Introduction to R Software

Swayam Prabha

Lecture 10

Matrices

Shalabh

Department of Mathematics and Statistics

Indian Institute of Technology Kanpur

Slides can be downloaded from

http://home.iitk.ac.in/~shalab/sp

Matrix

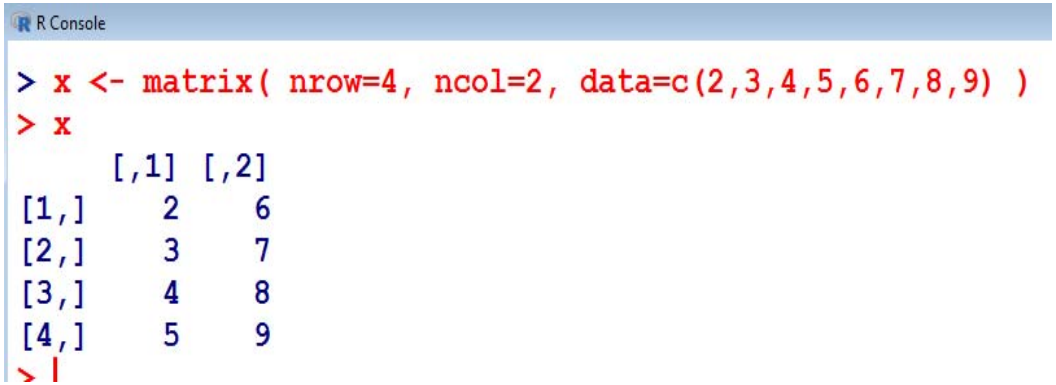
An element in the *i*-th row and *j*-th column is denoted by X_{ij} (book version) or *X*[*i*, *j*] ("program version"), *i* = 1,2,...,*n*, *j* = 1,2,...,*p*.

An element of a matrix can also be an object, for example a string. However, in mathematics, we are mostly interested in numerical matrices, whose elements are generally real numbers

Matrix

In R, a 4 × 2-matrix *X* can be created with a following command:

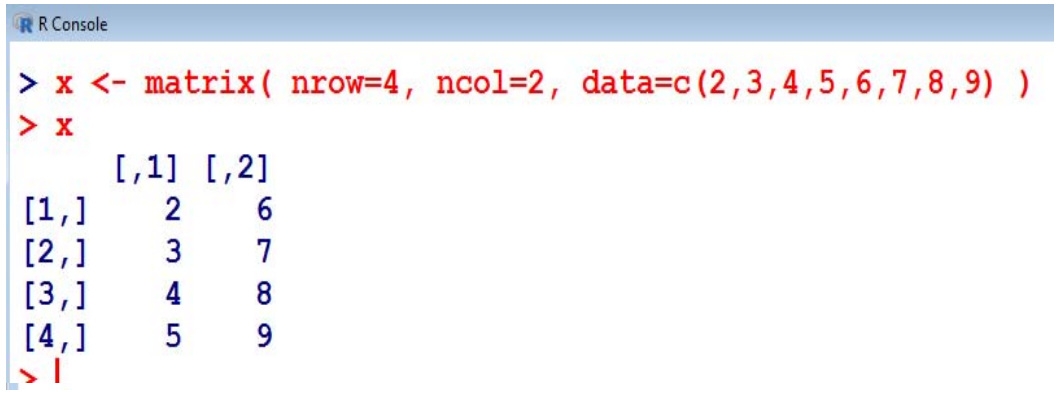
```
> x <- matrix( nrow=4, ncol=2,
                    data=c(2,3,4,5,6,7,8,9) )
> x
     [,1] [,2]
[1,]    2    6
[2,]    3    7
[3,]    4    8
[4,]    5    9
```



Matrix

In R, a 4 × 2-matrix *X* can be created with a following command:

```
> x <- matrix( nrow=4, ncol=2,
                    data=c(2,3,4,5,6,7,8,9) )
> x
     [,1] [,2]
[1,]    2    6
[2,]    3    7
[3,]    4    8
[4,]    5    9
```



Matrix

We see:

The parameter `nrow` defines the row number of a matrix.

