Introduction to R

Exercise 1

Use R as you would a calculator to find numeric answers to the following (show your work):

1. $1+2(3+4)$

```
1+2*(3+4)
```

```
## [1] 15
```

2. $\sqrt{(4+3)(2+1)}$

```
sqrt((4+3)*(2+1))
```

```
## [1] 4.582576
```

3. $cos(4\pi)$

```
cos(4*pi)
```

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

4. $ln(0)$

```
log(0)
```

```
## [1] -Inf
```

5. $6!$

```
factorial(6)
```

```
## [1] 720
```

6. $^{52}C_5$

```
choose(52,5)
```

```
## [1] 2598960
```

7. $(1+2i)(1-2i)$

```r
(1+2i)*(1-2i)
```

```
## [1] 5+0i
```

8. $\sqrt{-1}$

```r
sqrt(-1)
```

```
## Warning in sqrt(-1): NaNs produced
```

```
## [1] NaN
```

```r
sqrt(as.complex(-1))
```

```
## [1] 0+1i
```

Exercise 2

2.1 Let our small dataset be:

2 5 4 10 8

1. Enter this data into a data vector named x.

```r
x = c(2,5,4,10,8)
```

2. Find the square root of each number.

```r
sqrt(x)
```

```
## [1] 1.414214 2.236068 2.000000 3.162278 2.828427
```

3. Subtract 6 from each number.

```r
x-6
```

```
## [1] -4 -1 -2  4  2
```

4. Divide each number by 10 and find the square for each of the number.

```r
(x/10)^2
```

```
## [1] 0.04 0.25 0.16 1.00 0.64
```

2.2 You recorded the number of sales for a certain day from employees in a company as follows:

1 1 3 4 7 11

1. Find the number of employees you recorded.

```
x = c(1,1,3,4,7,11)
length(x)
```

```
## [1] 6
```

2. Calculate the total sales for the day.

```
sum(x)
```

```
## [1] 27
```

3. Find the vector of cumulative sums for the data you produce.

```
cumsum(x)
```

```
## [1]  1  2  5  9 16 27
```

4. If the number of sales for all the emplyees are the same for 3 days, calculate the product of sales for the 3 days. i.e (Total Sales Day 1) × (Total Sales Day 2) × (Total Sales Day 3)

```
27^3
```

```
## [1] 19683
```

2.3 The vector y has the following values as its elements:

3 6 14 90 54 2 8 65 28 45 7

1. Find a vector of logical expressions where TRUE is for elements of y that have values greater than 30

```
y = c(3,6,14,90,54,2,8,65,82,45,7)
y>30
```

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

2. Find the vector where only values less than 10 is recorded.

```
y[y<10]
```

```
## [1] 3 6 2 8 7
```

3. What is the length for the vector with values more than or equal to 10?

3

```
length(y[y>=10])
```

```
## [1] 6
```

4. Add 5 to the first five values of the vector y.

```
y[1:5] +5
```

```
## [1]  8 11 19 95 59
```

Exercise 3

3.1 A matrix as below is observed

$$\begin{pmatrix} 4 & 1 & 6 \\ 6 & 9 & 4 \\ 8 & 3 & 2 \\ 2 & 5 & 7 \\ 3 & 7 & 1 \end{pmatrix}$$

1. What is the dimension for the matrix?

```
y = c(4,1,6,6,9,4,8,3,2,2,5,7,3,7,1)
x = matrix(y, ncol=3, nrow=5, byrow=T)
dim(x)
```

```
## [1] 5 3
```

2. Add 3 to each element of the matrix.

```
z = x+3
z
```

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

3. Find he transpose matrix.

4

```
t = t(x)
t
```

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

4. Do matrix multiplication of the matrix and its transpose.

```
x%*%t
```

```
##      [,1] [,2] [,3] [,4] [,5]
## [1,]   53   57   47   55   25
## [2,]   57  133   83   85   85
## [3,]   47   83   77   45   47
## [4,]   55   85   45   78   48
## [5,]   25   85   47   48   59
```

3.2

$$\text{Let } A = \begin{pmatrix} 1 & 2 & 3 & 2 \\ 2 & 1 & 6 & 4 \\ 4 & 7 & 2 & 5 \end{pmatrix}, B = \begin{pmatrix} 1 & 3 & 5 & 2 \\ 0 & 1 & 3 & 4 \\ 2 & 4 & 7 & 3 \\ 1 & 5 & 1 & 2 \end{pmatrix}.$$

Find AB^{-1} and BA^T.

```
A = matrix(c(1,2,3,2,2,1,6,4,4,7,2,5), nrow=3,ncol=4,byrow = T)
B = matrix(c(1,3,5,2,0,1,3,4,2,4,7,3,1,5,1,2), nrow=4,ncol=4,byrow=T)

AB_1 = A%*%solve(B)
AB_1
```

```
##      [,1]      [,2]      [,3]       [,4]
## [1,] -0.5 0.1739130 0.6956522  0.1086957
## [2,] -2.5 0.6086957 2.4347826 -0.3695652
## [3,] -6.0 0.3043478 4.2173913  1.5652174
```

```
BA_T = B%*%t(A)
BA_T
```

```
##      [,1] [,2] [,3]
## [1,]   26   43   45
## [2,]   19   35   33
## [3,]   37   62   65
## [4,]   18   21   51
```

5

3.3 Find a matrix of logical expressions for all elements in the matrix below where TRUE are elements that have values less than 50.

$$R = \begin{pmatrix} 56 & 120 & 47 \\ 27 & 68 & 32 \\ 43 & 34 & 110 \end{pmatrix}$$

```r
R = matrix(c(56,120,47,27,68,32,43,34,110), nrow=3,ncol=3,byrow=T)
R<50
```

```
##        [,1]  [,2]  [,3]
## [1,] FALSE FALSE  TRUE
## [2,]  TRUE FALSE  TRUE
## [3,]  TRUE  TRUE FALSE
```