

# Variables and datatypes in R

# In this lecture

- Variables
- Basic data types
- R objects
  - Vectors
  - Lists

# Variables

# Variables

## Variable names - Rules

- Allowed characters are Alphanumeric, '\_' and '.'
- Always start with alphabets
- No special characters like !, @, #, \$, ....

## Examples

### Correct naming:

> b2 = 7

> Manoj\_GDPL = "Scientist"

> Manoj.GDPL = "Scientist"

### Wrong naming :

> 2b = 7

Error: unexpected input in  
"2b "

# Predefined constants

Constant	Symbol in R
<i>Pi</i>	pi
<i>letters</i>	a,b,c,.....x,y,z
<i>LETTERS</i>	A,B,.....,X,Y,Z
<i>Months in a year</i>	month.name, month.abb

```

Console C:/Users/Prem/Downloads/
> pi
[1] 3.141593
> letters
[1] "a" "b" "c" "d" "e" "f" "g" "h" "i"
[10] "j" "k" "l" "m" "n" "o" "p" "q" "r"
[19] "s" "t" "u" "v" "w" "x" "y" "z"
> LETTERS
[1] "A" "B" "C" "D" "E" "F" "G" "H" "I"
[10] "J" "K" "L" "M" "N" "O" "P" "Q" "R"
[19] "S" "T" "U" "V" "W" "X" "Y" "Z"
> month.name
[1] "January" "February" "March"
[4] "April" "May" "June"
[7] "July" "August" "September"
[10] "October" "November" "December"
> month.abb
[1] "Jan" "Feb" "Mar" "Apr" "May" "Jun"
[7] "Jul" "Aug" "Sep" "Oct" "Nov" "Dec"
>

```

# Data types

# Basic data types

Basic data types	Values
<i>Logical</i>	TRUE and FALSE
<i>Integer</i>	Set of all integers, $\mathbb{Z}$
<i>Numeric</i>	Set of all real numbers
<i>Complex</i>	Set of complex numbers
<i>Character</i>	"a", "b", "c", ..., "x", "y", "z", "@", "#", "\$", " ", "*", "1", "2", ... etc..

# Basic data types

TASK	ACTION	SYNTAX/EXAMPLE
<i>Find data type of object</i>	→ use command “typeof()”	→ Syntax: typeof(object)
<i>Verify if object is of a certain datatype</i>	→ use prefix “is.” before datatype as command.	→ Syntax: is.data_type(object) Example : is.integer()
<i>Coerce or convert data type of object to another</i>	→ use prefix “as.” before datatype as command.	→ Syntax: as.data_type(object) Example : as.logical()

**Note : Not all coercions are possible and if attempted will return “NA” as output**

## Sample Codes

<pre>Console ~/ &gt; typeof(1) [1] "double" &gt; typeof("22-01-2001") [1] "character"</pre>	<pre>Console ~/ &gt; is.character("21-11-2001") [1] TRUE &gt; is.character(as.Date("21-11-2001")) [1] FALSE</pre>	<pre>Console ~/ &gt; as.complex(2) [1] 2+0i &gt; as.numeric("a") [1] NA</pre>
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# Basic objects

Object	Values
<i>Vector</i>	Ordered collection of same data types
<i>List</i>	Ordered collection of objects
<i>Data frame</i>	Generic tabular object

# Vectors

# Vectors

- **Vector** : an ordered collection of basic data types of given length
- All the elements of a vector must be of same data type

## Code

```
# Vectors Example
```

```
X = c(2.3,4.5,6.7,8.9)
```

```
print(X)
```

## Console Output

Console ~/ ↗

```
> # Vectors Example  
> X = c(2.3,4.5,6.7,8.9)  
> print(X)  
[1] 2.3 4.5 6.7 8.9  
>  
>
```

# Lists

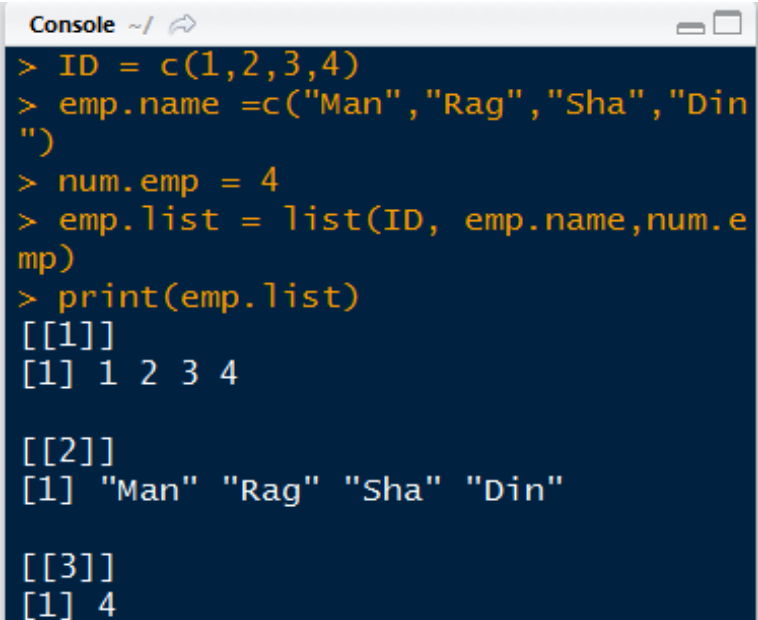
# Lists in R: create a list

- **List** : a generic object consisting of an ordered collection of objects
- A list could consist of a numeric vector, a logical value, a matrix, a complex vector, a character array, a function, and so on

