Foundations of R Software

Lecture 17

Basics of Calculations

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Relational and Logical Operators

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Relational Operators and Comparisons

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

TRUE and FALSE are reserved words denoting logical constants.

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

Zero is considered as

FALSE

and

non-zero numbers are

taken as TRUE

Logical Operators and Comparisons

Operator	Executions	
!	Logical not	
&	Element-wise logical and	Performs operation element-wise
&&	Logical and	examines only the first element of the operands
|	Element-wise logical or	Performs operation element-wise
||	Logical or	examines only the first element of the operands

Logical Operators and Comparisons

Operator	Executions
`xor(x,y)`	Either `x` or `y` (`x` or `y` but not `x` and `y`)
`isTRUE(x)` `isFALSE(x)`	test if `x` is TRUE test if `x` is FALSE
`TRUE` `FALSE`	true false

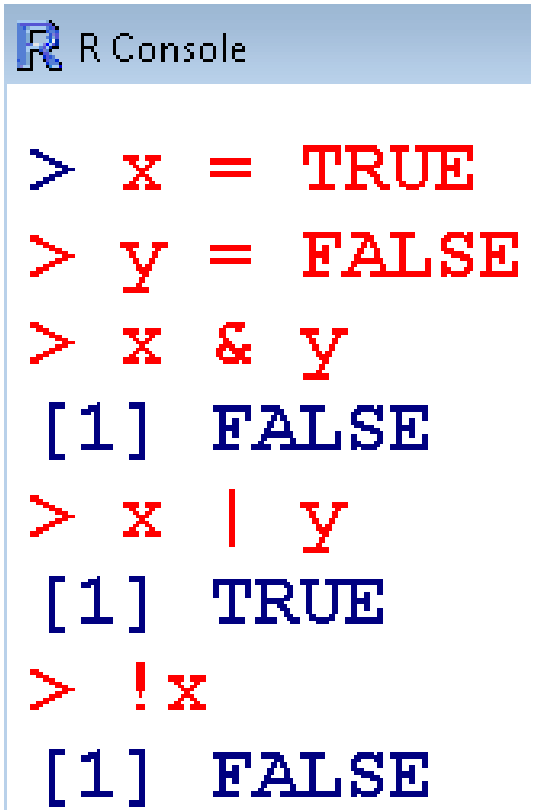
Example of Standard logical operations

Truth table

Statement 1 :: (x)	Statement 2 :: (y)	Outcome :: x and y	Outcome :: x or y
True	True	True	True
True	False	False	True
False	True	False	True
False	False	False	False

Example of Standard logical operations

```
> x = TRUE
> y = FALSE

> x & y      # x AND y
[1] FALSE


> x | y      # x OR y
[1] TRUE


> !x         # negation of x
[1] FALSE
```



Example

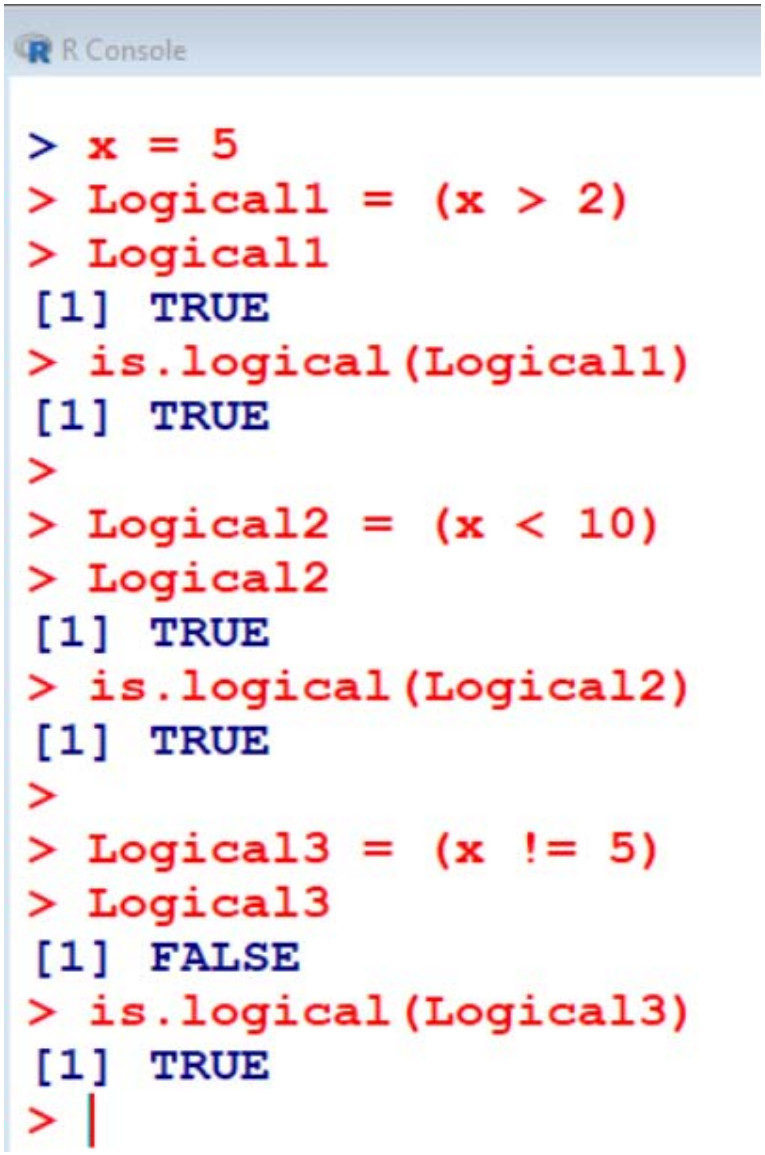
```
> x = 5
```

```
> Logical1 = (x > 2)
> Logical1
[1] TRUE
> is.logical(Logical1)
[1] TRUE
```

```
> Logical2 = (x < 10)
> Logical2
[1] TRUE
> is.logical(Logical2)
[1] TRUE
```

