Vector Definitions and Basic Operations

- <- , = is the assigning functional operators

```{r}
Name <- "Sections of Eng_Mohammad_ElDawansy"
Name  =  "Sections of Eng_Mohammad_ElDawansy"
Name
```

```
[1] "Sections of Eng_Mohammad_ElDawansy"
```

```{r}
# listing all object in current worspace
ls()
```

```
 [1] "A"      "B"      "d"      "Data"   "days"   "fn"     "fr"     "ln"     "mon"
[10] "Name"   "Profit" "shop1"  "shop2"  "shop3"  "th"     "tues"   "we"     "x"
```

```{r}
# Square Root
sqrt(25)
# to get help about any function in R
help(sqrt)
```

```
[1] 5
```

Basic Opeartions for vectors

```{r}
# Creating a mathematical sequence
x <- 1:10
y = seq(1,10)
x
y
x= seq(0,10,by=2)
x
y= seq(0,10,length = 6)
y
length(x)# get the length
sum(x)# summation of Vector
sum(x^2)# summation of square elements of a vector
x+y
x-y
x*y
x-2
x^2

```

```
 [1]  1  2  3  4  5  6  7  8  9 10
 [1]  1  2  3  4  5  6  7  8  9 10
[1]  0  2  4  6  8 10
[1]  0  2  4  6  8 10
[1] 6
[1] 30
[1] 220
[1]  0  4  8 12 16 20
[1] 0 0 0 0 0 0
[1]   0   4  16  36  64 100
[1] -2  0  2  4  6  8
[1]   0   4  16  36  64 100
```

```
## Mean & variance & structure & 5 number summary
```{r}
mean(x)
var(y)
```
```

```
[1] 5
[1] 14
```

```
```{r}
str(x)
summary(x)
help(str)

```
```

```
 num [1:6] 0 2 4 6 8 10
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max. 
    0.0     2.5     5.0     5.0     7.5    10.0 
```

```
## Repeating
```{r}
rep(0,100)# vector of 100 Zeros
rep(1:4,5)# get the seq from 1 to 4 then repeat them 5 times

```
```

```
  [1] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
 [42] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
 [83] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
 [1] 1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4
```

```
## Repeating

```{r}
rep(0,100)# vector of 100 Zeros
rep(1:4,5)# get the seq from 1 to 4 then repeat them 5 times

```
```

```
  [1] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
 [42] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
 [83] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
 [1] 1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4
```

```
## Excercise solve 2
```{r}
seq(4,10,by=2)
seq(3,30,length=10)
seq(6,-4,by=-2)
```
```

```
[1]  4  6  8 10
 [1]  3  6  9 12 15 18 21 24 27 30
[1]  6  4  2  0 -2 -4
```

```
```{r}
rep(2,4)
rep(c(1,2),4) # create a vector of 1,2 then repeat them 4 times
rep(1:4,rep(3,4)) # make sequence from 1 to 4 then repeat each element 3 times
```
```

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

```
## 4. Use the rep function to define simply the following vectors in R.
- (a) 6,6,6,6,6,6
- (b) 5,8,5,8,5,8,5,8
- (c) 5,5,5,5,8,8,8,8
```{r}
rep(6,6)
rep(c(5,8),4)
rep(c(5,8),rep(4,2))
```
```

```
[1] 6 6 6 6 6 6
[1] 5 8 5 8 5 8 5 8
[1] 5 5 5 5 8 8 8 8
```

```
## Data Types
```{r}
a <- c(1,2,3)
a
b <- c("Ahmed" , "Mohammad" ,  "Scott" , "Henselman")
b
c <- c(1:5 , "Hello" , "Can You Structure me" , "Am I Semi Structurecd" , 3.5)
c
str(a)
str(b)
str(c)
```
```

```
[1] 1 2 3
[1] "Ahmed"     "Mohammad"  "Scott"     "Henselman"
[1] "1"                     "2"                     "3"
[4] "4"                     "5"                     "Hello"
[7] "Can You Structure me"  "Am I Semi Structurecd" "3.5"
 num [1:3] 1 2 3
 chr [1:4] "Ahmed" "Mohammad" "Scott" "Henselman"
 chr [1:9] "1" "2" "3" "4" "5" "Hello" "Can You Structure me" ...
```

```

```

```
## Matrix
```{r}
A  <- matrix(c(1,2,3,4,5,6), nrow =2 , ncol = 3, byrow = FALSE)
A
B <- matrix(c(1,2,3,4,5,6), nrow =3 , ncol = 2)
B
t(A)# transpose
t(A) == B
C = matrix(c(1,2,3,4),nrow = 2 , ncol = 2)
solve(C) # inverse of a square matrix
```
```

```
     [,1] [,2] [,3]
[1,]    1    3    5
[2,]    2    4    6
     [,1] [,2]
[1,]    1    4
[2,]    2    5
[3,]    3    6
     [,1] [,2]
[1,]    1    2
[2,]    3    4
[3,]    5    6
      [,1]  [,2]
[1,]  TRUE FALSE
[2,] FALSE FALSE
[3,] FALSE  TRUE
     [,1] [,2]
[1,]   -2  1.5
[2,]    1 -0.5
```

```