## Code

```
# List Example : Employee details
ID = c(1,2,3,4)
emp.name =c("Man","Rag","Sha","Din")
num.emp = 4
emp.list = list(ID, emp.name,num.emp)
print(emp.list)
```

## Console Output



```
Console ~/
> ID = c(1,2,3,4)
> emp.name =c("Man","Rag","Sha","Din")
> num.emp = 4
> emp.list = list(ID, emp.name,num.e
mp)
> print(emp.list)
[[1]]
[1] 1 2 3 4

[[2]]
[1] "Man" "Rag" "Sha" "Din"

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

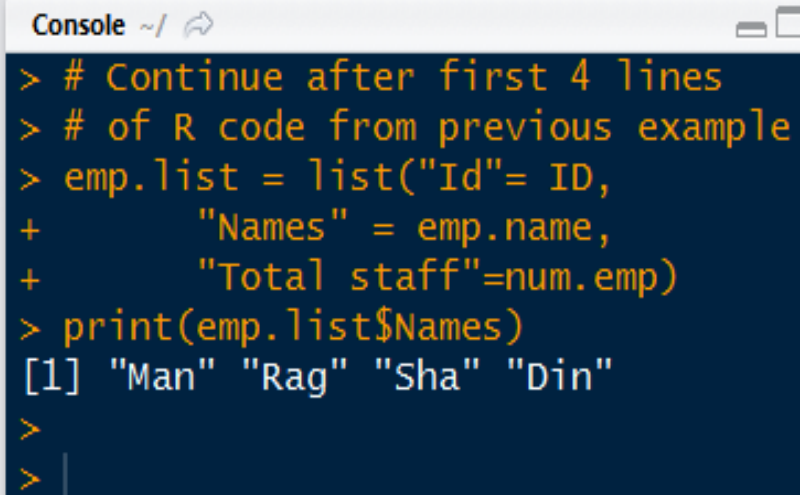
# Accessing components (by names)



- All the components of a list can be named
- These components can be accessed using the given names

## Code

```
# Continue after first 4 lines of R  
# code from previous example  
emp.list = list("Id"= ID,  
"Names" = emp.name,  
"Total staff"=num.emp)  
print(emp.list$Names)
```

## Console Output



```
Console ~/    
> # Continue after first 4 lines  
> # of R code from previous example  
> emp.list = list("Id"= ID,  
+ "Names" = emp.name,  
+ "Total staff"=num.emp)  
> print(emp.list$Names)  
[1] "Man" "Rag" "Sha" "Din"  
>  
> |
```

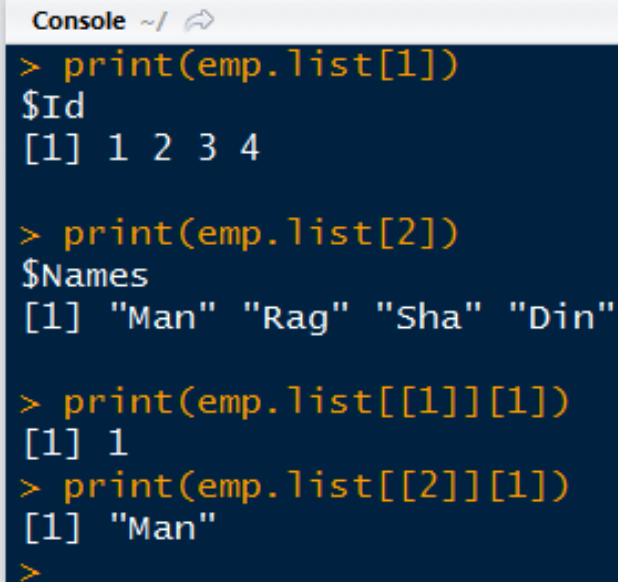
# Accessing components (indices)




To access top level components, use double slicing operator “`[[ ]]`” and for lower/inner level components use “`[ ]`” along with “`[[ ]]`”

## Code

```
# continuing from previous  
  
# code  
  
print(emp.list[[1]])  
print(emp.list[[2]])  
print(emp.list[[1]][1])  
print(emp.list[[2]][1])
```

## Console Output



```
Console ~/     
> print(emp.list[1])  
$Id  
[1] 1 2 3 4  
  
> print(emp.list[2])  
$Names  
[1] "Man" "Rag" "Sha" "Din"  
  
