OPERATORS IN R

INT 232

Operator

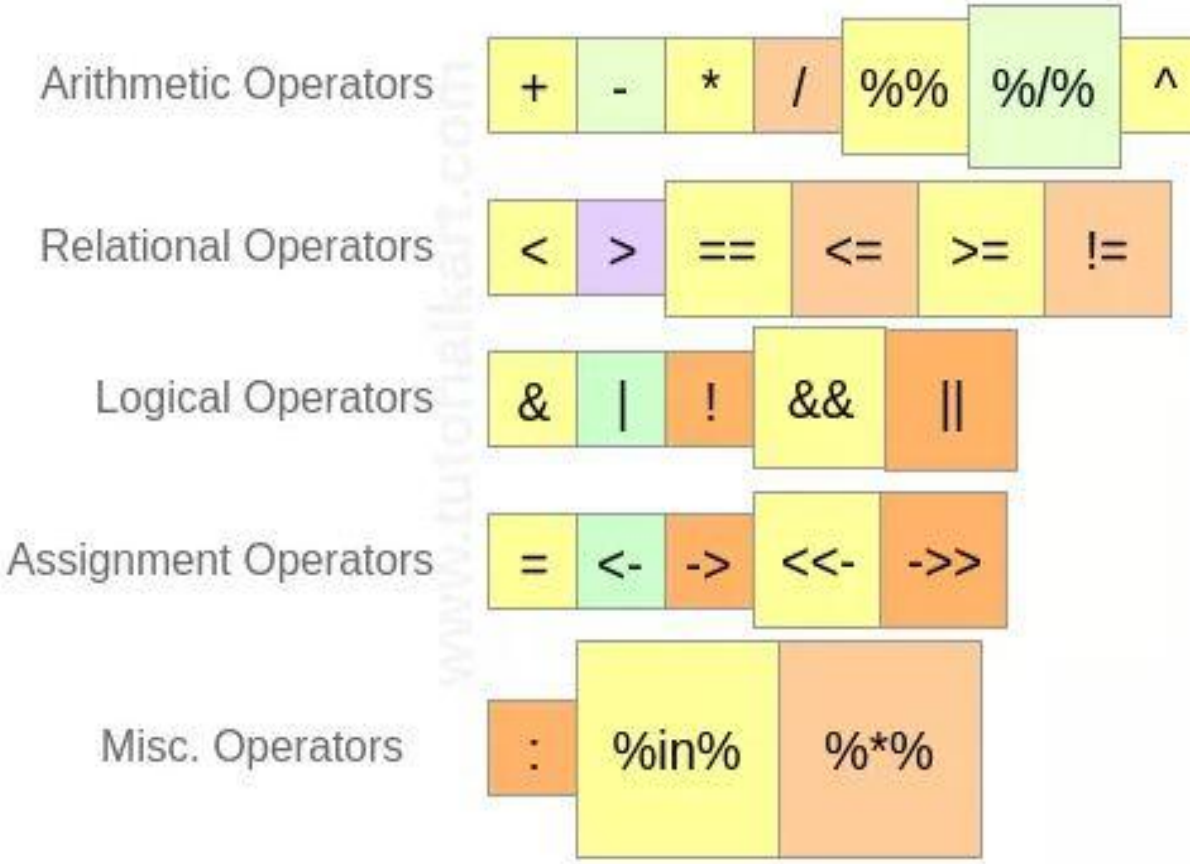
An operator is a symbol that tells the compiler to perform specific mathematical or logical manipulations.

R language is rich in built-in operators and provides following types of operators.

Types of Operators

We have the following types of operators in R programming −

- Arithmetic Operators
- Relational Operators
- Logical Operators
- Assignment Operators
- Miscellaneous Operators


Arithmetic Operators
+ - * / %% %/% ^
Relational Operators
< > == <= >= !=
Logical Operators
& | ! && ||
Assignment Operators
= <- -> <<- ->>
Misc. Operators
: %in% %*%

Arithmetic Operators

Operator	Description
+	addition
-	subtraction
*	multiplication
/	division
^ or **	exponentiation
x %% y	modulus (x mod y) 5%%2 is 1
x %/% y	integer division 5%/%2 is 2

Arithmetic Operators are used to accomplish arithmetic operations. They can be operated on the basic data types Numericals, Integers, Complex Numbers. Vectors with these basic data types can also participate in arithmetic operations, during which the operation is performed on one to one element basis.