```

Data Frames

```{r}
df = data.frame(c(1,2,3), c("Ahmed", "Mohammad","Scott"), c(6.6,8.4,-1.7))
df
```

c.1..2..3. <dbl>	c..Ahmed....Mohammad....Scott.. <fctr>	c.6.6..8.4...1.7. <dbl>
1	Ahmed	6.6
2	Mohammad	8.4
3	Scott	-1.7

3 rows

```{r}
str(df)
```

```
'data.frame':   3 obs. of  3 variables:
 $ c.1..2..3.                    : num  1 2 3
 $ c..Ahmed....Mohammad....Scott..: Factor w/ 3 levels "Ahmed","Mohammad",..: 1 2 3
 $ c.6.6..8.4...1.7.             : num  6.6 8.4 -1.7
```

```{r}
names(df)<-c("Id", "Name", "Degree")
df
```

Id <dbl>	Name <fctr>	Degree <dbl>
1	Ahmed	6.6
2	Mohammad	8.4
3	Scott	-1.7

3 rows

Excercise
1. If x<- c(5,9,2,3,4,6,7,0,8,12,2,9) decide what each of the following is:
- (a) x[2]
- (b) x[2:4]
- (c) x[c(2,3,6)]
- (d) x[c(1:5,10:12)]
- (e) x[-(10:12)]

```{r}
x<- c(5,9,2,3,4,6,7,0,8,12,2,9)
x[2]
x[2:4]
x[c(2,3,6)]
x[c(1:5,10:12)]
x[-(10:12)]# the others
```

```
[1] 9
[1] 9 2 3
[1] 9 2 6
[1]  5  9  2  3  4 12  2  9
[1] 5 9 2 3 4 6 7 0 8
```

```
## 2. The data y<-c(33,44,29,16,25,45,33,19,54,22,21,49,11,24,56) contain sales of milk in liters for 5 days in three different shops (the first 3 values are for shops 1,2 and 3 on Monday, etc.) Produce a statistical summary of the sales for each day of the week and also for each shop.
```{r}
y<-c(33,44,29,16,25,45,33,19,54,22,21,49,11,24,56)
DiaryShop <-matrix(y, nrow = 5 , ncol = 3)
DiaryShop


```
```

```
     [,1] [,2] [,3]
[1,]   33   45   21
[2,]   44   33   49
[3,]   29   19   11
[4,]   16   54   24
[5,]   25   22   56
```

```{r}

summary(DiaryShop[1,])# Day 1 of Week
summary(DiaryShop[2,])
summary(DiaryShop[3,])
summary(DiaryShop[4,])
summary(DiaryShop[5,])
summary(DiaryShop[,1])# Shop1
summary(DiaryShop[,2])
summary(DiaryShop[,3])
```
```

```
   Min. 1st Qu. Median   Mean 3rd Qu.   Max.
     21   27   33   33   39   45
   Min. 1st Qu. Median   Mean 3rd Qu.   Max.
   33.0   38.5   44.0   42.0   46.5   49.0
   Min. 1st Qu. Median   Mean 3rd Qu.   Max.
  11.00   15.00   19.00   19.67   24.00   29.00
   Min. 1st Qu. Median   Mean 3rd Qu.   Max.
  16.00   20.00   24.00   31.33   39.00   54.00
   Min. 1st Qu. Median   Mean 3rd Qu.   Max.
  22.00   23.50   25.00   34.33   40.50   56.00
   Min. 1st Qu. Median   Mean 3rd Qu.   Max.
   16.0   25.0   29.0   29.4   33.0   44.0
   Min. 1st Qu. Median   Mean 3rd Qu.   Max.
   19.0   22.0   33.0   34.6   45.0   54.0
   Min. 1st Qu. Median   Mean 3rd Qu.   Max.
   11.0   21.0   24.0   32.2   49.0   56.0
```
```

Exercise 1.2

1. Create in **R** the matrices

$$x = \begin{bmatrix} 3 & 2 \\ -1 & 1 \end{bmatrix}$$

and

$$y = \begin{bmatrix} 1 & 4 & 0 \\ 0 & 1 & -1 \end{bmatrix}$$

Calculate the following and check your answers in R:

