Name : Aditya Manojbhai Bhalsod **Enrollment** : 175690693001
Subject : Statistical Methods (SM) **Subject Code** : 4649302

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1. Introduction and a quick tour to R and R Studio (to be done in Lab)

(a) Basic data structures and constructs

→Vector

```
> var<-c(10,20,30,40,50)
> var
[1] 10 20 30 40 50
> varchar<-c("R Studio","Statistical Methods"," Mobile Computing","Compter Network"," Cyber Security & Forensic (
> varchar
[1] "R Studio"                          "Statistical Methods"
[3] " Mobile Computing"                 "Compter Network"
[5] " Cyber Security & Forensic (CSF)"
> logic<-c(TRUE,FALSE,TRUE,FALSE)
> logic
[1]  TRUE FALSE  TRUE FALSE
> float<-c(1.1,1.2,1.3,1.4,1.5)
> float
[1] 1.1 1.2 1.3 1.4 1.5
> int<-40
> int
[1] 40
> mix<-c(10,"Hello",T)
> mix
[1] "10"    "Hello" "TRUE"
> range<-c(1:35)
> range
 [1]  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26
[27] 27 28 29 30 31 32 33 34 35
> range[10]
[1] 10
> range[-10]
 [1]  1  2  3  4  5  6  7  8  9 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
[27] 28 29 30 31 32 33 34 35
> range[c(10.5,20.5)]
[1] 10 20
> id<-c("first"=1,"second"=2)
> id["first"]
first
    1
```

```
> typeof(var)
[1] "double"
> typeof(varchar)
[1] "character"
> typeof(logic)
[1] "logical"
> typeof(float)
[1] "double"
> typeof(int)
[1] "double"
> typeof(mix)
[1] "character"
> typeof(range)
[1] "integer"
> typeof(id)
[1] "double"
```

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→Matrix

```
> va<-c(1:6)
> va
[1] 1 2 3 4 5 6
> ml<-matrix(va,nrow=2,ncol=3,byrow=TRUE)
> ml
     [,1] [,2] [,3]
[1,]    1    2    3
[2,]    4    5    6
> ma<-matrix(1:4,nrow=2)
> ma
     [,1] [,2]
[1,]    1    3
[2,]    2    4
> mt<-c(1:9)
> class(mt)
[1] "integer"
> dim(mt)<-c(3,3)
> mt
     [,1] [,2] [,3]
[1,]    1    4    7
[2,]    2    5    8
[3,]    3    6    9
> class(mt)
[1] "matrix"
> x<-c(1,2,3)
> y<-c(4,5,6)
> z<-c(7,8,9)
> cbind(x,y,z)
     x y z
[1,] 1 4 7
[2,] 2 5 8
[3,] 3 6 9
> rbind(x,y,z)
  [,1] [,2] [,3]
x    1    2    3
y    4    5    6
z    7    8    9

> mt[1]
[1] 1
> mt[1,]
[1] 1 4 7
> mt[,1]
[1] 1 2 3
```

→Array

```
> ad<-matrix(c(1,2,3,4),2,2)
> ac<-matrix(c(5,6,7,8),2,2)
> adl<-array(c(ad,ac),c(2,2,2))
> adl
, , 1

     [,1] [,2]
[1,]    1    3
[2,]    2    4

, , 2

     [,1] [,2]
[1,]    5    7
[2,]    6    8

> vb<-c(6,5,4)
> vc<-c(3,2,1)
> ad2<-array(c(vb,vc),dim=c(3,3,2))
> ad2
, , 1

     [,1] [,2] [,3]
[1,]    6    3    6
[2,]    5    2    5
[3,]    4    1    4

, , 2

     [,1] [,2] [,3]
[1,]    3    6    3
[2,]    2    5    2
[3,]    1    4    1
```

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→Data Frame

```
> w<-c(111,112,113,114,115)
> h<-c(101,102,103,104,105)
> gender<-c("M","M","F","M","F")
> std<-data.frame(w,h,gender)
> std
    w   h gender
1 111 101      M
2 112 102      M
3 113 103      F
4 114 104      M
5 115 105      F
> std[2,1]
[1] 112
> std$gender
[1] M M F M F
Levels: F M
```

→Lists

```
> mt<-matrix(1:9,3,3)
> log<-c(vb,vc,mt)
> log
 [1] 6 5 4 3 2 1 1 2 3 4 5 6 7 8 9
> log<-list(vb,vc,mt)
> log
[[1]]
[1] 6 5 4

[[2]]
[1] 3 2 1

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

> log2<-list(c(91,92,93),35.5,"xxx")
> log2
[[1]]
[1] 91 92 93

[[2]]
[1] 35.5

[[3]]
[1] "xxx"
```

→Factors

```
> data<-c("VB.net","VB6","PHP","Java","JavaScript","Python","R")
> data
[1] "VB.net"     "VB6"        "PHP"        "Java"       "JavaScript" "Python"
[7] "R"
> print(is.factor(data))
[1] FALSE
> factor_data <- factor(data)
> print(factor_data)
[1] VB.net     VB6        PHP        Java       JavaScript Python     R
Levels: Java JavaScript PHP Python R VB.net VB6
> print(is.factor(factor_data))
[1] TRUE
```

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(a) Available R Datasets, such as mtcars , faithful, etc.