Operator	Description	Usage
+	Addition of two operands	a + b
–	Subtraction of second operand from first	a – b
*	Multiplication of two operands	a * b
/	Division of first operand with second	a / b
%%	Remainder from division of first operand with second	a %% b
%/%	Quotient from division of first operand with second	a %/% b
^	First operand raised to the power of second operand	a^b

An example for each of the arithmetic operator on Numerical values is provided below :

r_op_arithmetic.R R Script File

```r
# R Arithmetic Operators Example for integers

a <- 7.5
b <- 2

print ( a+b )    #addition
print ( a-b )    #subtraction
print ( a*b )    #multiplication
print ( a/b )    #Division
print ( a%%b )    #Reminder
print ( a%/%b )    #Quotient
print ( a^b )    #Power of
```

Output

```
$ Rscript r_op_arithmetic.R
[1] 9.5
[1] 5.5
[1] 15
[1] 3.75
[1] 1.5
[1] 3
[1] 56.25
```

An example for each of the arithmetic operator on Vectors is provided below :

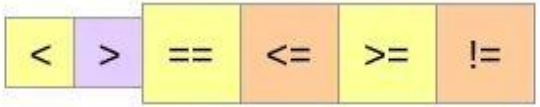
r_op_arithmetic_vector.R R Script File

```
1  # R Operators - R Arithmetic Operators Example for vectors
2
3  a <- c(8, 9, 6)
4  b <- c(2, 4, 5)
5
6  print ( a+b )     #addition
7  print ( a-b )     #subtraction
8  print ( a*b )     #multiplication
9  print ( a/b )     #Division
10 print ( a%%b )     #Reminder
11 print ( a%/%b )     #Quotient
12 print ( a^b )     #Power of
```

Output

```
1 $ Rscript r_op_arithmetic_vector.R
2 [1] 10 13 11
3 [1] 6 5 1
4 [1] 16 36 30
5 [1] 4.00 2.25 1.20
6 [1] 0 1 1
7 [1] 4 2 1
8 [1]   64 6561 7776
```

Relational Operators



Relational Operators are those that find out relation between the two operands provided to them. Following are the six relational operations R programming language supports.The output is boolean (TRUE or FALSE) for all of the Relational Operators in R programming language.

Operator	Description	Usage
<	Is first operand **less than** second operand	a < b
>	Is first operand **greater than** second operand	a > b
==	Is first operand **equal to** second operand	a == b
<=	Is first operand **less than** or equal to second operand	a <= b
>=	Is first operand **greater than** or equal to second operand	a > = b
!=	Is first operand **not equal** to second operand	a!=b

An example for each of the relational operator on Numberical values is provided below :

r_op_relational.R R Script File

```
# R Operators - R Relational Operators Example for Numbers

a <- 7.5
b <- 2

print ( a<b )    # less than
print ( a>b )    # greater than
print ( a==b )    # equal to
print ( a<=b )    # less than or equal to
print ( a>=b )    # greater than or equal to
print ( a!=b )    # not equal to
```

Output

```
$ Rscript r_op_relational.R
[1] FALSE
[1] TRUE
[1] FALSE
[1] FALSE
[1] TRUE
[1] TRUE
```

An example for each of the relational operator on Vectors is provided below :

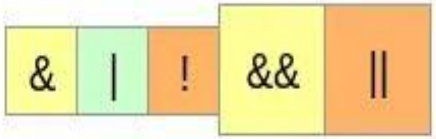
r_op_relational_vector.R R Script File

```
# R Operators - R Relational Operators Example for Numbers

a <- c(7.5, 3, 5)
b <- c(2, 7, 0)

print ( a<b )    # less than
print ( a>b )    # greater than
print ( a==b )    # equal to
print ( a<=b )    # less than or equal to
print ( a>=b )    # greater than or equal to
print ( a!=b )    # not equal to
```

Output

```
$ Rscript r_op_relational_vector.R
[1] FALSE  TRUE FALSE
[1]  TRUE FALSE  TRUE
[1] FALSE FALSE FALSE
[1] FALSE  TRUE FALSE
[1]  TRUE FALSE  TRUE
[1] TRUE TRUE TRUE
```

Logical Operators



Logical Operators in R programming language work only for the basic data types logical, numeric and complex and vectors of these basic data types.

