

Exploratory Statistical Data Analysis With R Software (ESDAR) Swayam Prabha

Lecture 4

Basic Calculations and R as a Calculator

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



Basics

- `>` is the prompt sign in R.
- The assignment operators are the left arrow with dash `<-` and equal sign `=`.

`> x <- 20` assigns the value 20 to `x`.

```
R R Console
> x <- 20
> x
[1] 20
>
```

`> x = 20` assigns the value 20 to `x`.

```
R R Console
> x = 20
> x
[1] 20
>
```

Initially only `<-` was available in R.

Basics

> $x = 20$ assigns the value 20 to x .

> $y = x * 4$ assigns the value $4*x$ to y .

> $z = x - y$ assigns the value $x - y$ to z .

```
R Console
> x = 20
> x
[1] 20
>
> y = x * 4
> y
[1] 80
.
```

```
R Console
> z = x - y
> z
[1] -60
```

Basics

- # : The character # marks the beginning of a comment.

All characters until the end of the line are ignored.

> # mu is the mean

> # x = 20 is treated as comment only

Basics

- Capital and small letters are different.

> **X** = 20 and > **x** = 20 are different

```
R Console
> X = 20
> X
[1] 20
```

```
R Console
> x = 20
> x
[1] 20
>
> X
Error: object 'X' not found
>
> X = 20
> X
[1] 20
```

Basics

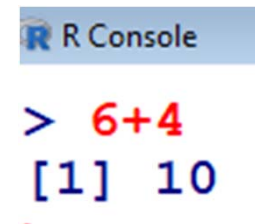
- The command `c(6,7,8,9,10)` combines the numbers 6, 7, 8, 9 and 10 to a vector.

```
R Console
> y = 6,7,8,9,10
Error: unexpected ',' in "y = 6,"
>
> y = (6,7,8,9,10)
Error: unexpected ',' in "y = (6,"
>
> y = c(6,7,8,9,10)
> y
[1] 6 7 8 9 10
```

R as a calculator

Addition

```
> 6+4          # Command  
[1] 10         # Output
```



```
R Console  
> 6+4  
[1] 10
```

Multiplication

```
> 6*4          # Command  
[1] 24         # Output
```



```
R Console  
> 6*4  
[1] 24
```

R as a calculator

Subtraction

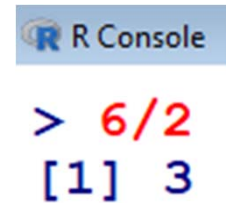
```
> 6-4      # Command  
[1] 2      # Output
```



R Console
> 6-4
[1] 2

Division

```
> 6/2      # Command  
[1] 3      # Output
```

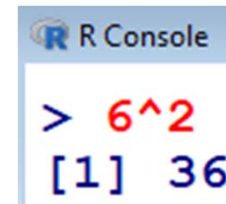


R Console
> 6/2
[1] 3

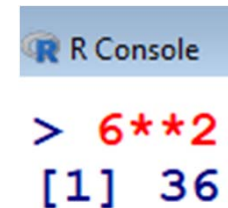
R as a calculator

Power

```
> 6^2          # Command  
[1] 36         # Output
```



```
> 6**2        # Command  
[1] 36         # Output
```

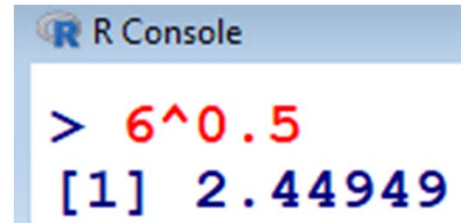


$$6^2$$

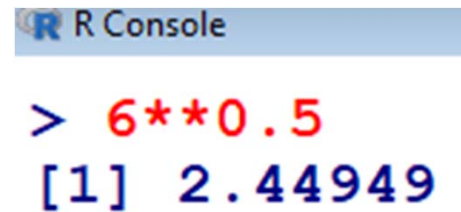
R as a calculator

Power

```
> 6^0.5      # Command  
[1] 1.732051  # Output
```



```
> 6**0.5     # Command  
[1] 1.732051  # Output
```

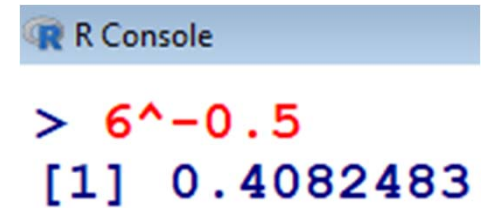


$$6^{1/2}$$

R as a calculator

Power

```
> 6^-0.5          # Command  
[1] 0.5773503     # Output
```



```
R Console  
> 6^-0.5  
[1] 0.4082483
```

