

# **Introduction to R Software**

**Basics of Calculations**

**:::**

**Logical Operators**

**Shalabh**

**Department of Mathematics and Statistics**

**Indian Institute of Technology Kanpur**

# Logical Operators and Comparisons

The following table shows the operations and functions for logical comparisons (True or False).

Operator	Executions
>	Greater than
>=	Greater than or equal
<	Less than
<=	Less than or equal
==	Exactly equal to
!=	Not equal to
!	Negation (not)
&, &&	and
,	or

Operator	Executions
<code>xor()</code>	either... or (exclusive)
<code>isTRUE(x)</code>	test if <code>x</code> is TRUE
TRUE	true
FALSE	false

## Examples:

```
> x = 1:6          # Generates x=1,2,3,4,5,6
> (x > 2) & (x < 5) # Checks whether the
                    values are greater
                    than 2 and less than 2

[1] FALSE FALSE TRUE TRUE FALSE FALSE

> x[(x > 2) & (x < 5)] # Finds which values
                       are greater than 2 and
                       smaller than 5

[1] 3 4
```

## Examples:

R Console

```
> x = 1:6
```

```
> x
```

```
[1] 1 2 3 4 5 6
```

```
>
```

```
> (x > 2) & (x < 5)
```

```
[1] FALSE FALSE TRUE TRUE FALSE FALSE
```

```
>
```

```
> x[(x > 2) & (x < 5)]
```

```
[1] 3 4
```

## Examples:

```
> x = 1:6          # Generates x=1,2,3,4,5,6
```

```
> (x > 2) | (x < 5) # Checks whether the  
                      values are greater  
                      than 2 or less than 5
```

```
[1] TRUE TRUE TRUE TRUE TRUE TRUE
```

```
> x[(x > 2) | (x < 5)] # Finds which values  
                        are greater than 2 or  
                        smaller than 5
```

```
[1] 1 2 3 4 5 6
```

## Examples:

R Console

```
> x = 1:6
```

```
> (x > 2) | (x < 5)
```

```
[1] TRUE TRUE TRUE TRUE TRUE TRUE
```

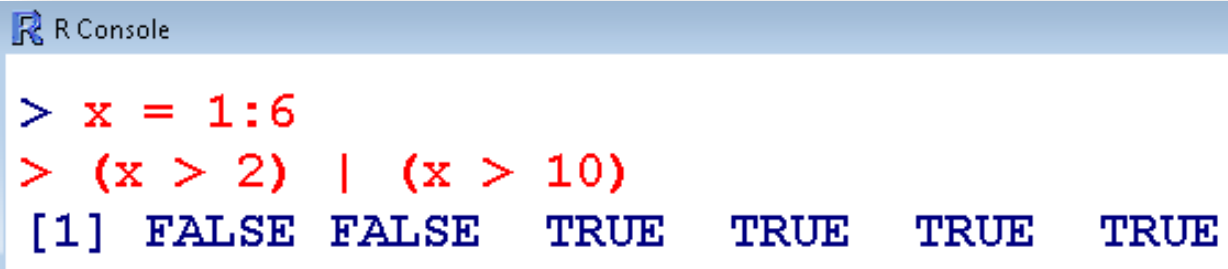
```
>
```

```
> x[(x > 2) | (x < 5)]
```

```
[1] 1 2 3 4 5 6
```

## Examples:

```
> x = 1:6          # Generates x=1,2,3,4,5,6  
  
> (x > 2) | (x > 10) # Checks whether the  
                      values are greater than  
                      2 or greater than 10  
  
[1] FALSE FALSE  TRUE  TRUE  TRUE  TRUE
```



R Console

```
> x = 1:6  
> (x > 2) | (x > 10)  
[1] FALSE FALSE  TRUE  TRUE  TRUE  TRUE
```

## Examples:

```
> x = 1:6          # Generates x = 1,2,3,4,5,6
```

```
> (x > 2) | (x > 10) # Checks whether the  
                      values are greater than  
                      2 or greater than 10
```

```
[1] FALSE FALSE  TRUE  TRUE  TRUE  TRUE
```

```
> x[(x > 2) | (x > 10)] # Finds which values  
                        are greater than 2 or  
                        smaller than 10
```

```
[1] 3 4 5 6
```



## Examples:

R Console

```
> x = 1:6
> (x > 2) | (x > 10)
[1] FALSE FALSE TRUE TRUE TRUE TRUE
>
> x[(x > 2) | (x > 10)]
[1] 3 4 5 6
```

# Logical Operators and Comparisons

Operator	Executions
<code>&amp; , &amp;&amp;</code>	and
<code>  ,   </code>	or

- The shorter form performs element-wise comparisons in almost the same way as arithmetic operators.
- The longer form evaluates left to right examining only the first element of each vector. Evaluation proceeds only until the result is determined.