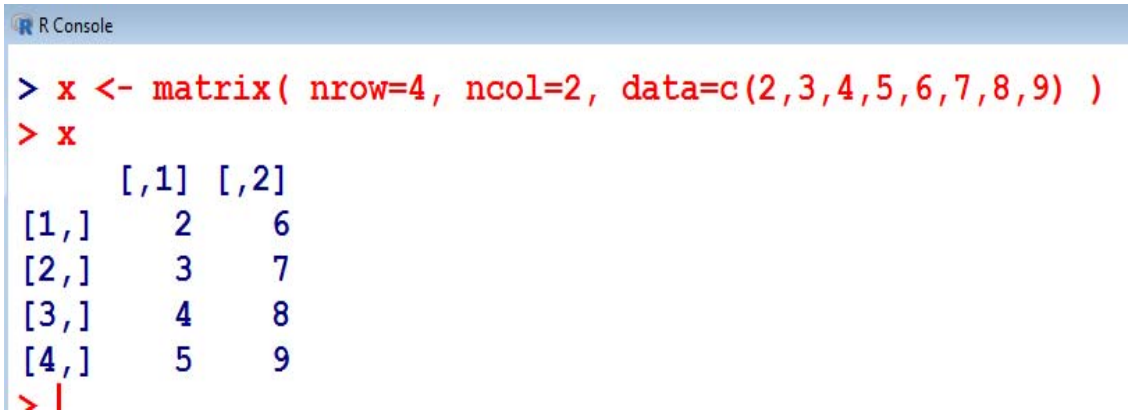
The parameter `ncol` defines the column number of a matrix.

The parameter `data` assigns specified values to the matrix elements.

The values from the parameters are written column-wise in matrix.

Matrix

```
> x
     [,1] [,2]
[1,]    2    6
[2,]    3    7
[3,]    4    8
[4,]    5    9
```

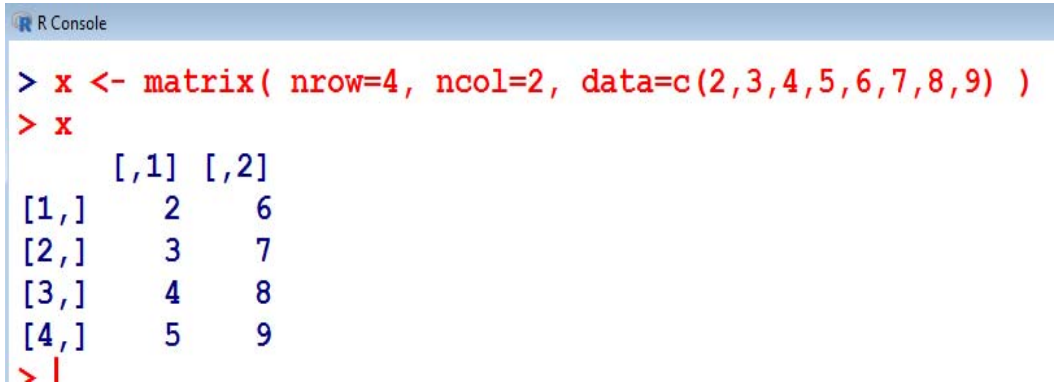


One can access a single element of a matrix with `x[i,j]`:

```
> x[4,2]
[1] 9
```

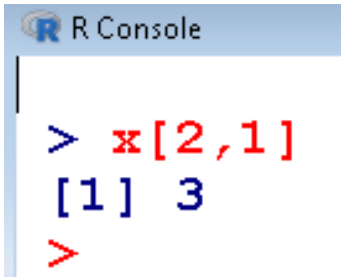
Matrix

```
> x
     [,1] [,2]
[1,]    2    6
[2,]    3    7
[3,]    4    8
[4,]    5    9
```