Operator	Description	Usage
&	Element wise logical AND operation.	a & b
|	Element wise logical OR operation.	a | b
!	Element wise logical NOT operation.	!a
&&	Operand wise logical AND operation.	a && b
||	Operand wise logical OR operation.	a || b

r_op_logical.R R Script File

```r
# R Operators - R Logical Operators Example for basic logical elements

a <- 0    # logical FALSE
b <- 2    # logical TRUE

print ( a & b )    # logical AND element wise
print ( a | b )    # logical OR element wise
print ( !a )    # logical NOT element wise
print ( a && b )    # logical AND consolidated for all elements
print ( a || b )    # logical OR consolidated for all elements
```

Output

```
$ Rscript r_op_logical.R
[1] FALSE
[1] TRUE
[1] TRUE
[1] FALSE
[1] TRUE
```

An example for each of the logical operators on Vectors is provided below :

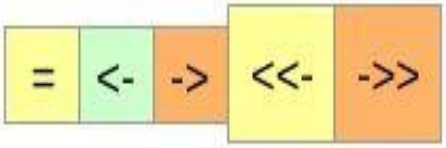
R Script File

```
1  # R Operators - R Logical Operators Example for boolean vectors
2
3  a <- c(TRUE, TRUE, FALSE, FALSE)
4  b <- c(TRUE, FALSE, TRUE, FALSE)
5
6  print ( a & b )    # logical AND element wise
7  print ( a | b )    # logical OR element wise
8  print ( !a )    # logical NOT element wise
9  print ( a && b )    # logical AND consolidated for all elements
10 print ( a || b )    # logical OR consolidated for all elements
```

Output

```
1 $ Rscript r_op_logical_vector.R
2 [1]  TRUE FALSE FALSE FALSE
3 [1]  TRUE  TRUE  TRUE FALSE
4 [1] FALSE FALSE  TRUE  TRUE
5 [1] TRUE
6 [1] TRUE
```

Assignment Operators



Assignment Operators are those that help in assigning a value to the variable.

Operator	Description	Usage
=	Assigns right side value to left side operand	a = 3
<-	Assigns right side value to left side operand	a <- 5
->	Assigns left side value to right side operand	4 -> a
<<-	Assigns right side value to left side operand	a <<- 3.4
->>	Assigns left side value to right side operand	c(1,2) ->> a

An example for each of the assignment operators is provided below :

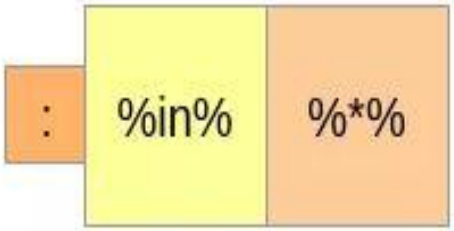
r_op_assignment.R R Script File

```r
# R Operators - R Assignment Operators

a = 2
print ( a )

a <- TRUE
print ( a )

454 -> a
print ( a )

a <<- 2.9
print ( a )

c(6, 8, 9) -> a
print ( a )
```

Output

```
$ Rscript r_op_assignment.R
[1] 2
[1] TRUE
[1] 454
[1] 2.9
[1] 6 8 9
```

Misc. Operators



These operators does not fall into any of the categories mentioned above, but are significantly important during R programming for manipulating data.

Operator	Description	Usage
:	Creates series of numbers from left operand to right operand	a:b
%in%	Identifies if an element(a) belongs to a vector(b)	a %in% b
%*%	Performs multiplication of a vector with its transpose	A %*% t(A)

An example for each of the Miscellaneous operators is provided below :

r_op_misc.R R Script File

```r
# R Operators - R Misc Operators

a = 23:31
print ( a )

a = c(25, 27, 76)
b = 27
print ( b %in% a )

M = matrix(c(1,2,3,4), 2, 2, TRUE)
print ( M %*% t(M) )
```

Output

```
$ Rscript r_op_misc.R
[1] 23 24 25 26 27 28 29 30 31
[1] TRUE
     [,1] [,2]
[1,]    5   11
[2,]   11   25
```