

Foundations of R Software

Lecture 13

Basics of Calculations

⋮

Matrix Operations – Row, Column & Other Operations

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Matrix Operations

Renaming the row and column names

```
> x = matrix( nrow=4, ncol=3, data=c(1:12) )
```

```
> x
```

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

rownames(x) Renames the row names

colnames(x) Renames the column names

Matrix Operations

Renaming the row and column names

```
> rownames(x) = c("r1", "r2", "r3", "r4")
```

```
> x
```

	[, 1]	[, 2]	[, 3]
r1	1	5	9
r2	2	6	10
r3	3	7	11
r4	4	8	12

```
> colnames(x) = c("c1", "c2", "c3")
```

```
> x
```

	c1	c2	c3
r1	1	5	9
r2	2	6	10
r3	3	7	11
r4	4	8	12

Matrix Operations

```
R Console

> x = matrix( nrow=4, ncol=3, data=c(1:12) )
> x
      [,1] [,2] [,3]
[1,]    1    5    9
[2,]    2    6   10
[3,]    3    7   11
[4,]    4    8   12
> rownames(x) = c("r1", "r2", "r3", "r4")
> x
      [,1] [,2] [,3]
r1      1    5    9
r2      2    6   10
r3      3    7   11
r4      4    8   12
> colnames(x) = c("c1", "c2", "c3")
> x
      c1 c2 c3
r1     1  5  9
r2     2  6 10
r3     3  7 11
r4     4  8 12
> |
```

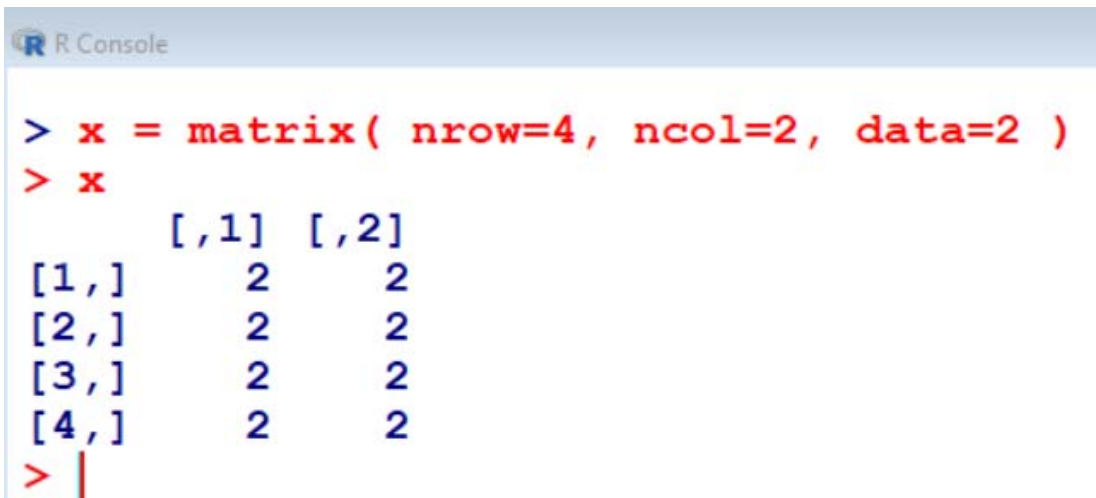
Matrix Operations

Assigning a specified number to all matrix elements:

```
> x = matrix( nrow=4, ncol=2, data=2 )
```

```
> x
```

	[,1]	[,2]
[1,]	2	2
[2,]	2	2
[3,]	2	2
[4,]	2	2



```
R Console  
  
> x = matrix( nrow=4, ncol=2, data=2 )  
> x  
      [,1] [,2]  
[1,]    2    2  
[2,]    2    2  
[3,]    2    2  
[4,]    2    2  
> |
```

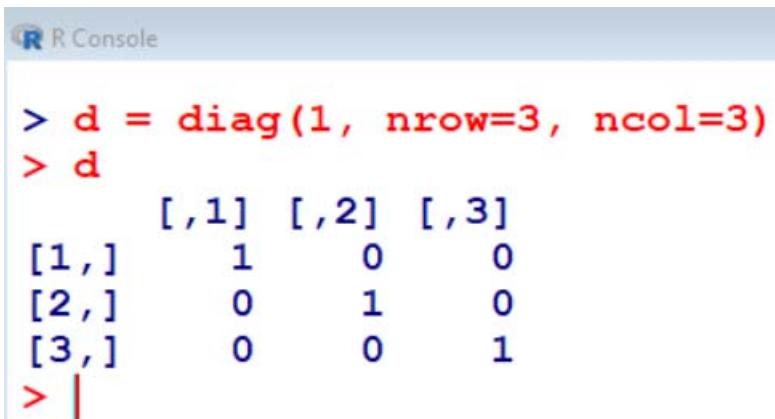
Matrix Operations: Diagonal matrix

Construction of a diagonal matrix, here the identity matrix of a dimension 3:

```
> d = diag(1, nrow=3, ncol=3)
```

```
> d
```

