

Foundations of R Software

Lecture 10

Basics of Calculations

⋮

**R as a Calculator with Scalars and Data Vectors :
Power operations, Integer and Modulo divisions**

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R as a calculator

```
> 2^3          # Command for power operator  
[1] 8          # Output
```

```
> 2**3         # Command for power operator  
[1] 8          # Output
```

 R Console

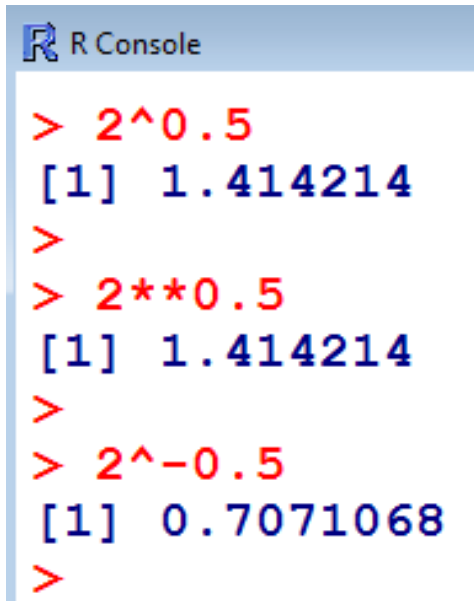
```
> 2^3  
[1] 8  
>  
> 2**3  
[1] 8
```

R as a calculator

```
> 2^0.5          # Command for power operator  
[1] 1.414214      # Output
```

```
> 2**0.5         # Command for power operator  
[1] 1.414214      # Output
```

```
> 2^-0.5         # Command for power operator  
[1] 0.7071068      # Output
```

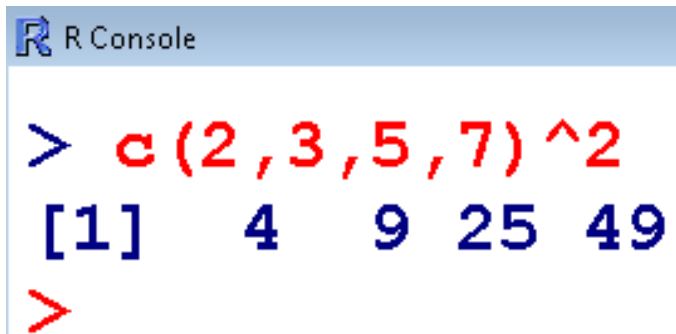


```
R Console  
> 2^0.5  
[1] 1.414214  
>  
> 2**0.5  
[1] 1.414214  
>  
> 2^-0.5  
[1] 0.7071068  
>
```

Power operator with scalar

```
> c(2,3,5,7)^2      # command: application to a  
                      vector  
[1] 4 9 25 49        # output
```

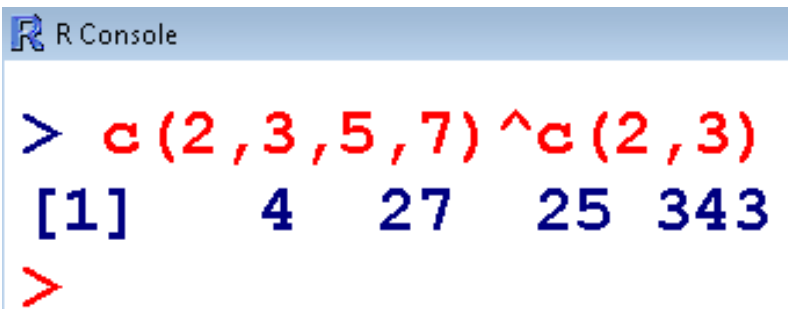
$2^2, 3^2, 5^2, 7^2$

A screenshot of the R Console window. The title bar says "R Console". The console shows the command `> c(2,3,5,7)^2` in red text, followed by the output `[1] 4 9 25 49` in blue text. A red prompt character `>` is visible at the bottom.

```
R Console  
> c(2,3,5,7)^2  
[1] 4 9 25 49  
>
```

Power operation with vector

```
> c(2,3,5,7)^c(2,3) # !!ATTENTION! Observe the  
                        operation  
[1]  4 27 25 343      # output
```

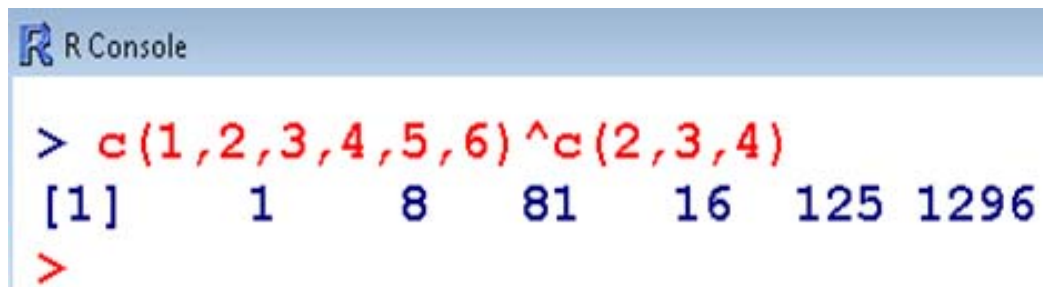
$$2^2, 3^3, 5^2, 7^3$$
A screenshot of the R Console window. The title bar says "R Console". The prompt ">" is followed by the command "c(2,3,5,7)^c(2,3)" in red. The output "[1] 4 27 25 343" is shown in blue. A second red ">" prompt is visible at the bottom.

```
R Console  
> c(2,3,5,7)^c(2,3)  
[1]  4 27 25 343  
>
```