One can access a single element of a matrix with `x[i,j]`:

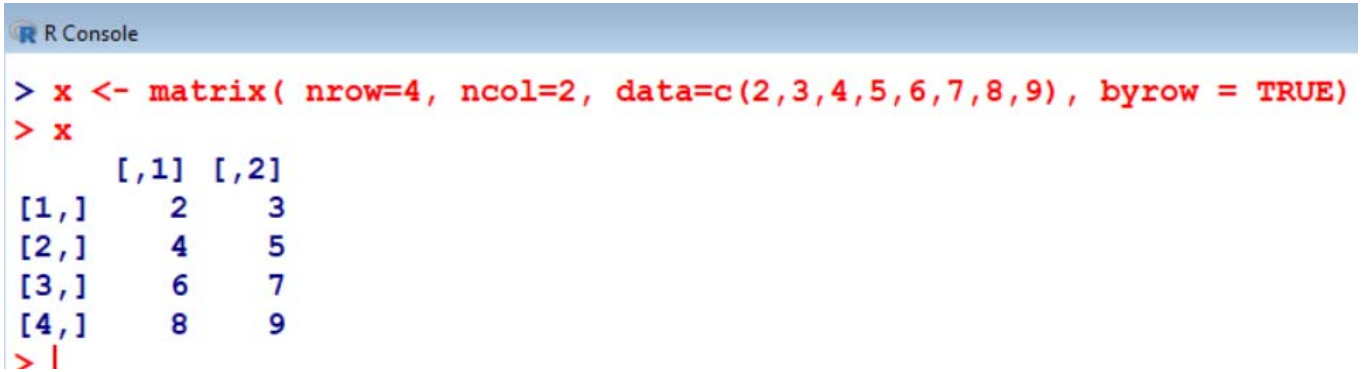
```
> x[2,1]
[1] 3
```



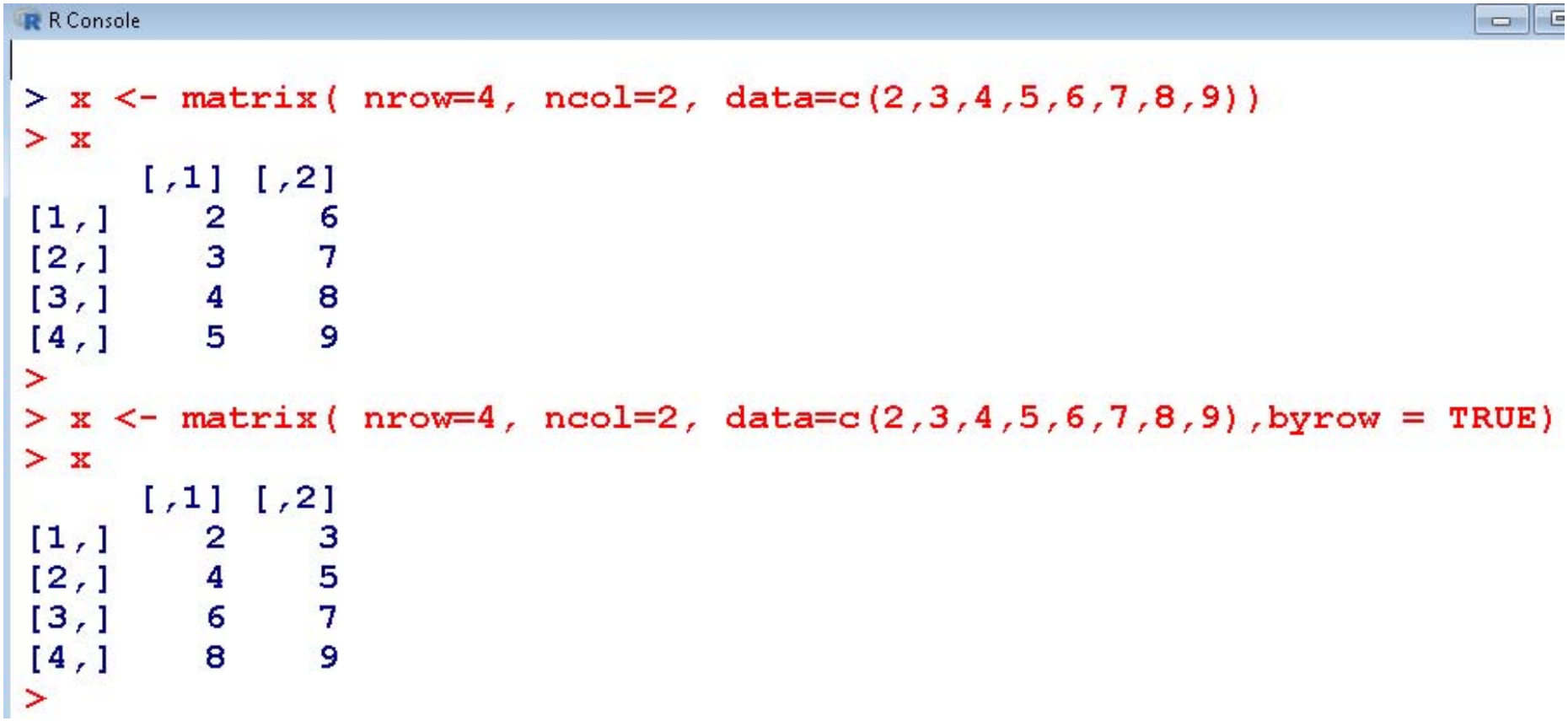
Matrix

In case, the data has to be entered row wise, then a 4 × 2-matrix *X* can be created with

```
> x <- matrix( nrow=4, ncol=2,
          data=c(2,3,4,5,6,7,8,9), byrow = TRUE)
> x
     [,1] [,2]
[1,]    2    3