>data()

```
faithful                Old Faithful Geyser Data
fdeaths (UKLungDeaths)
                        Monthly Deaths from Lung Diseases in the UK
freeny                  Freeny's Revenue Data
freeny.x (freeny)       Freeny's Revenue Data
freeny.y (freeny)       Freeny's Revenue Data
infert                  Infertility after Spontaneous and Induced
                        Abortion
iris                    Edgar Anderson's Iris Data
iris3                   Edgar Anderson's Iris Data
islands                 Areas of the World's Major Landmasses
ldeaths (UKLungDeaths)
                        Monthly Deaths from Lung Diseases in the UK
lh                      Luteinizing Hormone in Blood Samples
longley                 Longley's Economic Regression Data
lynx                    Annual Canadian Lynx trappings 1821-1934
mdeaths (UKLungDeaths)
                        Monthly Deaths from Lung Diseases in the UK
morley                  Michelson Speed of Light Data
mtcars                  Motor Trend Car Road Tests
nhtemp                  Average Yearly Temperatures in New Haven
nottem                  Average Monthly Temperatures at Nottingham,
                        1920-1939
npk                     Classical N, P, K Factorial Experiment
occupationalStatus      Occupational Status of Fathers and their Sons
precip                  Annual Precipitation in US Cities
presidents              Quarterly Approval Ratings of US Presidents
pressure                Vapor Pressure of Mercury as a Function of
                        Temperature
quakes                  Locations of Earthquakes off Fiji
randu                   Random Numbers from Congruential Generator RANDU
rivers                  Lengths of Major North American Rivers
rock                    Measurements on Petroleum Rock Samples
sleep                   Student's Sleep Data
stack.loss (stackloss)
                        Brownlee's Stack Loss Plant Data
stack.x (stackloss)     Brownlee's Stack Loss Plant Data
stackloss               Brownlee's Stack Loss Plant Data
```

(C) Null, NA, Missing Values.

```
> is.na(x)
[1] FALSE FALSE FALSE
> ns<-c(1,2,3,NA)
> is.na(ns)
[1] FALSE FALSE FALSE  TRUE
```

(D) Basic Packages related to Statistics: e. g. stats, stats4, graphics, grDevices, modeest, agricolae, etc.

```
> packageDescription("Stats")
Package: stats
Version: 3.5.2
Priority: base
Title: The R Stats Package
Author: R Core Team and contributors worldwide
Maintainer: R Core Team <R-core@r-project.org>
Description: R statistical functions.
License: Part of R 3.5.2
Imports: utils, grDevices, graphics
Suggests: MASS, Matrix, SuppDists, methods, stats4
NeedsCompilation: yes
Built: R 3.5.2; x86_64-w64-mingw32; 2018-12-20 09:41:17 UTC; windows

-- File: C:/Program Files/R/R-3.5.2/library/Stats/Meta/package.rds
> packageDescription("Stats4")
Package: stats4
Title: Statistical Functions using S4 Classes
Version: 3.5.2
Priority: base
Author: R Core Team and contributors worldwide
Description: Statistical Functions using S4 classes.
Maintainer: R Core Team <R-core@r-project.org>
Imports: graphics, methods, stats
License: Part of R 3.5.2
Built: R 3.5.2; ; 2018-12-20 09:42:48 UTC; windows

-- File: C:/Program Files/R/R-3.5.2/library/Stats4/Meta/package.rds
> packageDescription("graphics")
Package: graphics
Version: 3.5.2
Priority: base
Title: The R Graphics Package
Author: R Core Team and contributors worldwide
Maintainer: R Core Team <R-core@r-project.org>
Description: R functions for base graphics.
Imports: grDevices
License: Part of R 3.5.2
NeedsCompilation: yes
Built: R 3.5.2; x86_64-w64-mingw32; 2018-12-20 09:41:03 UTC; windows

-- File: C:/Program Files/R/R-3.5.2/library/graphics/Meta/package.rds
```