Power operation with vector

```
> c(1,2,3,4,5,6)^c(2,3,4) # command: application  
                           to a vector with vector  
[1]  1  8 81 16 125 1296 # output
```

$1^2, 2^3, 3^4, 4^2, 5^3, 6^4$

A screenshot of the R Console window. The title bar says "R Console". The command prompt shows the command `> c(1,2,3,4,5,6)^c(2,3,4)` in red text. Below it, the output is displayed in blue text: `[1] 1 8 81 16 125 1296`. A red prompt character `>` is visible at the bottom left.

```
R Console  
> c(1,2,3,4,5,6)^c(2,3,4)  
[1] 1 8 81 16 125 1296  
>
```

Power operation with vector

```
> c(2,3,5,7)^c(2,3,4)      #error message
[1]    4  27 625  49        # output
Warning message:
longer object length is not a multiple of
shorter object length in: c(2,3,5,7)^c(2,3,4)
```

$$2^2, 3^3, 5^4, 7^2$$

```
R Console
> c(2,3,5,7)^c(2,3,4)
[1]    4  27 625  49
Warning message:
In c(2, 3, 5, 7)^c(2, 3, 4) :
  longer object length is not a multiple of shorter object length
>
```

Integer division with scalar

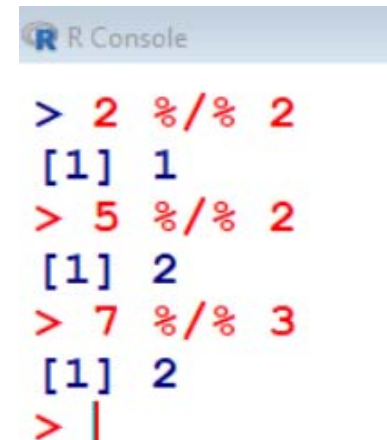
Integer Division: Division in which the fractional part (remainder) is discarded

Operator : `%/%`

```
> 2 %/% 2  
[1] 1
```

```
> 5 %/% 2  
[1] 2
```

```
> 7 %/% 3  
[1] 2
```

A screenshot of an R console window showing three lines of integer division commands and their outputs. The first line is '> 2 %/% 2' followed by '[1] 1'. The second line is '> 5 %/% 2' followed by '[1] 2'. The third line is '> 7 %/% 3' followed by '[1] 2'. The prompt '>' is shown at the end of the third line.

```
R Console  
> 2 %/% 2  
[1] 1  
> 5 %/% 2  
[1] 2  
> 7 %/% 3  
[1] 2  
> |
```

Integer division with scalar

```
> c(2,3,5,7) %% 2  
[1] 1 1 2 3
```

$2\% / \%2, 3\% / \%2, 5\% / \%2, 7\% / \%2$

 R Console

```
> c(2,3,5,7) %% 2  
[1] 1 1 2 3
```

Integer division with data vector

```
> c(2,3,5,7) %/% c(2,3)
[1] 1 1 2 2
```

$2\% / \%2, 3\% / \%3, 5\% / \%2, 7\% / \%3$

```
R R Console
> c(2,3,5,7) %/% c(2,3)
[1] 1 1 2 2
```

Integer division with data vector

```
> c(2,3,5) %/% c(2,3)
```

```
[1] 1 1 2
```

Warning message:

In `c(2, 3, 5)%/%c(2, 3)` :

longer object length is not a multiple of
shorter object length

$2\% / \%2, 3\% / \%3, 5\% / \%2$

R Console

```
> c(2,3,5) %/% c(2,3)
```

```
[1] 1 1 2
```

Warning message:

In `c(2, 3, 5)%/%c(2, 3)` :

longer object length is not a multiple of shorter object length

```
> |
```

Modulo Division (x mod y) with scalars

Modulo Division: modulo operation finds the remainder after division of one number by another.

Operator : %%

```
> 2 %% 2  
[1] 0
```

```
> 3 %% 2  
[1] 1
```

```
> 7 %% 3  
[1] 1
```

```
> 7 %% 4  
[1] 3
```



A screenshot of an R console window titled 'R Console'. It displays a series of commands and their outputs for modulo operations. The commands are: 2 %% 2, 3 %% 2, 7 %% 3, 7 %% 4, and a final prompt line with a vertical bar. The outputs are: [1] 0, [1] 1, [1] 1, [1] 3, and no output for the last line.

```
R Console  
> 2 %% 2  
[1] 0  
> 3 %% 2  
[1] 1  
> 7 %% 3  
[1] 1  
> 7 %% 4  
[1] 3  
> |
```

Modulo Division (x mod y) with scalars

```
> c(2, 3, 5, 7) %% 2  
[1] 0 1 1 1
```

$2\%2$, $3\%2$, $5\%2$, $7\%2$

 R Console

```
> c(2, 3, 5, 7) %% 2  
[1] 0 1 1 1
```

Modulo Division ($x \bmod y$) with data vectors

```
> c(2,3,5,7) %% c(2,3)
[1] 0 0 1 1
```

$2\%2, 3\%3, 5\%2, 7\%3$

 R Console

```
> c(2,3,5,7) %% c(2,3)
[1] 0 0 1 1
```

Modulo Division ($x \bmod y$) with data vectors

```
> c(2,3,5) %% c(2,3)
[1] 0 0 1
```

Warning message:

```
In c(2, 3, 5)%%c(2, 3) :
  longer object length is not a multiple of
shorter object length
```

$2\%2, 3\%3, 5\%2$

R Console

```
> c(2,3,5) %% c(2,3)
[1] 0 0 1
Warning message:
In c(2, 3, 5)%%c(2, 3) :
  longer object length is not a multiple of shorter object length
> |
```