 10), times = 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:

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

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

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

b) Compute:

$$\sum_{n=1}^{100} n^2$$

```r
sum(seq(1, 100) ^2)
```

```
## [1] 338350
```

c) Compute:

$$\sum_{n=10}^{20} \left(\frac{2^n}{n} + \frac{3^n}{n^3}\right)$$

```r
sum(((2^(seq(10, 20)))/seq(10, 20)) + (3^(seq(10, 20))/(seq(10, 20))^3))
```

```
## [1] 826751
```

d) Compute:

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

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

```r
sum(1/(factorial(seq(10,0))))
```

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

e) Compute:

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

```r
sum((2 * seq(1, 20)) + (1/(seq(1, 20)^2)))
```

```
## [1] 421.5962
```

Question 3

a) Create an empty list `mylist`.

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

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

```
mylist$aa <- 42
```

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

```
mylist$bb <- as.numeric(1:10)
```

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

```
mylist$cc <- c("Hello", "CIND 123")
```

e) Add a component named `dd` whose value is a 4x3 matrix whose elements are (1,2, … ,12) in column-major order.

```
mylist$dd <- matrix(1:12, nrow = 4)
```

f) Display `mylist` on the screen.

```
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]
## [1,]    1    5    9
## [2,]    2    6   10
## [3,]    3    7   11
## [4,]    4    8   12
```

Question 4

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

Loading the `ISwR` package into the current session.

```
library(ISwR)
```

a) Display the head of the `thuesen` data frame.

```
head(thuesen)
```

```
##   blood.glucose short.velocity
## 1          15.3           1.76
## 2          10.8           1.34
## 3           8.1           1.27
## 4          19.5           1.47
## 5           7.2           1.27
## 6           5.3           1.49
```

b) Compute the mean of each variable using `sapply()`, removing `NA` values.

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

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

c) Create a numeric vectors `n1`, `n2`, and `n3` whose elements are the integers from 1 to 20, their squares, and their cubes.

```
n1 <- c((1:20))
n2 <- c((1:20)^2)
n3 <- c((1:20)^3)
```

d) Create a new data frame `nn` from the above three vectors.

```
nn <- data.frame(n1, n2, n3)
```

e) Display the tail of `nn`.

```
tail(nn)
```

```
##    n1  n2   n3
## 15 15 225 3375
## 16 16 256 4096
## 17 17 289 4913
## 18 18 324 5832
## 19 19 361 6859
## 20 20 400 8000
```

f) Compute the sum of each variable in `nn` using `sapply`.

```
sapply(nn, sum)
```

```
##    n1    n2    n3
##   210  2870 44100
```

Question 5

a) Create a 4x4 empty matrix, i.e. all elements equal to NA, display mat1.

```
(mat1 <- matrix(nrow = 4, ncol = 4))
```

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

b) fill the middle 4 elements with the values ‘This’ ‘is’ ‘the’ ‘middle’ and display mat1.

```
mat1[2:3, 2:3] <- c('This', 'the', 'is', 'middle')
mat1
```

```
##      [,1] [,2]   [,3]     [,4]
## [1,] NA   NA     NA       NA
## [2,] NA   "This" "is"     NA
## [3,] NA   "the"  "middle" NA
## [4,] NA   NA     NA       NA
```

END of Assignment #1.