

❖ Variables in R

Variables are a means of storing data and using it later in mathematical or analytical operations. The name of a variable consists of letters, numbers, and a period, and it does not begin with a number. The variable is created using the assignment symbol. (<- ,=)

• Types of variables

The R language contains several types of variables, the most important of which are:

1. Numeric عددي (3.14 , 100)
2. Integer عدد صحيح (10L)
3. Character نص (Hello , RStudio)
4. Logical منطقي (TRUE , FALSE)
5. Complex مركب (2+3i)
6. Vector متجه (1,2,3)

• Check variable type

class(x) يبين نوع البيانات
typeof(x) يبين نوع التخزين
is.numeric(x)
is.character(x)
is.logical

Example :

```
> x=42  
> class(x)  
[1] "numeric"  
> typeof(x)  
[1] "double"  
> is.character(x)  
[1] FALSE  
> is.numeric(x)  
[1] TRUE
```

• Update the value of the variable

The variable can be changed or given a new value using the same assignment method (->, =). Example:

```
> x<-5
> x<-10
> print(x)
[1] 10
> name="Ali"
> name<-"SaRa"
> print(name)
[1] "SaRa"
```

Or you can update the value itself by adding or subtracting a mathematical operation, as in the example below:

```
> count<-1
> count<-count+4
> print(count)
[1] 5
```

❖ Data in R program

In each programming language, different types of data are dealt with, which are written in formats specific to that language. In the R language, data refers to all values that can be stored and processed, whether they are numbers, texts, tables, time series, etc. Data is stored within variables or data structures.

❖ Vector

A vector is a collection of values of the same type (either numbers, text, or logical) only, consisting of one column or one row of data. To create a vector, we use the `c()` function (which stands for combine). For example:

▪ Access vector elements

To access specific elements in the vector, we use the following command:

Example :

```
v1 <- c(1, 4, 7, 12)
> v1[1]
```

```
[1] 1
> v1[5]
[1] 10
> v2[1]
[1] "Ali"
> v1[1:3]
[1] 1 4 5
```

- The type of () function : To determine the type of a vector.
- The length () function : To determine the number of elements in a vector.

To create ascending or descending numbers, see the example below:

Example :

```
> numbers5to20 <- 5:20
> numbers5to20
[1] 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
```

- Vectors can be linked together:

Example :

```
z=c(1,2,5)
> c(numbers5to20, z)
[1] 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 1 2 5
```

- The diff() function: To find the difference between elements.
- setdiff() function: To find the difference between two vectors

Example :

```
> x=c(3,5,7,23)
> diff(x)
[1] 2 2 16
```

Example :

```
> y=c(1,4,7,23)
```

```
> setdiff(x,y)
```

```
[1] 3 5
```

```
> setdiff(y,x)
```

```
[1] 1 4
```

- **Vector Arithmetic**

In the R language, arithmetic operations can be performed on vectors, such as addition, subtraction, and multiplication, as in the following example:

Example :

```
> v1=c(1,4,5,2,10) #اعداد متجهه
```

```
> sum(v1)
```

```
[1] 22
```

```
> mean(v1)
```

```
[1] 4.4
```

```
> v1*2 # الضرب في ثابت
```

```
[1] 2 8 10 4 20
```

```
> v1+c(5,8,3,1,0)
```

```
[1] 6 12 8 3 10
```

```
> sort(v1) # ترتيب البيانات تصاعدي
```

```
[1] 1 2 4 5 10
```

```
> v1^2 # الرفع للاس 2
```

```
[1] 1 16 25 4 100
```

```
> rep(4,7) # تكرار العدد 4 سبع مرات
```

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

```
> rep(c(1, 4), c(3, 2)) # ثلاث مرات والعدد 4 مرتين تكرار العدد 1
```

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

```
> rep(c(1, 4), each=3) # تكرار كل قيمة ثلاث مرات
```

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

```
> rep(seq(2, 20, 2), rep(2, 10)) # تكرار كل قيمتين مرتين
```

```
[1] 2 2 4 4 6 6 8 8 10 10 12 12 14 14 16 16 18 18 20 20
```

```
> rep(seq(from=2,to=7,by=2),time=3)
```

```
[1] 2 4 6 2 4 6 2 4 6
```