**Example of** “The longer form evaluates left to right examining only the first element of each vector”

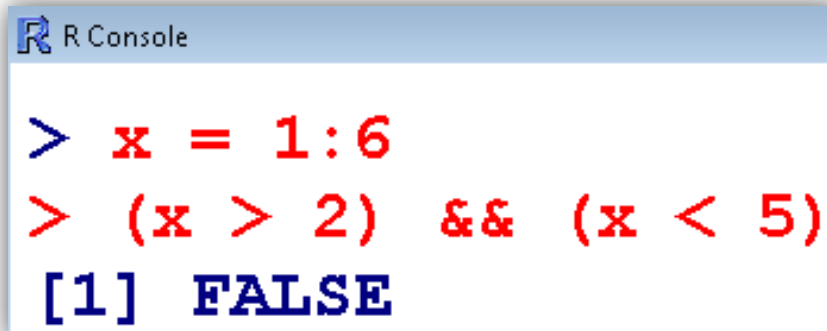
```
> x = 1:6           # Generates x = 1,2,3,4,5,6
```

```
> (x > 2) && (x < 5)
[1] FALSE
```

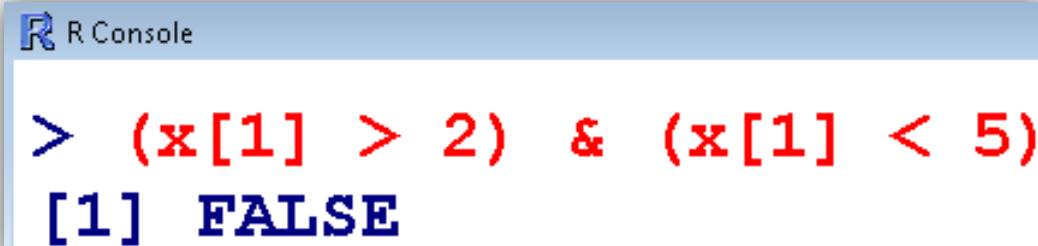
is equivalent to:

```
> (x[1] > 2) & (x[1] < 5)
[1] FALSE
```

Note that `x[1]` is only the first element in `x`



A screenshot of an R Console window. The title bar says 'R Console'. The console shows the following code and output: `> x = 1:6`, `> (x > 2) && (x < 5)`, and `[1] FALSE`. The code is in red and the output is in blue.

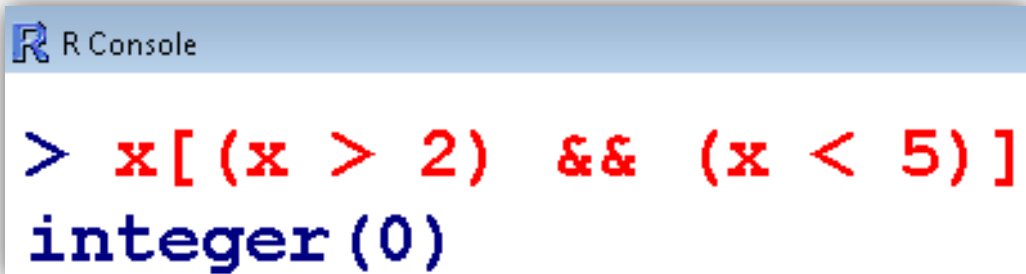


A screenshot of an R Console window. The title bar says 'R Console'. The console shows the following code and output: `> (x[1] > 2) & (x[1] < 5)` and `[1] FALSE`. The code is in red and the output is in blue.

**Example of** “The longer form evaluates left to right examining only the first element of each vector”

(Contd...)

```
> x[(x > 2) && (x < 5)] # Finds which values  
integer(0)               are greater than 2 and  
                           smaller than 5
```



R Console

```
> x[(x > 2) && (x < 5)]  
integer(0)
```

This statement is equivalent to

```
> x[(x[1] > 2) & (x[1] < 5)]  
integer(0)
```