(a) 2*x
(b) x*x
(c) x%*%x
(d) x%*%y

```r
x <-matrix(c(3,2,-1,1),nrow = 2, ncol = 2 , byrow =TRUE)
x <-matrix(c(3,-1,2,1),nrow = 2, ncol = 2)# notice that the arrangements byrow
y <- matrix(c(1,4,0,0,1,-1), nrow = 2 , ncol = 3 , byrow = TRUE)
x
y
2*x
x*x
x%*%x# Matrix Multiplications
x%*%y
```

```
     [,1] [,2]
[1,]    3    2
[2,]   -1    1
     [,1] [,2] [,3]
[1,]    1    4    0
[2,]    0    1   -1
     [,1] [,2]
[1,]    6    4
[2,]   -2    2
     [,1] [,2]
[1,]    9    4
[2,]    1    1
     [,1] [,2]
[1,]    7    8
[2,]   -4   -1
     [,1] [,2] [,3]
[1,]    3   14   -2
[2,]   -1   -3   -1
```

Adding The Working Directory

```{r}
setwd('E:\\Projects\\DataScience.Learning\\R')
Data <- read.csv('data.csv')
Data
```

name <fctr>	gender <fctr>	height <int>	weight <int>
jessica	female	155	60
tom	male	190	100
sam	male	178	80
sandy	female	169	54
refan	female	153	55

5 rows

```{r}
names(Data)
```

```
[1] "name"   "gender" "height" "weight"
```

```
head(Data,  n=5)
```

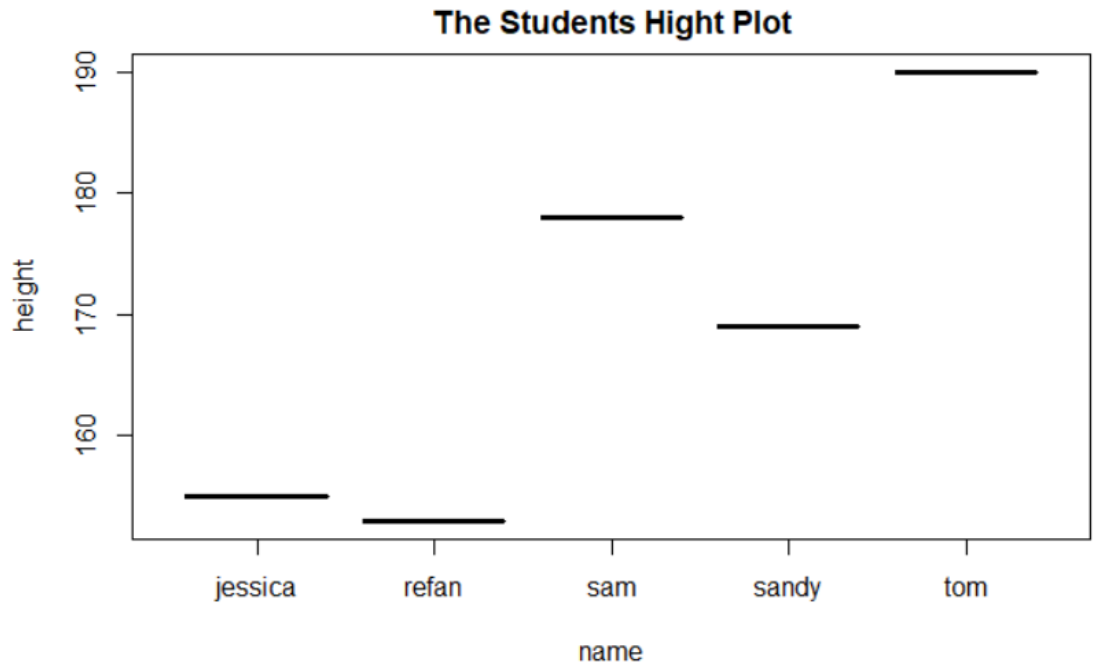
	name <fctr>	gender <fctr>	height <int>	weight <int>
1	jessica	female	155	60
2	tom	male	190	100
3	sam	male	178	80
4	sandy	female	169	54
5	refan	female	153	55