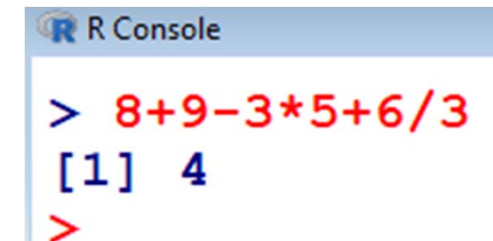
$$6^{-1/2}$$

R as a calculator

Multiple operators (BODMAS)

Bracket, Of, Division, Multiplication, Addition, and Subtraction.

```
> 8+9-3*5+6/3 # Command  
[1] 4          # Output
```



```
R Console  
> 8+9-3*5+6/3  
[1] 4  
>
```

R as a calculator

How R behaves with data vectors?

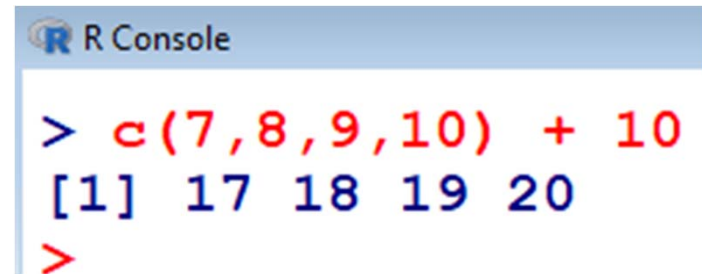
**What happens when a scalar is added/subtracted/multiplied/divided
in a data vector?**

R as a calculator

Addition with vector versus scalar

```
> c(7,8,9,10) + 10  
[1] 17 18 19 20
```

7+10, 8+10, 9+10, 10+10



```
R Console  
> c(7,8,9,10) + 10  
[1] 17 18 19 20  
>
```

R as a calculator

Addition with vector versus vector

```
> c(7,8,9,10) + c(2,3)
[1] 9 11 11 13
```

$7 + 2, 8 + 3, 9 + 2, 10 + 3$

R as a calculator

Addition with vector versus vector

```
> c(7,8,9,10) + c(2,3,4)
[1] 9 11 13 12
```

Warning message:

```
In c(7,8,9,10) + c(2,3,4) :
  longer object length is not a multiple of
shorter object length
```

$7 + 2, 8 + 3, 9 + 4, 10 + 2$

R as a calculator

Addition with vector versus vector

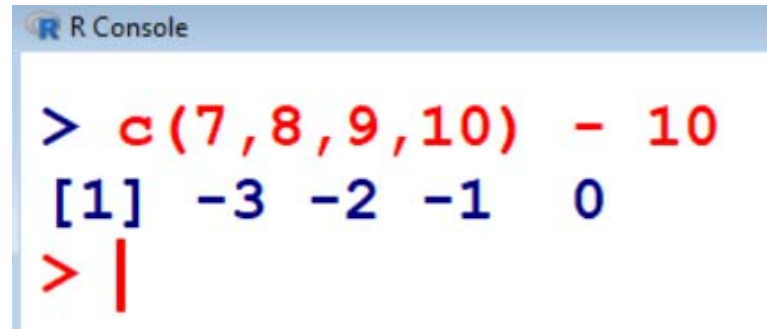
```
R Console  
> c(7,8,9,10) + c(2,3,4)  
[1] 9 11 13 12  
Warning message:  
In c(7, 8, 9, 10) + c(2, 3, 4) :  
  longer object length is not a multiple of shorter object length  
>
```

R as a calculator

Subtraction with vector versus scalar

```
> c(7,8,9,10) - 10  
[1] -3 -2 -1  0
```

7-10, 8-10, 9-10, 10-10



```
R Console  
> c(7,8,9,10) - 10  
[1] -3 -2 -1  0  
> |
```

R as a calculator

Addition with vector versus vector

```
> c(7,8,9,10) - c(2,3)
[1] 5 5 7 7
```

$7-2, 8-3, 9-2, 10-3$

R as a calculator

Subtraction with vector versus vector

```
> c(7,8,9,10) - c(2,3,4)
```

```
[1] 5 5 5 8
```

Warning message:

```
In c(7, 8, 9, 10) - c(2, 3, 4) :
```

```
longer object length is not a multiple of  
shorter object length
```