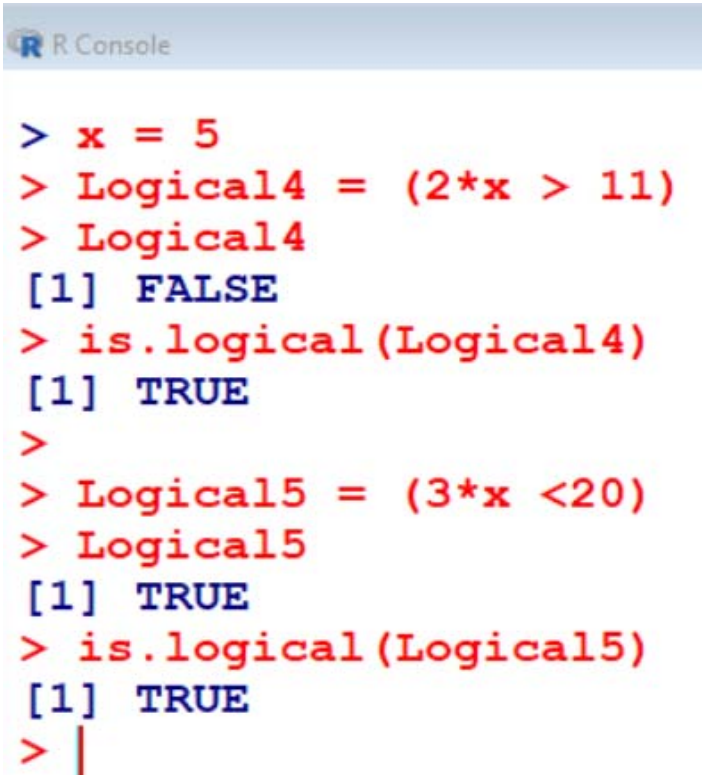
```
> Logical3 = (x != 5)
> Logical3
[1] FALSE
> is.logical(Logical3)
[1] TRUE
```

Example


R Console
> x = 5
> Logical1 = (x > 2)
> Logical1
[1] TRUE
> is.logical(Logical1)
[1] TRUE
>
> Logical2 = (x < 10)
> Logical2
[1] TRUE
> is.logical(Logical2)
[1] TRUE
>
> Logical3 = (x != 5)
> Logical3
[1] FALSE
> is.logical(Logical3)
[1] TRUE
>

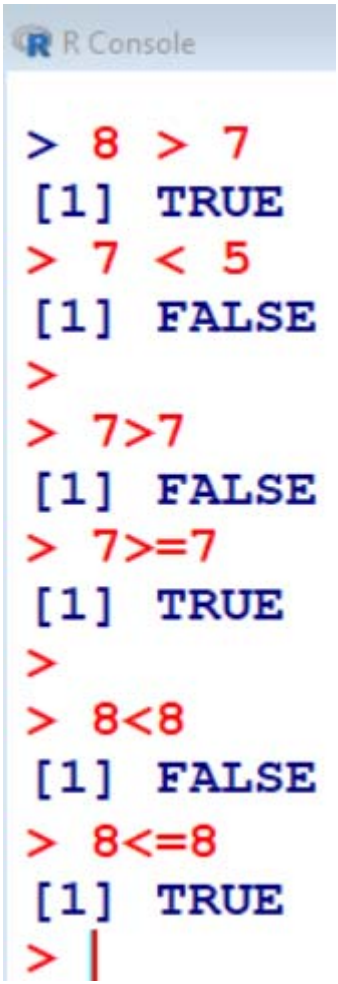
Example

```
> x = 5
> Logical4 = (2*x > 11)
> Logical4
[1] FALSE
> is.logical(Logical4)
[1] TRUE

> Logical5 = (3*x <20)
> Logical5
[1] TRUE
> is.logical(Logical5)
[1] TRUE
```