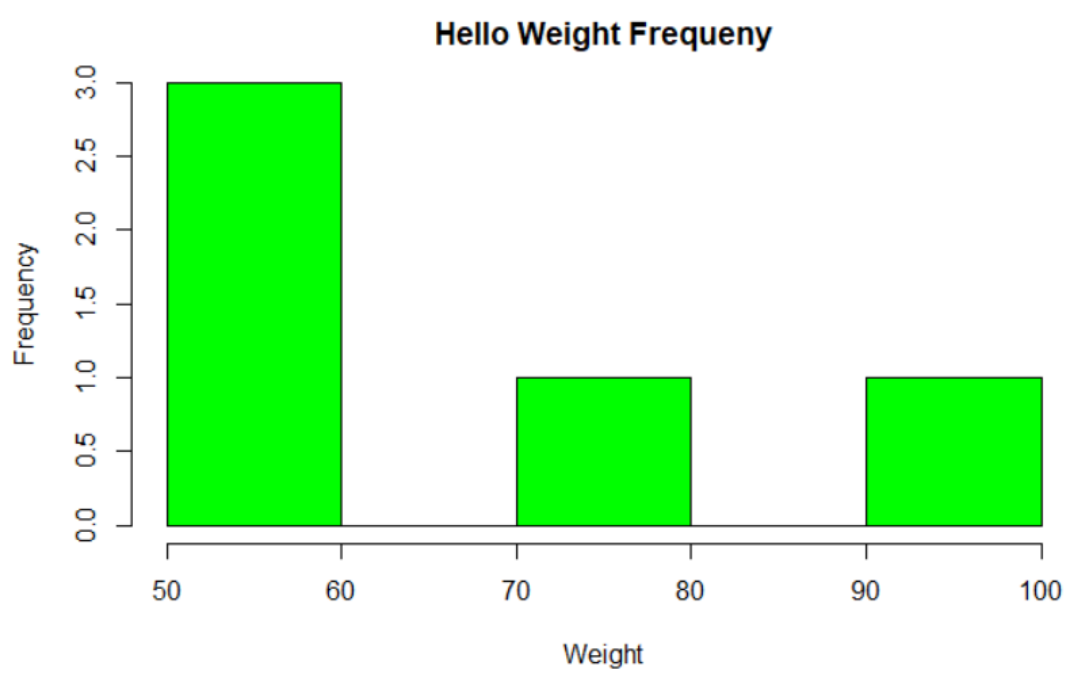
5 rows

```{r}
tail(Data, n=3)
```

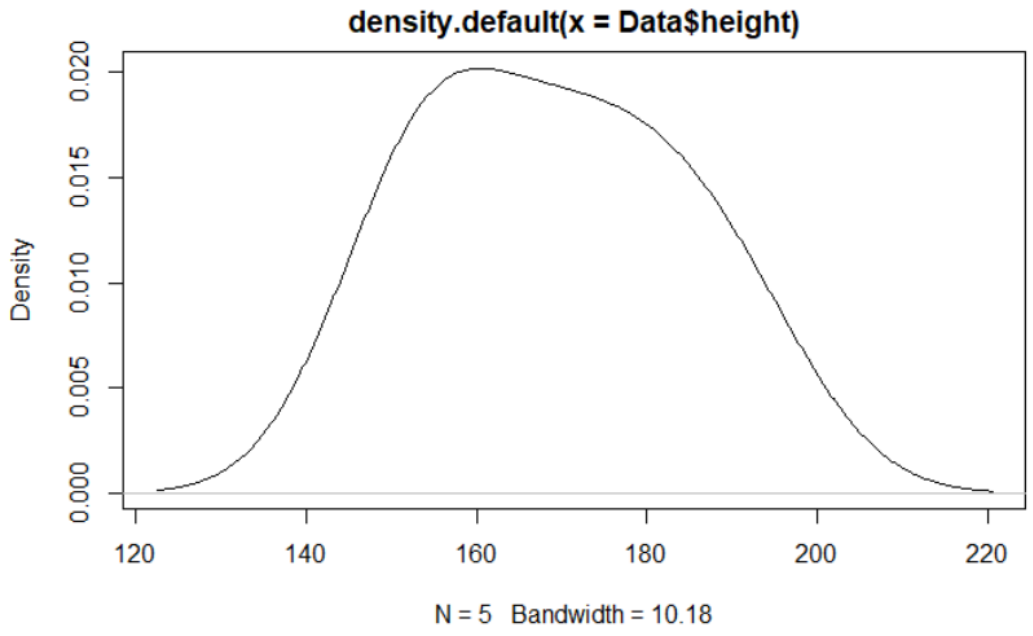
	name <fctr>	gender <fctr>	height <int>	weight <int>
3	sam	male	178	80
4	sandy	female	169	54
5	refan	female	153	55

3 rows

```
## Basic Graphics
- Bar Plot Between 2 Attribute , 1 NominaL => X , 1 Numerical
```{r}
plot(Data$name, Data$height,  main = "The Students Hight Plot" , xlab= 'name' , ylab = 'height')


```
```




```
```{r}
hist(Data$weight, main="Hello Weight Frequeny" , col= "green" ,  xlab= "Weight" , ylab= "Frequency" )
```
```



```r
d <- density(Data$height)
plot(d)
```




```r
pie.data <- c(70,40,30,80,80,50,34)
dpt <- c("IS" ,"IT","CS","BIO","SE","General")
names(pie.data)<- paste(dpt,pie.data,"%")
pie.data
pie(pie.data)
```