$7-2, 8-3, 9-4, 10-2$

R as a calculator

Subtraction with vector versus vector

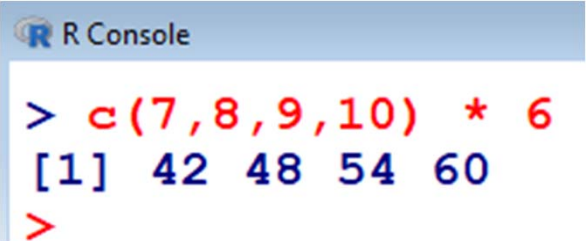
```
R Console  
> c(7,8,9,10) - c(2,3,4)  
[1] 5 5 5 8  
Warning message:  
In c(7, 8, 9, 10) - c(2, 3, 4) :  
  longer object length is not a multiple of shorter object length  
> |
```

R as a calculator

Multiplication with vector versus scalar

```
> c(7,8,9,10) * 6  
[1] 42 48 54 60
```

$7 \times 6, 8 \times 6, 9 \times 6, 10 \times 6$



```
R Console  
> c(7,8,9,10) * 6  
[1] 42 48 54 60  
>
```

R as a calculator

Multiplication with vector versus vector

```
> c(7,8,9,10) * c(-7,-8,-9,-10)
[1] -49  -64  -81 -100
```

$7 \times (-7), 8 \times (-8), 9 \times (-9), 10 \times (-10)$

R Console

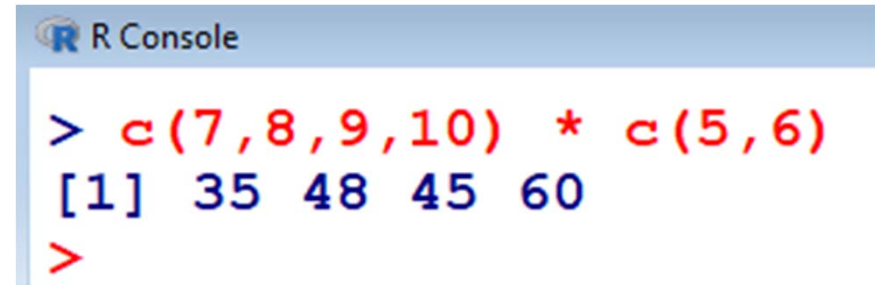
```
> c(7,8,9,10) * c(-7,-8,-9,-10)
[1] -49  -64  -81 -100
>
```

R as a calculator

Multiplication with vector versus vector

```
> c(7,8,9,10) * c(5,6)
[1] 35 48 45 60
```

$7 \times 5, 8 \times 6, 9 \times 5, 10 \times 6$



```
R Console
> c(7,8,9,10) * c(5,6)
[1] 35 48 45 60
>
```


R as a calculator

Multiplication with vector versus vector

```
> c(7,8,9,10) * c(2,3,4)
```

```
[1] 14 24 36 20
```

```
Warning message:
```

```
In c(7,8,9,10) * c(2,3,4) :longer object  
length is not a multiple of shorter object  
length
```

$7 \times 2, 8 \times 3, 9 \times 4, 10 \times 2$

R as a calculator

Multiplication with vector versus vector

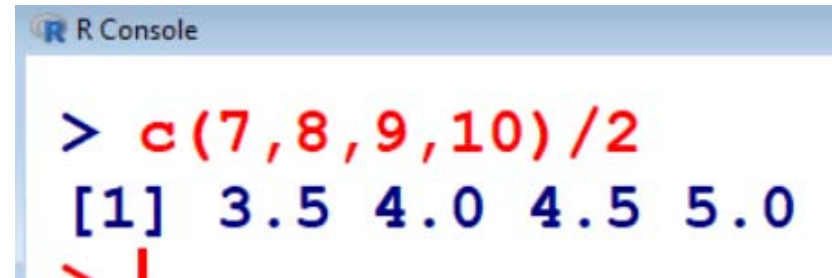
```
R Console  
> c(7,8,9,10) * c(2,3,4)  
[1] 14 24 36 20  
Warning message:  
In c(7, 8, 9, 10) * c(2, 3, 4) :  
  longer object length is not a multiple of shorter object length  
>
```

R as a calculator

Division with vector versus scalar

```
> c(7,8,9,10)/2  
[1] 3.5 4.0 4.5 5.0
```

$7/2, 8/2, 9/2, 10/2$



```
R Console  
> c(7,8,9,10)/2  
[1] 3.5 4.0 4.5 5.0  
~ |
```

R as a calculator

Division with vector versus scalar

```
> c(7,8,9,10)/c(2,4)  
[1] 3.5 2.0 4.5 2.5
```

$7/2, 8/4, 9/2, 10/4$

R as a calculator

Division with vector versus vector

```
> c(7,9,8,10)/c(2,3,4)
```

```
[1] 3.5 3.0 2.0 5.0
```

Warning message:

```
In c(7, 9, 8, 10)/c(2, 3, 4) :
```

```
  longer object length is not a multiple of  
shorter object length
```