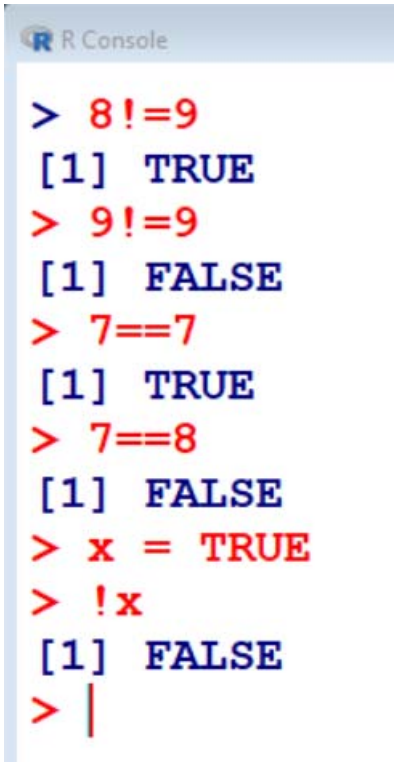
Examples:

```
> 8 > 7
[1] TRUE

> 7 < 5
[1] FALSE

> 7 > 7
[1] FALSE

> 7 >= 7
[1] TRUE

> 8 < 8
[1] FALSE

> 8 <= 8
[1] TRUE
```



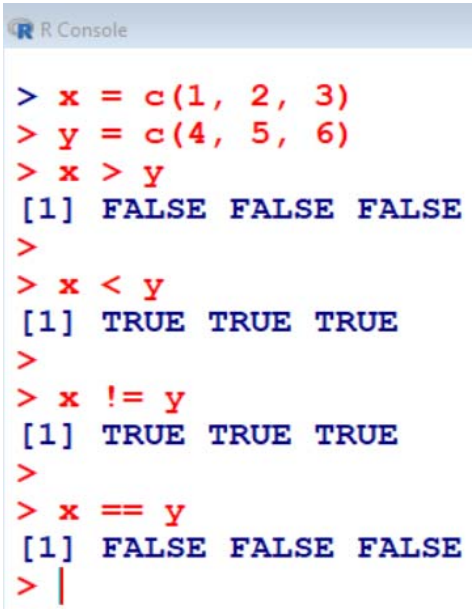
Examples:

```
> 8 != 9
[1] TRUE

> 9 != 9
[1] FALSE

> 7 == 7
[1] TRUE

> 7 == 8
[1] FALSE

> x = TRUE
> !x
[1] FALSE
```



Examples:

```
> x = c(1, 2, 3)
> y = c(4, 5, 6)

> x > y     # Compares 1 > 4, 2 > 5, 3 > 6
[1] FALSE FALSE FALSE

> x < y     # Compares 1 < 4, 2 < 5, 3 < 6
[1] TRUE TRUE TRUE

> x != y    # Compares 1 ≠ 4, 2 ≠ 5, 3 ≠ 6

[1] TRUE TRUE TRUE

> x == y    # Compares 1 = 4, 2 = 5, 3 = 6
[1] FALSE FALSE FALSE
```



Examples:

Is 8 less than 6?

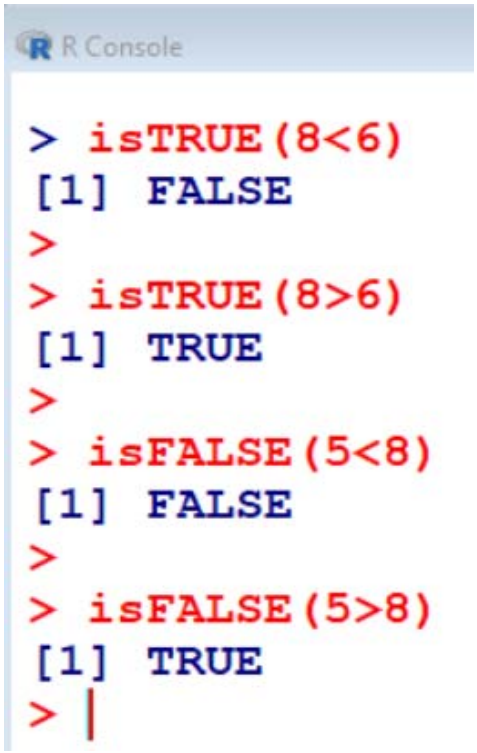
```
> isTRUE(8 < 6)
[1] FALSE
```

Is 8 greater than 6?

```
> isTRUE(8 > 6)
[1] TRUE
```

Is 5 less than 8?

```
> isFALSE(5 < 8)
[1] FALSE
```

Is 5 greater than 8?

```
> isFALSE(5 > 8)
[1] TRUE
```