[2,]    4    5
[3,]    6    7
[4,]    8    9
```



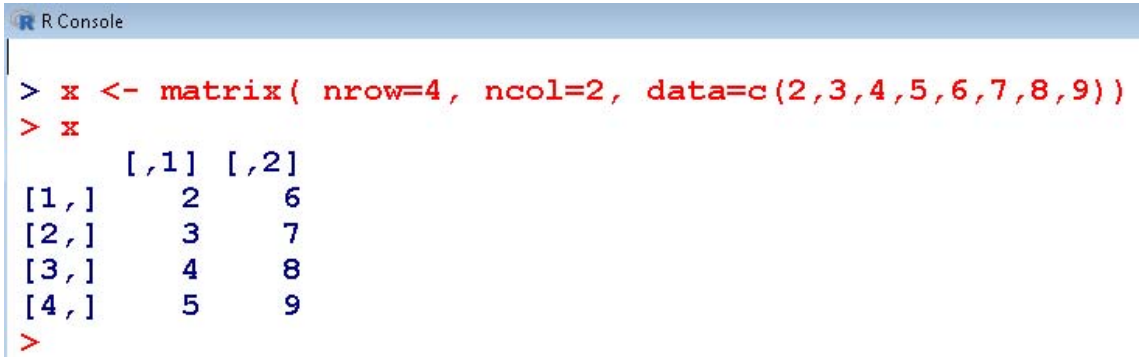
Matrix


R Console
> x <- matrix(nrow=4, ncol=2, data=c(2,3,4,5,6,7,8,9))
> x
     [,1] [,2]
[1,]   2   6
[2,]   3   7
[3,]   4   8
[4,]   5   9
>
> x <- matrix(nrow=4, ncol=2, data=c(2,3,4,5,6,7,8,9),byrow = TRUE)
> x
     [,1] [,2]
[1,]   2   3
[2,]   4   5
[3,]   6   7
[4,]   8   9
>

