

Foundations of R Software

Lecture 14

Basics of Calculations

::::

Matrix Operations – Access and Mathematical Operations

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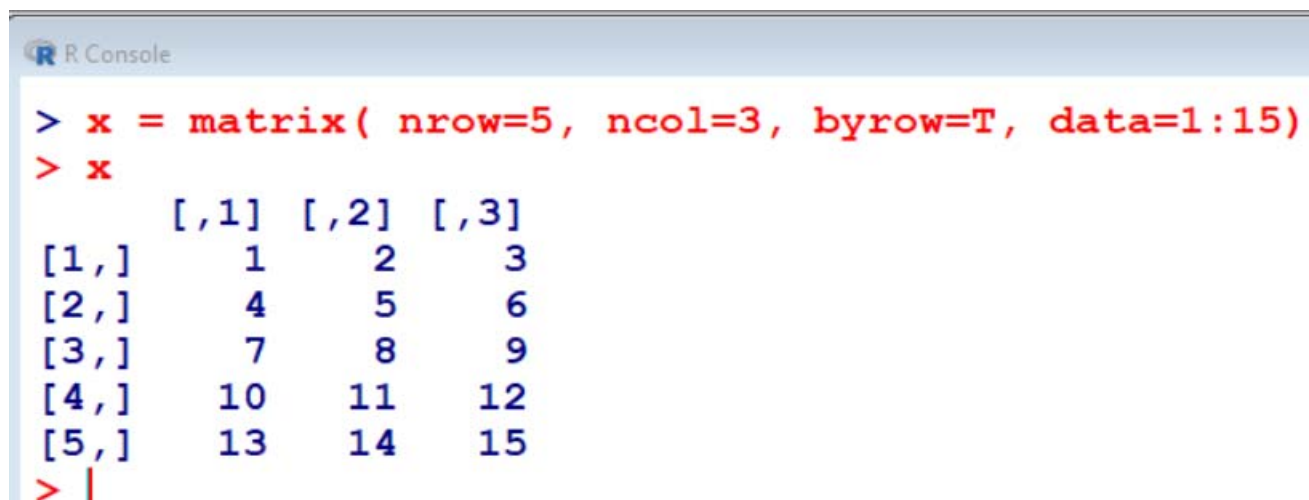
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Access to rows, columns or submatrices

```
x = matrix( nrow=5, ncol=3, byrow=T, data=1:15)  
x
```

	[,1]	[,2]	[,3]
[1,]	1	2	3
[2,]	4	5	6
[3,]	7	8	9
[4,]	10	11	12
[5,]	13	14	15



```
R Console  
> x = matrix( nrow=5, ncol=3, byrow=T, data=1:15)  
> x  
      [,1] [,2] [,3]  
[1,]  1    2    3  
[2,]  4    5    6  
[3,]  7    8    9  
[4,] 10   11   12  
[5,] 13   14   15  
> |
```

Access to rows, columns or submatrices

```
> x[3,]  
[1] 7 8 9
```

```
> x[,2]  
[1] 2 5 8 11 14
```

```
> x[4:5, 2:3]  
      [,1] [,2]  
[1,]    11    12  
[2,]    14    15
```

R Console

```
> x[3,]  
[1] 7 8 9
```

```
>
```

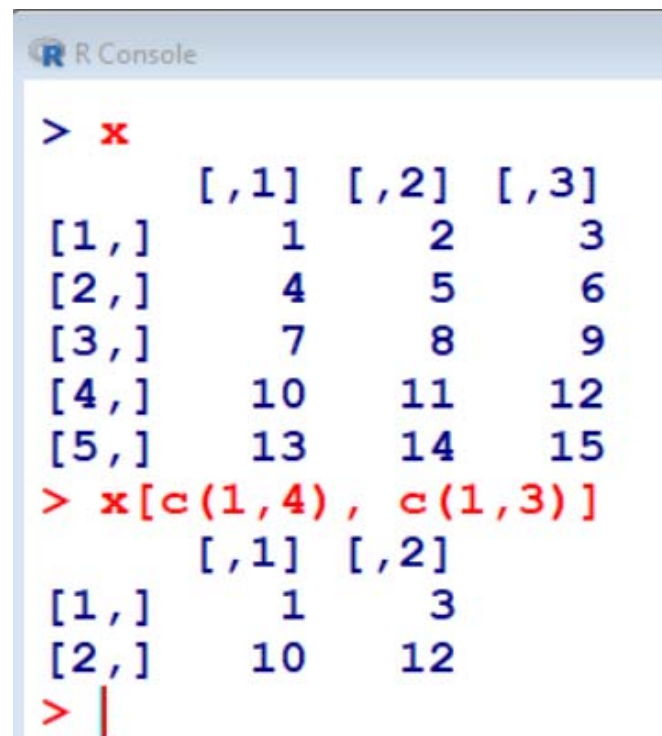
```
> x[,2]  
[1] 2 5 8 11 14
```

```
>
```

```
> x[4:5, 2:3]  
      [,1] [,2]  
[1,]    11    12  
[2,]    14    15
```

