

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

Following table shows the arithmetic operators supported by R language. The operators act on each element of the vector.

Operator	Description	Example
+	Adds two vectors	<pre>v <- c(2,5.5,6) t <- c(8, 3, 4) print(v+t) it produces the following result – [1] 10.0 8.5 10.0</pre>
-	Subtracts second vector from the first	<pre>v <- c(2,5.5,6) t <- c(8, 3, 4) print(v-t) it produces the following result – [1] -6.0 2.5 2.0</pre>
*	Multiplies both vectors	<pre>v <- c(2,5.5,6) t <- c(8, 3, 4) print(v*t) it produces the following result – [1] 16.0 16.5 24.0</pre>

/	Divide the first vector with the second	<pre>v <- c(2,5.5,6) t <- c(8, 3, 4) print(v/t)</pre> <p>When we execute the above code, it produces the following result –</p> <pre>[1] 0.250000 1.833333 1.500000</pre>
%%	Give the remainder of the first vector with the second	<pre>v <- c(2,5.5,6) t <- c(8, 3, 4) print(v%%t)</pre> <p>it produces the following result –</p> <pre>[1] 2.0 2.5 2.0</pre>
/%	The result of division of first vector with second (quotient)	<pre>v <- c(2,5.5,6) t <- c(8, 3, 4) print(v/%t)</pre> <p>it produces the following result –</p> <pre>[1] 0 1 1</pre>
^	The first vector raised to the exponent of second vector	<pre>v <- c(2,5.5,6) t <- c(8, 3, 4) print(v^t)</pre> <p>it produces the following result –</p> <pre>[1] 256.000 166.375 1296.000</pre>

Relational Operators

Following table shows the relational operators supported by R language. Each element of the first vector is compared with the corresponding element of the second vector. The result of comparison is a Boolean value.

Operator	Description	Example
>	Checks if each element of the first vector is greater than the corresponding element of the second vector.	<pre>v <- c(2,5.5,6,9) t <- c(8,2.5,14,9) print(v>t)</pre> <p>it produces the following result –</p> <pre>[1] FALSE TRUE FALSE FALSE</pre>

<	Checks if each element of the first vector is less than the corresponding element of the second vector.	<pre>v <- c(2,5.5,6,9) t <- c(8,2.5,14,9) print(v < t)</pre> it produces the following result – <pre>[1] TRUE FALSE TRUE FALSE</pre>
"=="	Checks if each element of the first vector is equal to the corresponding element of the second vector.	<pre>v <- c(2,5.5,6,9) t <- c(8,2.5,14,9) print(v == t)</pre> it produces the following result – <pre>[1] FALSE FALSE FALSE TRUE</pre>
<=	Checks if each element of the first vector is less than or equal to the corresponding element of the second vector.	<pre>v <- c(2,5.5,6,9) t <- c(8,2.5,14,9) print(v<=t)</pre> it produces the following result – <pre>[1] TRUE FALSE TRUE TRUE</pre>
>=	Checks if each element of the first vector is greater than or equal to the corresponding element of the second vector.	<pre>v <- c(2,5.5,6,9) t <- c(8,2.5,14,9) print(v>=t)</pre> it produces the following result – <pre>[1] FALSE TRUE FALSE TRUE</pre>
!=	Checks if each element of the first vector is unequal to the corresponding element of the second vector.	<pre>v <- c(2,5.5,6,9) t <- c(8,2.5,14,9) print(v!=t)</pre> it produces the following result – <pre>[1] TRUE TRUE TRUE FALSE</pre>

Logical Operators

Following table shows the logical operators supported by R language. It is applicable only to vectors of type logical, numeric or complex. All numbers greater than 1 are considered as logical value TRUE.

Each element of the first vector is compared with the corresponding element of the second vector. The result of comparison is a Boolean value.

Operator	Description	Example
&	It is called Element-wise Logical AND operator. It combines each element of the first vector with the corresponding element of the second vector and gives a output TRUE if both the elements are TRUE.	<pre>v <- c(3,1,TRUE,2+3i) t <- c(4,1,FALSE,2+3i) print(v&t)</pre> it produces the following result – [1] TRUE TRUE FALSE TRUE
	It is called Element-wise Logical OR operator. It combines each element of the first vector with the corresponding element of the second vector and gives a output TRUE if one the elements is TRUE.	<pre>v <- c(3,0,TRUE,2+2i) t <- c(4,0,FALSE,2+3i) print(v t)</pre> it produces the following result – [1] TRUE FALSE TRUE TRUE
!	It is called Logical NOT operator. Takes each element of the vector and gives the opposite logical value.	<pre>v <- c(3,0,TRUE,2+2i) print(!v)</pre> it produces the following result – [1] FALSE TRUE FALSE FALSE

The logical operator && and || considers only the first element of the vectors and give a vector of single element as output.

Operator	Description	Example
&&	Called Logical AND operator. Takes first element of both the vectors and gives the TRUE only if both are TRUE.	<pre>v <- c(3,0,TRUE,2+2i) t <- c(1,3,TRUE,2+3i) print(v&&t)</pre> it produces the following result – <pre>[1] TRUE</pre>
	Called Logical OR operator. Takes first element of both the vectors and gives the TRUE if one of them is TRUE.	<pre>v <- c(0,0,TRUE,2+2i) t <- c(0,3,TRUE,2+3i) print(v t)</pre> it produces the following result – <pre>[1] FALSE</pre>

Assignment Operators

These operators are used to assign values to vectors.

Operator	Description	Example
<pre><- or = or <<-</pre>	Called Left Assignment	<pre>v1 <- c(3,1,TRUE,2+3i) v2 <<- c(3,1,TRUE,2+3i) v3 = c(3,1,TRUE,2+3i) print(v1) print(v2) print(v3)</pre> it produces the following result – <pre>[1] 3+0i 1+0i 1+0i 2+3i [1] 3+0i 1+0i 1+0i 2+3i [1] 3+0i 1+0i 1+0i 2+3i</pre>

-> or ->>	Called Right Assignment	<pre>c(3,1,TRUE,2+3i) -> v1 c(3,1,TRUE,2+3i) ->> v2 print(v1) print(v2) it produces the following result - [1] 3+0i 1+0i 1+0i 2+3i [1] 3+0i 1+0i 1+0i 2+3i</pre>
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Miscellaneous Operators

These operators are used to for specific purpose and not general mathematical or logical computation.

Operator	Description	Example
:	Colon operator. It creates the series of numbers in sequence for a vector.	<pre>v <- 2:8 print(v) it produces the following result - [1] 2 3 4 5 6 7 8</pre>
%in%	This operator is used to identify if an element belongs to a vector.	<pre>v1 <- 8 v2 <- 12 t <- 1:10 print(v1 %in% t) print(v2 %in% t) it produces the following result - [1] TRUE [1] FALSE</pre>

%*%

This operator is used to multiply a matrix with its transpose.

```
M = matrix( c(2,6,5,1,10,4), nrow = 2, ncol = 3, byrow = TRUE)
t = M %*% t(M)
print(t)
```

it produces the following result –

```
      [,1] [,2]
[1,]   65   82
[2,]   82  117
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