

Introduction to R Software

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Lecture 15

Truth Table and Conditional Executions

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**Slides can be downloaded from
<http://home.iitk.ac.in/~shalab/sp>**



Example of Standard logical operations

Truth table

Statement 1 :: (x)	Statement 2 :: (y)	Outcome :: $x \text{ and } y$	Outcome :: $x \text{ or } y$
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
```

R Console

```
> x = TRUE  
> y = FALSE  
> x & y  
[1] FALSE  
> x | y  
[1] TRUE  
> !x  
[1] FALSE
```

Example

```
> x <- 6  
  
> Logical1 <- (x > 2)  
  
> is.logical(Logical1)  
[1] TRUE
```

```
> Logical2 <- (x < 11)  
  
> is.logical(Logical2)  
[1] TRUE
```

R Console

```
> x <- 6  
> Logical1 <- (x > 2)  
> is.logical(Logical1)  
[1] TRUE  
>  
> Logical2 <- (x < 11)  
> is.logical(Logical2)  
[1] TRUE  
>
```

Examples

```
> x <- 6  
> Logical3 <- (2*x > 12)  
> is.logical(Logical3)  
[1] TRUE
```

```
> Logical4 <- (3*x <30)  
> is.logical(Logical4)  
[1] TRUE
```

R R Console

```
> x <- 6  
> Logical3 <- (2*x > 12)  
> is.logical(Logical3)  
[1] TRUE  
>  
> Logical4 <- (3*x <30)  
> is.logical(Logical4)  
[1] TRUE  
>
```

Control structures in R :

Control statements,

loops,

functions

Conditional execution

1. Conditional execution

Syntax

```
if (condition) {executes commands if condition is TRUE}  
if (condition) {executes commands if condition is TRUE}  
else { executes commands if condition is FALSE }
```

Please note:

- The condition in this control statement may not be vector valued and if so, only the first element of the vector is used.
- The condition may be a complex expression where the logical operators "and" (`&&`) and "or" (`||`) can be used.

1. Conditional execution

Example

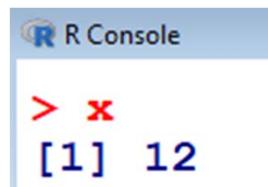
```
> x <- 6  
> if ( x==3 ) { x <- x-1 } else { x <- 2*x }
```

Interpretation:

- If $x = 3$, then execute $x = x - 1$.
- If $x \neq 3$, then execute $x = 2^*x$.

In this case, $x = 5$, so $x \neq 3$. Thus $x = 10$

```
> x  
[1] 12
```

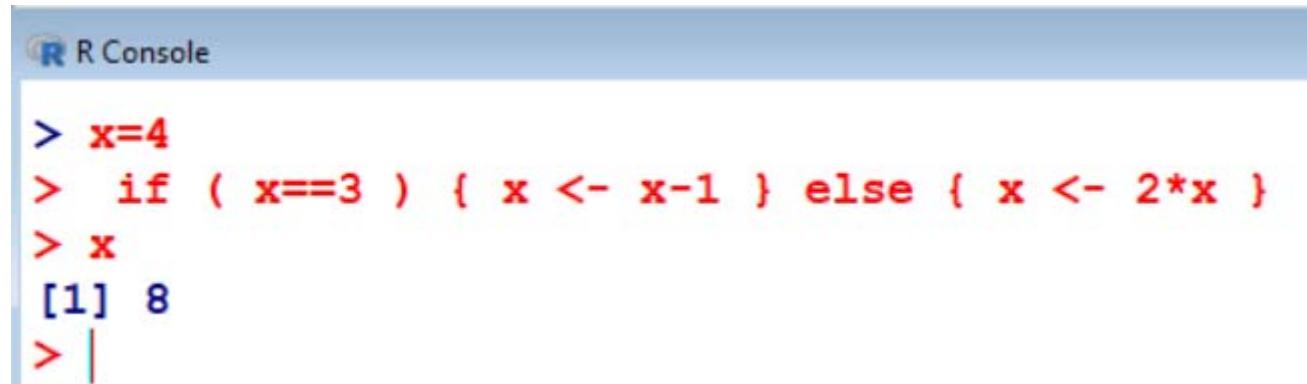


The image shows a screenshot of an R console window. The title bar says "R Console". The console area contains the following text:
> x
[1] 12

1. Conditional execution

Examples

```
> x <- 4  
> if ( x==3 ) { x <- x-1 } else { x <- 2*x }  
> x  
[1] 8
```



The screenshot shows the R console window with the title "R Console". Inside, the same R code is displayed, with the output "[1] 8" visible below the prompt. A cursor is shown at the end of the line, indicating where the next input will be placed.

Interpretation:

- If $x = 3$, then execute $x = x - 1$.
- If $x \neq 3$, then execute $x = 2*x$.

1. Conditional execution

Examples

```
> x <- 8

> if ( x^3+x^2+4 > 30 ) { x <- log(x^2) } else
{ x <- exp(2*x)+log(x) }

> x
[1] 4.158883
```

1. Conditional execution

Examples

```
> x <- 8

> if ( x^3+x^2+4 > 30 ) { x <- log(x^2) } else
{ x <- exp(2*x)+log(x) }

> x
[1] 4.158883
```

2. Conditional execution

Syntax

```
ifelse(test, yes, no)
```

- **Vector-valued evaluation of conditions .**
- **For the components in the vector-valued logical expression `test` which provide the value `TRUE`, the operations given by `yes` are executed.**
- **For the components in the vector-valued logical expression `test` which provide the value `FALSE`, the operations given by `no` are executed.**

2. Conditional execution

Examples

```
> x <- 1:10  
[1] 1 2 3 4 5 6 7 8 9 10  
  
> ifelse( x<5, x^2, x+1 )  
[1] 1 4 9 16 6 7 8 9 10 11
```

Interpretation

- If $x < 5$ (TRUE), then $x = x^2$ (YES) .
 - If $x \geq 5$ (FALSE), then $x = x + 1$ (NO).
-
- So for $x = 1, 2, 3, 4, 5$, we get $x = x^2 = 1, 4, 9, 16, 25$
 - For $x=6, 7, 8, 9, 10$, we get $x = x+1 = 7, 8, 9, 10, 11$

2. Conditional execution

```
R Console  
> x <- 1:10  
> x  
[1] 1 2 3 4 5 6 7 8 9 10  
> ifelse( x<5, x^2, x+1 )  
[1] 1 4 9 16 6 7 8 9 10 11  
>
```

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