	[,1]	[,2]	[,3]
[1,]	1	0	0
[2,]	0	1	0
[3,]	0	0	1



```
R Console  
> d = diag(1, nrow=3, ncol=3)  
> d  
      [,1] [,2] [,3]  
[1,]    1    0    0  
[2,]    0    1    0  
[3,]    0    0    1  
> |
```

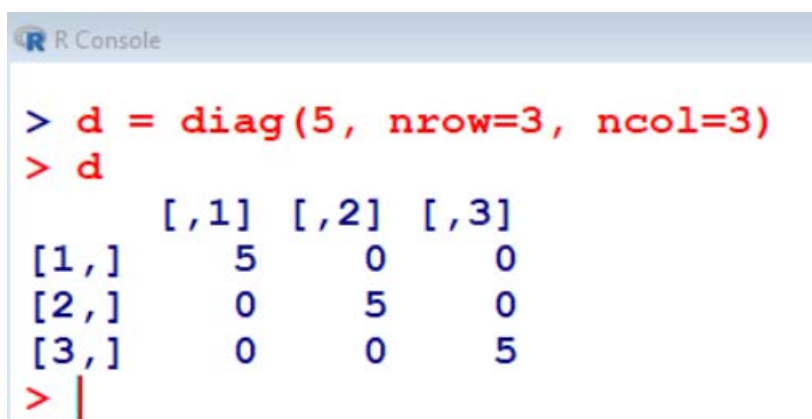
Matrix Operations: Diagonal matrix

Construction of a diagonal matrix with all numbers as 5 of a dimension 3:

```
> d = diag(5, nrow=3, ncol=3)
```

```
> d
```

	[,1]	[,2]	[,3]
[1,]	5	0	0
[2,]	0	5	0
[3,]	0	0	5



```
R Console  
  
> d = diag(5, nrow=3, ncol=3)  
> d  
      [,1] [,2] [,3]  
[1,]    5    0    0  
[2,]    0    5    0  
[3,]    0    0    5  
> |
```

Matrix Operations: Transpose

Transpose of a matrix X: X'

```
> 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

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

```
> |
```

Matrix Operations: Transpose

Transpose of a matrix X : X'

```
> xt = t(x)
```

```
> xt
```

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

```
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
> xt = t(x)
> xt
      [,1] [,2] [,3] [,4]
[1,]    1    3    5    7
[2,]    2    4    6    8
> |
```

Matrix Operations: Row and column sums

Finding the row and column sums

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

```
> x
```

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

rowSums(x) Finds the sum of numbers in rows

colSums(x) Finds the sum of numbers in columns

Matrix Operations: Row and column means

```
> x
```

	[,1]	[,2]	
[1,]	1	5	→ (1+5) = 6
[2,]	2	6	→ (2+6) = 8
[3,]	3	7	→ (3+7) = 10
[4,]	4	8	→ (4+8) = 12
	(1+2+3+4) = 10	(5+6+7+8) = 26	

```
> rowSums(x)
[1] 6 8 10 12
```

```
> colSums(x)
[1] 10 26
```

```
R Console
> x = matrix(nrow=4, ncol=2, data=c(1,2,3,4,5,6,7,8))
> x
      [,1] [,2]
[1,]    1    5
[2,]    2    6
[3,]    3    7
[4,]    4    8
> rowSums(x)
[1] 6 8 10 12
> colSums(x)
[1] 10 26
> |
```

Matrix Operations: Row and column means

Finding the row and column means

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

```
> x
```

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

rowMeans(x) Finds the means of rows

colMeans(x) Finds the means of columns

Matrix Operations: Row and column means

```
> x
```

	[, 1]	[, 2]	
[1,]	1	5	→ $(1+5)/2 = 3$
[2,]	2	6	→ $(2+6)/2 = 4$
[3,]	3	7	→ $(3+7)/2 = 5$
[4,]	4	8	→ $(4+8)/2 = 6$
	$(1+2+3+4)/4$ = 2.5	$(5+6+7+8)/4$ = 6.5	

```
> rowMeans(x)
```

```
[1] 3 4 5 6
```

```
> colMeans(x)
```

```
[1] 2.5 6.5
```

```
R Console
> x = matrix( nrow=4, ncol=2, data=c(1,2,3,4,5,6,7,8) )
> x
      [,1] [,2]
[1,]    1    5
[2,]    2    6
[3,]    3    7
[4,]    4    8
> rowMeans(x)
[1] 3 4 5 6
> colMeans(x)
[1] 2.5 6.5
> |
```