Access to rows, columns or submatrices

```
> x[c(1,4), c(1,3)]  
      [,1] [,2]  
[1,]     1     3  
[2,]    10    12
```

A screenshot of an R console window. The title bar says "R Console". The prompt is ">". The user has entered "x", and the console displays a 5x3 matrix. The matrix has columns labeled [,1], [,2], and [,3]. The rows are labeled [1,], [2,], [3,], [4,], and [5,]. The values are: Row 1: 1, 2, 3; Row 2: 4, 5, 6; Row 3: 7, 8, 9; Row 4: 10, 11, 12; Row 5: 13, 14, 15. The user then enters "> x[c(1,4), c(1,3)]" in red. The console displays the resulting 2x2 submatrix with columns labeled [,1] and [,2]. The rows are labeled [1,] and [2,]. The values are: Row 1: 1, 3; Row 2: 10, 12. The prompt "> |" is shown at the bottom.

```
> x  
      [,1] [,2] [,3]  
[1,]     1     2     3  
[2,]     4     5     6  
[3,]     7     8     9  
[4,]    10    11    12  
[5,]    13    14    15  
> x[c(1,4), c(1,3)]  
      [,1] [,2]  
[1,]     1     3  
[2,]    10    12  
> |
```

Access to rows, columns or submatrices

```
> x
```

	[, 1]	[, 2]	[, 3]
[1,]	1	2	3
[2,]	4	5	6
[3,]	7	8	9
[4,]	10	11	12
[5,]	13	14	15

Look at the outcome

```
[1] 2 5 8 11 14
```

Not possible to know if It is a row or a column.

Addition of a matrix with a constant

Every element is added with the scalar

```
> x = matrix(nrow=4, ncol=2, data=1:8, byrow=T)
```

```
> x
```

	[,1]	[,2]
[1,]	1	2
[2,]	3	4
[3,]	5	6
[4,]	7	8

```
> x+5
```

	[,1]	[,2]
[1,]	6	7
[2,]	8	9
[3,]	10	11
[4,]	12	13

```
R Console
> x = matrix(nrow=4, ncol=2, data=1:8, byrow=T )
> x
      [,1] [,2]
[1,]    1    2
[2,]    3    4
[3,]    5    6
[4,]    7    8
> x+5
      [,1] [,2]
[1,]     6    7
[2,]     8    9
[3,]    10   11
[4,]    12   13
> |
```

