

Foundations of R Software

Lecture 16

Basics of Calculations

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Logical Operators

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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(x, y)</code>	either... or (exclusive)
<code>isTRUE(x)</code>	test if <code>x</code> is TRUE
<code>isFALSE(x)</code>	test if <code>x</code> is FALSE
TRUE	true
FALSE	false

Logical Operators and Comparisons

Operator	Executions
&, &&	and
,	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.

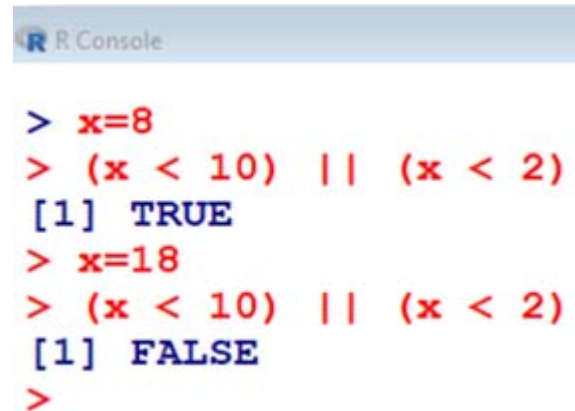
Examples: Use of | and ||

```
> x=8
```

```
> (x < 10) || (x < 2)  
[1] TRUE
```

```
> x=18
```

```
> (x < 10) || (x < 2)  
[1] FALSE
```

A screenshot of an R console window with a light blue header bar containing the R logo and the text "R Console". The console shows the following commands and their outputs:

```
> x=8  
> (x < 10) || (x < 2)  
[1] TRUE  
> x=18  
> (x < 10) || (x < 2)  
[1] FALSE  
>
```

The screenshot shows an R console window with a light blue header bar containing the R logo and the text "R Console". The console displays the following commands and their outputs:

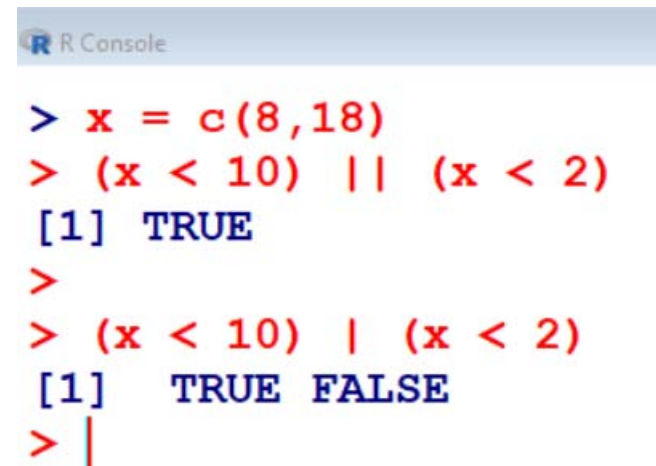
```
> x=8  
> (x < 10) || (x < 2)  
[1] TRUE  
> x=18  
> (x < 10) || (x < 2)  
[1] FALSE  
>
```

Examples: Use of | and ||

```
> x = c(8,18)
> (x < 10) || (x < 2)
[1] TRUE
```

|| Operates only on the first element and not on remaining elements.

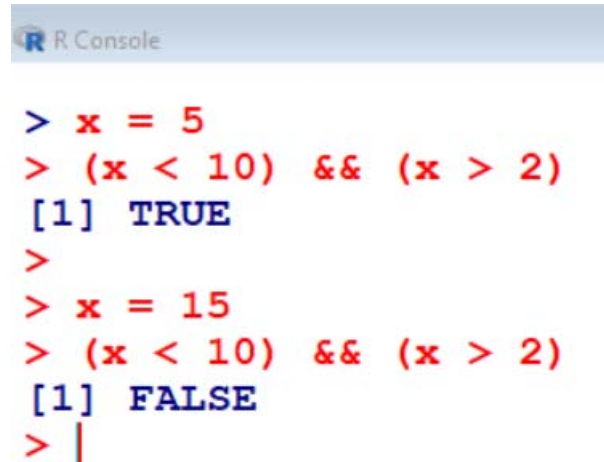
```
> (x < 10) | (x < 2)
[1] TRUE FALSE
| Operates on all the elements.
```