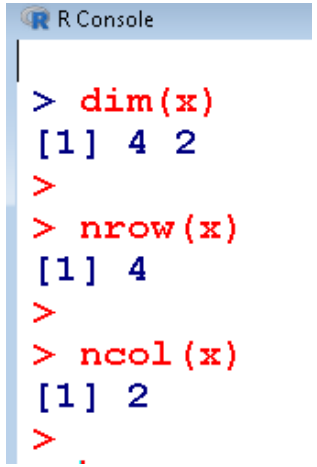
Properties of a Matrix

We can get specific *properties* of a matrix:

```
> dim(x)  # tells the dimension of matrix
[1] 4 2
```



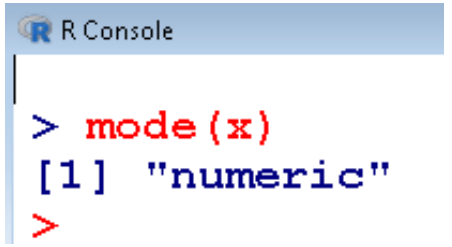

```
> nrow(x) # tells the number of rows
[1] 4
```




```
> ncol(x) # tells the number of columns
[1] 2
```

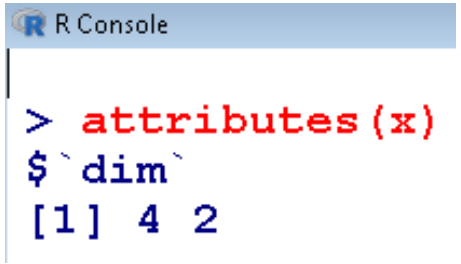
Properties of a Matrix

```
> mode(x)          # Informs the type or storage
[1] "numeric"        mode of an object, e.g.,
                     numerical, logical etc.
```



`attributes` provides all the attributes of an object

```
> attributes(x) #Informs the dimension of matrix
$dim [1] 4 2
```



Help on the Object "Matrix"

To know more about these important objects, we use R–help on "matrix".

```
> help("matrix")
```

```
matrix      package:base      R Documentation
```

Matrices

Description:

'`matrix`' creates a matrix from the given set of values.

'`as.matrix`' attempts to turn its argument into a matrix.

'`is.matrix`' tests if its argument is a (strict) matrix. It is generic: you can write methods to handle specific classes of objects, see Internal Methods.

Help on the Object "Matrix"

Arguments:

`data:` an optional data vector.

`nrow:` the desired number of rows

`ncol:` the desired number of columns

`byrow:` logical. If '**`FALSE`**'(the default) the matrix is filled by columns, otherwise the matrix is filled by rows.

`dimnames`: A '**`dimnames`**' attribute for the matrix: a '**`list`**' of length 2.

`x`: an R object.

Help on the Object "Matrix"

Then, the meaning of each parameter is explained:

Details:

If either of 'nrow' or 'ncol' is not given, an attempt is made to infer it from the length of 'data' and the other parameter.

If there are too few elements in 'data' to fill the array, then the elements in 'data' are recycled. If 'data' has length zero, 'NA' of an appropriate type is used for atomic vectors and 'NULL' for lists.

'is.matrix' returns 'TRUE' if 'x' is a matrix (i.e., it is _not_ a 'data.frame' and has a 'dim' attribute of length 2) and 'FALSE' otherwise.

Help on the Object "Matrix"

'as.matrix' is a generic function. The method for data frames will convert any non-numeric/complex column into a character vector using 'format' and so return a character matrix, except that all-logical data frames will be coerced to a logical matrix.

Finally, references and cross-references are displayed...

References:

Becker, R. A., Chambers, J. M. and Wilks, A.R. (1988) The New S Language. Wadsworth & Brooks/Cole.

Help on the Object "Matrix"

See Also:

'data.matrix', which attempts to convert to a numeric matrix.

.. as well as an example:

Examples:

```
is.matrix(as.matrix(1:10))
data(warpbreaks)
!is.matrix(warpbreaks)# data.frame, NOT matrix!
warpbreaks[1:10,]
as.matrix(warpbreaks[1:10,]) #using
  as.matrix.data.frame(.) method
```