Subtraction of a matrix with a constant

Every element is subtracted by the scalar

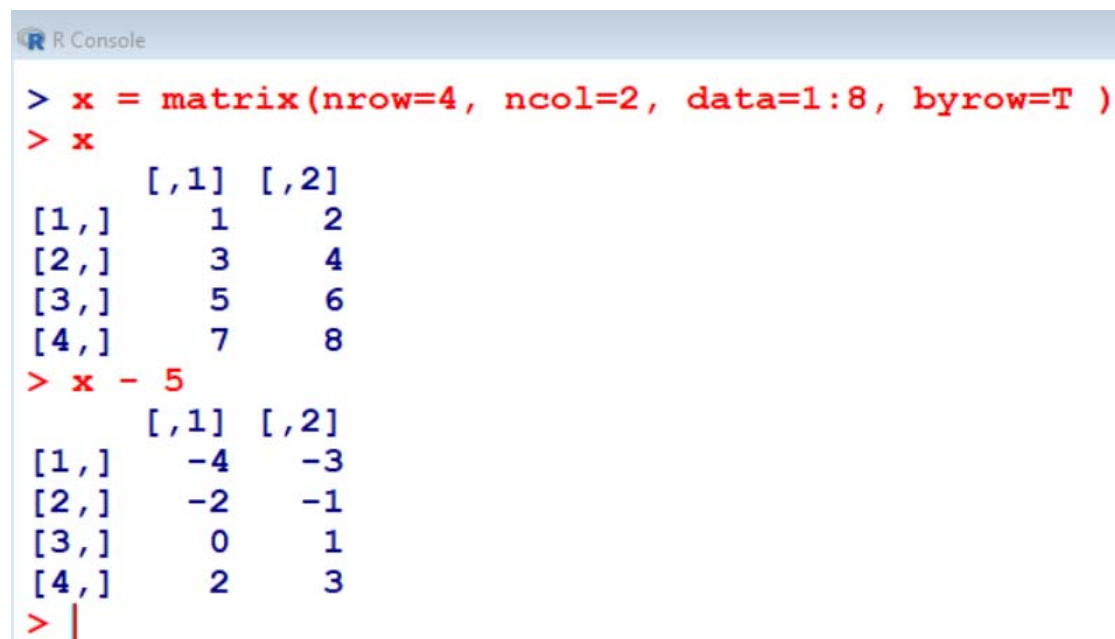
```
> x = matrix(nrow=4, ncol=2, data=1:8, byrow=T)
```

```
> x
```

	[,1]	[,2]
[1,]	1	2
[2,]	3	4
[3,]	5	6
[4,]	7	8

```
> x - 5
```

	[,1]	[,2]
[1,]	-4	-3
[2,]	-2	-1
[3,]	0	1
[4,]	2	3



```
R Console
> x = matrix(nrow=4, ncol=2, data=1:8, byrow=T)
> x
      [,1] [,2]
[1,]    1    2
[2,]    3    4
[3,]    5    6
[4,]    7    8
> x - 5
      [,1] [,2]
[1,]   -4   -3
[2,]   -2   -1
[3,]    0    1
[4,]    2    3
> |
```

Multiplication of a matrix with a constant

Every element is multiplied by the scalar

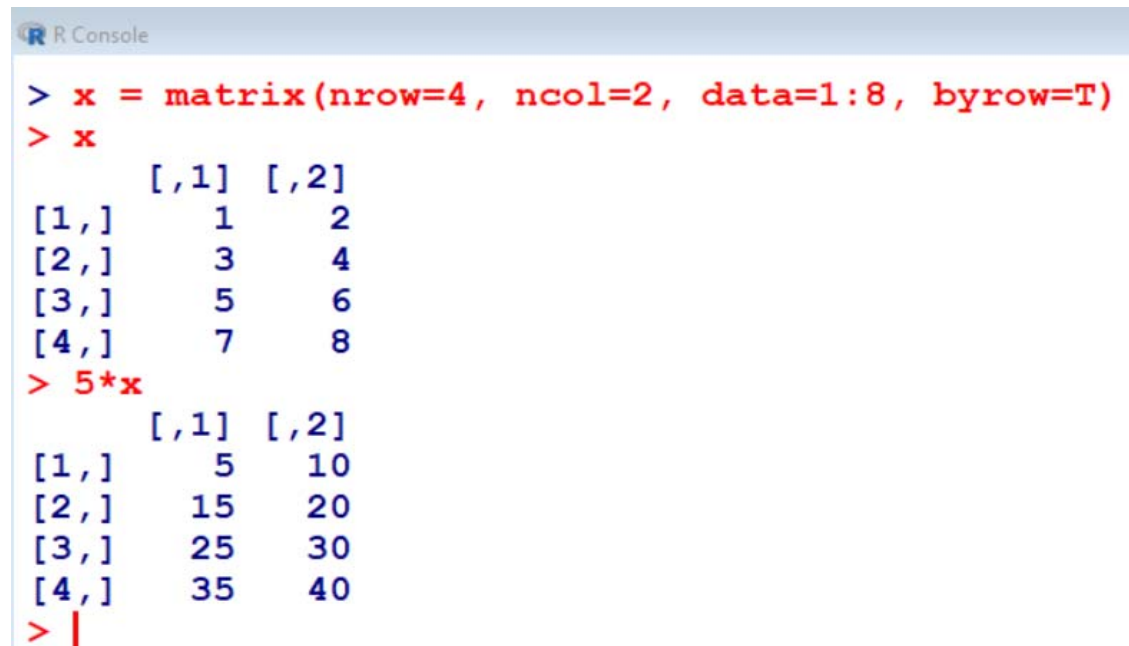
```
> x = matrix(nrow=4, ncol=2, data=1:8, byrow=T)
```

```
> x
```