A screenshot of an R console window with a light blue header bar containing the R logo and the text "R Console". The console shows the following R code and output:

```
> x = c(8,18)
> (x < 10) || (x < 2)
[1] TRUE
>
> (x < 10) | (x < 2)
[1] TRUE FALSE
> |
```

Examples: Use of & and &&

```
> x = 5  
> (x < 10) && (x > 2)  
[1] TRUE
```

A screenshot of an R console window with a light blue header bar containing the R logo and the text "R Console". The console shows a series of commands and their outputs in a monospaced font. The commands are color-coded: assignment and logical expressions are in red, while the prompt and output are in blue.

```
> x = 5  
> (x < 10) && (x > 2)  
[1] TRUE  
>  
> x = 15  
> (x < 10) && (x > 2)  
[1] FALSE  
> |
```

```
> x = 15  
> (x < 10) && (x > 2)  
[1] FALSE
```

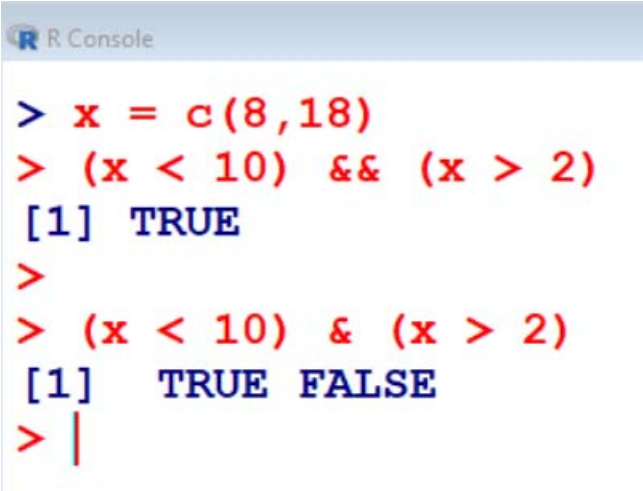
Examples: Use of & and &&

```
> x = c(8,18)
> (x < 10) && (x > 2)
[1] TRUE
```

&& Operates only on the first element and not on remaining elements.

```
> (x < 10) & (x > 2)
[1] TRUE FALSE
```

& Operates on all the elements.



```
R Console
> x = c(8,18)
> (x < 10) && (x > 2)
[1] TRUE
>
> (x < 10) & (x > 2)
[1] TRUE 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 5
```

```
[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 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:

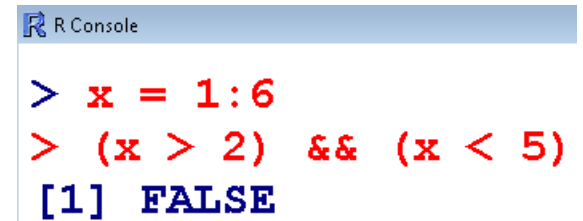
R Console

```
> 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
```

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
```

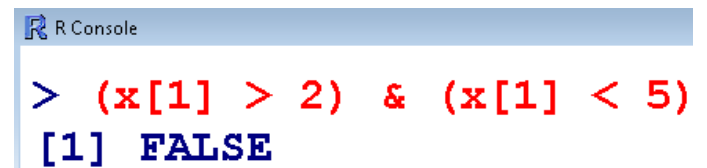
```
> (x > 2) && (x < 5)
[1] FALSE
```



```
R Console
> x = 1:6
> (x > 2) && (x < 5)
[1] FALSE
```

is equivalent to:

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



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

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