##Day1

##Data Type: R objetcs and attributes

```
> x <- c(0.5, 0.6)
> x
[1] 0.5 0.6
> x <- c(TRUE, FALSE)
> x
[1]  TRUE FALSE
> x <- c(T, F)
> x
[1]  TRUE FALSE
> x <- c("a", "b", "c")
> x
[1] "a" "b" "c"
> x <- c(1+0i, 2+4i)
> x
[1] 1+0i 2+4i
```

Data Type: Vector and Lists

```
> x <- vector("numeric", length(10))
> x
[1] 0
> x <- vector("numeric", length = 10)
> x
 [1] 0 0 0 0 0 0 0 0 0 0
> x <- c(1+0i, "a")
> x
[1] "1+0i" "a"
> x <- c(1+0i, 2)
> x
[1] 1+0i 2+0i
> x <- c(T, 2)
> x
[1] 1 2
```

```
> x <- 0:6
> x
[1] 0 1 2 3 4 5 6
> class(x)
[1] "integer"
> as.numeric(x)
[1] 0 1 2 3 4 5 6
```

```
> as.logical(x)
[1] FALSE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE
> as.character(x)
[1] "0" "1" "2" "3" "4" "5" "6"
> x <- c("a", "b")
> as.numeric(x)
[1] NA NA
> as.complex(x)
[1] NA NA

> x <- list(1, "a", T, 2+1i)
> x
[[1]]
[1] 1

[[2]]
[1] "a"

[[3]]
[1] TRUE

[[4]]
[1] 2+1i

> x <- list(1, "a", "b", T, 2+1i)
> x
[[1]]
[1] 1

[[2]]
[1] "a"

[[3]]
[1] "b"

[[4]]
[1] TRUE

[[5]]
[1] 2+1i
```

Data Type: Matrics

```
> m <- matrix(nrow = 2, ncol = 3)
> m
     [,1] [,2] [,3]
[1,]   NA   NA   NA
```

```
[2,]   NA   NA   NA
> dim(m)
[1] 2 3
> attributes(m)
$dim
[1] 2 3

> m <- matrix(1:6, nrow = 2, ncol = 3)
> m
     [,1] [,2] [,3]
[1,]    1    3    5
[2,]    2    4    6
> m <- 1:10
> m
 [1]  1  2  3  4  5  6  7  8  9 10
> dim(m)
NULL
> dim(m) <- c(2, 5)
> m
     [,1] [,2] [,3] [,4] [,5]
[1,]    1    3    5    7    9
[2,]    2    4    6    8   10

> x <- 1:3
> y <- 10:12
> cbind(x, y)
     x  y
[1,] 1 10
[2,] 2 11
[3,] 3 12

> rbind(x, y)
  [,1] [,2] [,3]
x    1    2    3
y   10   11   12
```

Data Type: factors

```
> x <- factor(c("yes", "no", "why", "no", "yes"))
> x
[1] yes no  why no  yes
Levels: no why yes
> table(x)
x
 no why yes
  2   1   2
> unclass(x)
[1] 3 1 2 1 3
```

```
attr(,"levels")
[1] "no"  "why" "yes"
> x <- factor(c("yes", "no", "yes", "no", "yes"), levels = c("yes", "no"))
> x
[1] yes no  yes no  yes
Levels: yes no
> x <- factor(c("yes", "no", "yes", "no", "why"), levels = c("yes", "no"))
> x
[1] yes  no   yes  no   <NA>
Levels: yes no
```

Data Type: Missing values

```
> x <- c(1, 2, NA, 3, 4)
> x
[1]  1  2 NA  3  4
> is.na(x)
[1] FALSE FALSE  TRUE FALSE FALSE

> x <- c(1, 2, NA, NaN, 4)
> x
[1]   1   2  NA NaN   4
> is.na(x)
[1] FALSE FALSE  TRUE  TRUE FALSE
> is.nan(x)
[1] FALSE FALSE FALSE  TRUE FALSE
```

Data Type: Data Frames

```
> x <- data.frame(foo = 1:4, bar = c(T, T, F, T))
> x
  foo   bar
1   1  TRUE
2   2  TRUE
3   3 FALSE
4   4  TRUE
> nrow(x)
[1] 4
> ncol(x)
[1] 2
> x <- 1:3
> x
[1] 1 2 3
> names(x) <- c("foo", "bar", "norf")
> x
 foo  bar norf
```

```
   1    2    3
> x <- data.frame(foo = 1:4, bar = c(T, T, F, T))
> x
  foo   bar
1   1  TRUE
2   2  TRUE
3   3 FALSE
4   4  TRUE
> row.names(x) <- c("foo", "bar", "norf", "joiy")
> x
     foo   bar
foo    1  TRUE
bar    2  TRUE
norf   3 FALSE
joiy   4  TRUE
```

Data Type: Names Attributes

```
> m <- matrix(1:6, nrow = 2, ncol = 3)
> m
     [,1] [,2] [,3]
[1,]    1    3    5
[2,]    2    4    6

> dimnames(m) <- list(c("a", "b"), c("d", "e", "f"))
> m
  d e f
a 1 3 5
b 2 4 6
```