$7/2, 9/3, 8/4, 10/2$

R as a calculator

Division with vector versus vector

R Console

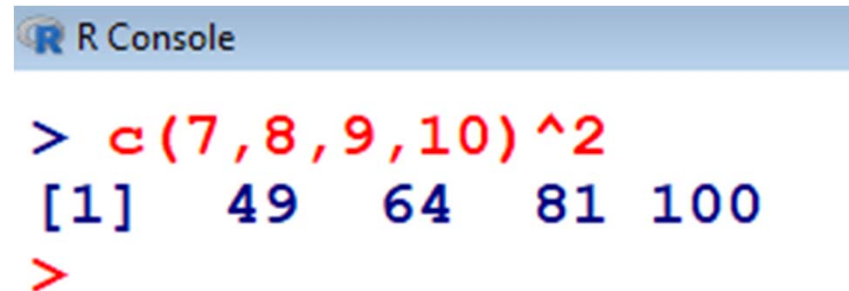
```
> c(7,9,8,10)/c(2,3,4)
[1] 3.5 3.0 2.0 5.0
Warning message:
In c(7, 9, 8, 10)/c(2, 3, 4) :
  longer object length is not a multiple of shorter object length
> |
```

R as a calculator

Power operators with vector versus scalar

```
> c(7,8,9,10)^2      # command: application to a
                      # vector
[1] 49  64  81 100    # output
```

$7^2, 8^2, 9^2, 10^2$



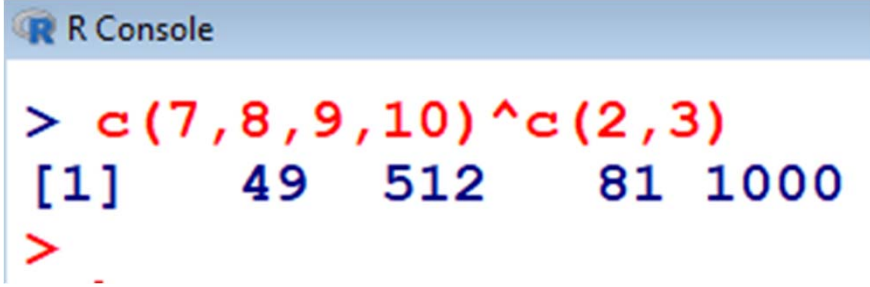
```
R Console
> c(7,8,9,10)^2
[1] 49  64  81 100
>
```

R as a calculator

Power operators with vector versus vector

```
> c(7,8,9,10)^c(2,3) # !!ATTENTION! Observe the operation  
[1] 49 512 81 1000 # output
```

$7^2, 8^3, 9^2, 10^3$



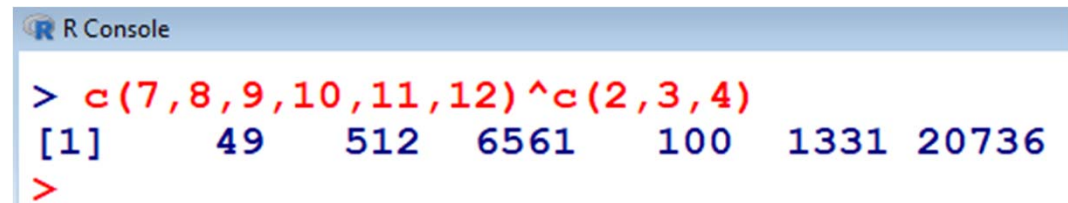
```
R Console  
> c(7,8,9,10)^c(2,3)  
[1] 49 512 81 1000  
>
```


R as a calculator

Power operators with vector versus vector

```
> c(7,8,9,10,11,12)^c(2,3,4) # command:  
      application to a vector with vector  
[1] 49    512   6561    100   1331  20736 # output
```

$7^2, 8^3, 9^4, 10^2, 11^3, 12^4$



```
R Console  
> c(7,8,9,10,11,12)^c(2,3,4)  
[1] 49    512   6561    100   1331  20736  
>
```

R as a calculator

Power operators with vector versus vector

```
> c(7,8,9,10)^c(3,4,5)
[1] 343  4096 59049  1000
```

Warning message:

```
In c(7,8,9,10)^c(3,4,5) :longer object length
is not a multiple of shorter object length
```

$7^3, 8^4, 9^5, 10^3$

R as a calculator

Power operators with vector versus vector

R Console

```
> c(7,8,9,10)^c(3,4,5)
[1] 343 4096 59049 1000
Warning message:
In c(7, 8, 9, 10)^c(3, 4, 5) :
  longer object length is not a multiple of shorter object length
>
```