	[,1]	[,2]
[1,]	1	2
[2,]	3	4
[3,]	5	6
[4,]	7	8

```
> 5*x
```

	[,1]	[,2]
[1,]	5	10
[2,]	15	20
[3,]	25	30
[4,]	35	40



```
R Console
> x = matrix(nrow=4, ncol=2, data=1:8, byrow=T)
> x
      [,1] [,2]
[1,]    1    2
[2,]    3    4
[3,]    5    6
[4,]    7    8
> 5*x
      [,1] [,2]
[1,]    5   10
[2,]   15   20
[3,]   25   30
[4,]   35   40
> |
```

Division of a matrix with a constant

Every element is divided by the scalar

```
> x = matrix(nrow=4, ncol=2, data=1:8, byrow=T)
```

```
> x
```

	[,1]	[,2]
[1,]	1	2
[2,]	3	4
[3,]	5	6
[4,]	7	8

```
> x/2
```

	[,1]	[,2]
[1,]	0.5	1
[2,]	1.5	2
[3,]	2.5	3
[4,]	3.5	4

```
R Console
> x = matrix(nrow=4, ncol=2, data=1:8, byrow=T)
> x
      [,1] [,2]
[1,]    1    2
[2,]    3    4
[3,]    5    6
[4,]    7    8
> x/2
      [,1] [,2]
[1,]  0.5    1
[2,]  1.5    2
[3,]  2.5    3
[4,]  3.5    4
> |
```

Addition and subtraction of matrices

Addition and subtraction of matrices (of same dimensions) can be executed with the usual operators + and -

```
x = matrix(nrow=4, ncol=2, data=1:8, byrow=T)
```

```
y = matrix(nrow=4, ncol=2, data=11:18, byrow=T)
```

```
> x
```

	[, 1]	[, 2]
[1,]	1	2
[2,]	3	4
[3,]	5	6
[4,]	7	8

```
> y
```

	[, 1]	[, 2]
[1,]	11	12
[2,]	13	14
[3,]	15	16
[4,]	17	18

Addition and subtraction of matrices

```
> x + y
```

	[,1]	[,2]
[1,]	12	14
[2,]	16	18
[3,]	20	22
[4,]	24	26

```
> x - y
```

	[,1]	[,2]
[1,]	-10	-10
[2,]	-10	-10
[3,]	-10	-10
[4,]	-10	-10

R Console

```
> x = matrix(nrow=4, ncol=2, data=1:8, byrow=T)
> x
      [,1] [,2]
[1,]    1    2
[2,]    3    4
[3,]    5    6
[4,]    7    8
> y = matrix(nrow=4, ncol=2, data=11:18, byrow=T)
> y
      [,1] [,2]
[1,]   11   12
[2,]   13   14
[3,]   15   16
[4,]   17   18
> x+y
      [,1] [,2]
[1,]   12   14
[2,]   16   18
[3,]   20   22
[4,]   24   26
> |
```

Addition and subtraction of matrices

```
> x - y
```

	[,1]	[,2]
[1,]	-10	-10
[2,]	-10	-10
[3,]	-10	-10
[4,]	-10	-10

```
R Console  
  
> x = matrix(nrow=4, ncol=2, data=1:8, byrow=T)  
> x  
      [,1] [,2]  
[1,]    1    2  
[2,]    3    4  
[3,]    5    6  
[4,]    7    8  
  
> y = matrix(nrow=4, ncol=2, data=11:18, byrow=T)  
> y  
      [,1] [,2]  
[1,]   11   12  
[2,]   13   14  
[3,]   15   16  
[4,]   17   18  
  
> x-y  
      [,1] [,2]  
[1,]   -10  -10  
[2,]   -10  -10  
[3,]   -10  -10  
[4,]   -10  -10  
> |
```