Day2

```
> ##hello
> x <- matrix(1:12, 3, 4)
> comment(x) <- c("Write a comment for x value")
> x
     [,1] [,2] [,3] [,4]
[1,]    1    4    7   10
[2,]    2    5    8   11
[3,]    3    6    9   12
> comment(x)
[1] "Write a comment for x value"
```

Conections: interfaces to the outside world

```
> str(file)
function (description = "", open = "", blocking = TRUE, encoding =
getOption("encoding"),
    raw = FALSE, method = getOption("url.method", "default"))
>
>
> con <- file("Day2_Prcatice.txt", "r")
> data <- read.csv(con)
> con
A connection with
description "Day2_Prcatice.txt"
class       "file"
mode        "r"
text        "text"
opened      "opened"
can read    "yes"
can write   "no"

> close(con)

> data <- read.csv("Day2_Prcatice.txt")

> con <- gzfile("words.gz")
> x <- readLines(con, 10)


> con <- url("https://www.jhsph.edu", "r")
> x <- readLines(con)
> head(x)
[1] "<!DOCTYPE html>"
[2] "<html lang=\"en\">"
[3] ""
[4] "<head>"
[5] "<meta charset=\"utf-8\" />"
[6] "<title>Johns Hopkins Bloomberg School of Public Health</title>"




> ## Subsetting R Objects: Basics

> x <- c("a", "b", "c", "d", "e")
> x[1]
[1] "a"
> x[3]
[1] "c"
> x[1:3]
[1] "a" "b" "c"
>
> x[x > "a"]
```

```
[1] "b" "c" "d" "e"
> u <- x > "a"
> u
[1] FALSE  TRUE  TRUE  TRUE  TRUE
> x[u]
[1] "b" "c" "d" "e"
```

```
> ## Subsetting R Objects: Lists

> x <- list(foo = 1:4, bar = 0.6)
> x[1]
$foo
[1] 1 2 3 4

> x[2]
$bar
[1] 0.6

> x[[1]]
[1] 1 2 3 4
> x[[2]]
[1] 0.6
> x$bar
[1] 0.6
> x["bar"]
$bar
[1] 0.6

> x <- list(foo = 1:4, bar = 0.6, baz = "hello")
> x[1:3]
$foo
[1] 1 2 3 4

$bar
[1] 0.6

$baz
[1] "hello"

> x[c(1,3)]
$foo
[1] 1 2 3 4

$baz
[1] "hello"

> x <- list(a = list(10, 11, 12), b = c(3.14, 2.45))
```

```
> x[c(1,3)]
$a
$a[[1]]
[1] 10

$a[[2]]
[1] 11

$a[[3]]
[1] 12


$<NA>
NULL

> x[[c(1,3)]]
[1] 12
> x[[c(2,1)]]
[1] 3.14
```

```
> ## Subsetting R Objects: Matrics

> x <- matrix(1:6, 2, 3)
> x
     [,1] [,2] [,3]
[1,]    1    3    5
[2,]    2    4    6
> x[1, 2]
[1] 3
> x[1, ]
[1] 1 3 5
> x[, 2]
[1] 3 4
> x[1, 2, drop = FALSE]
     [,1]
[1,]    3
> x[1, 2, drop = T]
[1] 3
> x[1, , drop = FALSE]
     [,1] [,2] [,3]
[1,]    1    3    5
```

```
> ## Subsetting R Objects: Subsetting with Names- Partial matching
```

```
> x <- list(avkrd = 1:5)
> x$a
[1] 1 2 3 4 5
> x[["a"]]
NULL
> x[["a", exact = FALSE]]
[1] 1 2 3 4 5
```

```
> ## Subsetting R Objects: Removing Missing Values

> x <- c(1, 2, NA, 4, NA, 5)
> is.na(x)
[1] FALSE FALSE  TRUE FALSE  TRUE FALSE
> bad <- is.na(x)
> x[!bad]
[1] 1 2 4 5
> x
[1]  1  2 NA  4 NA  5
> x <- c(1, 2, NA, 4, NA, 5)
> y <- c("a", "b", NA, "d", NA, "f")
> good <- complete.cases(x, y)
> good
[1]  TRUE  TRUE FALSE  TRUE FALSE  TRUE
> x[good]
[1] 1 2 4 5
> y[good]
[1] "a" "b" "d" "f"
```

```
## Vectorize Operations

> x <- 1:4; y <- 6:9
> x + y
[1]  7  9 11 13
> x > 2
[1] FALSE FALSE  TRUE  TRUE
> x/y
[1] 0.1666667 0.2857143 0.3750000 0.4444444
> x * y
[1]  6 14 24 36
> x <- matrix(1:4, 2, 2); y <- matrix(rep(10, 4), 2, 2)
> x
     [,1] [,2]
[1,]    1    3
[2,]    2    4
> y
```

```
     [,1] [,2]
[1,]   10   10
[2,]   10   10
> x * y ## element wise multiply
     [,1] [,2]
[1,]   10   30
[2,]   20   40
> x %*% y ##  true matrix multiply
     [,1] [,2]
[1,]   40   40
[2,]   60   60
```