> print(emp.list[[1]][1])  
[1] 1  
> print(emp.list[[2]][1])  
[1] "Man"  
>
```

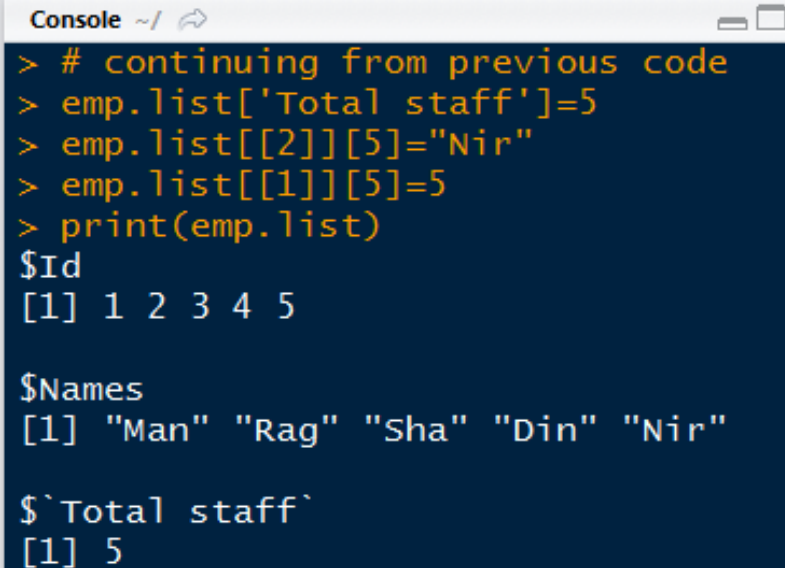
# Manipulating lists




A list can be modified by accessing components & replacing them

## Code

```
# continuing from previous code  
emp.list['Total staff']=5  
  
emp.list[[2]][5]="Nir"  
  
emp.list[[1]][5]=5  
print(emp.list)
```

## Console Output



```
Console ~/     
> # continuing from previous code  
> emp.list['Total staff']=5  
> emp.list[[2]][5]="Nir"  
> emp.list[[1]][5]=5  
> print(emp.list)  
$Id  
[1] 1 2 3 4 5  
  
$Names  
[1] "Man" "Rag" "Sha" "Din" "Nir"  
  
$`Total staff`  
[1] 5
```



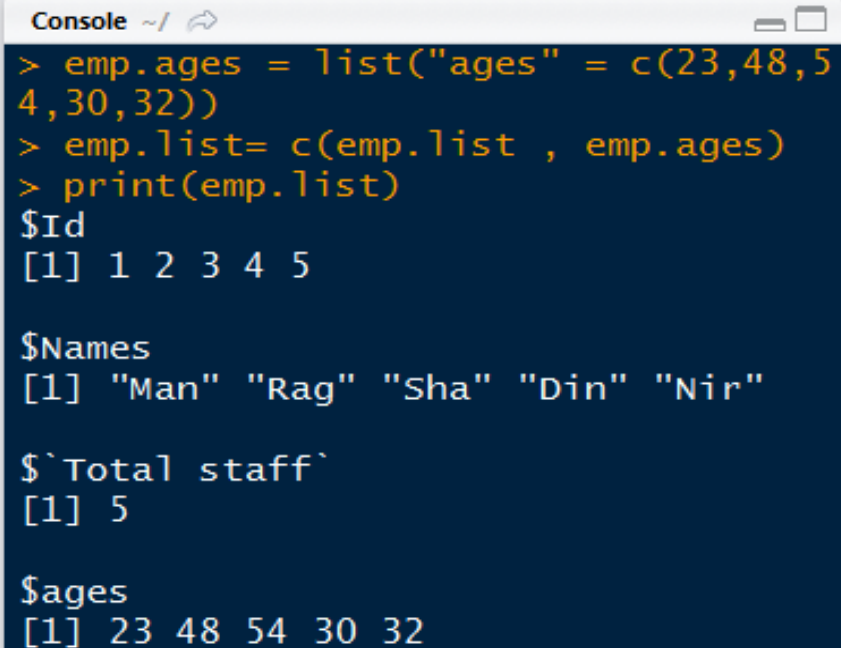
# Concatenation of lists



Two lists can be concatenated using the concatenation function,  
`c(list1, list2)`

## Code

```
# continuing from previous code  
emp.ages = list("ages" =  
c(23,48,54,30,32))  
emp.list= c(emp.list , emp.ages)  
print(emp.list)
```

## Console Output



```
Console ~/    
> emp.ages = list("ages" = c(23,48,5  
4,30,32))  
> emp.list= c(emp.list , emp.ages)  
> print(emp.list)  
$Id  
[1] 1 2 3 4 5  
  
$Names  
[1] "Man" "Rag" "Sha" "Din" "Nir"  
  
$`Total staff`  
[1] 5  
  
$ages  
[1] 23 48 54 30 32
```