20181019m Matrices

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### Definition of matrices

A = matrix(c(1,3,2,2,8,9), byrow = T, nrow = 2); A

## [,1] [,2] [,3]  
## [1,] 1 3 2  
## [2,] 2 8 9

### Multiplying a matrix with a number

A\*3

## [,1] [,2] [,3]  
## [1,] 3 9 6  
## [2,] 6 24 27

### Transpose of matrix

t(A)

## [,1] [,2]  
## [1,] 1 2  
## [2,] 3 8  
## [3,] 2 9

### Sum of matrices

A = matrix(c(1,2,2,1),ncol = 2); A

## [,1] [,2]  
## [1,] 1 2  
## [2,] 2 1

B = matrix(c(3,1,4,2),ncol = 2); B

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

A + B

## [,1] [,2]  
## [1,] 4 6  
## [2,] 3 3

### Multiplication of matrices

By row from left to right, row(i) of first matrix \* col(i) of second matrix  
i.e. number of row depends on the row of first matrix  
and number of col depends on the col of the second matrix

a 2x3 %*% 3x2 matrix would thereby give a 2x2 matrix;*  
*while a 3x2 %*% 2x3 matrix would give a 3x3 matrix

A = matrix(c(1,3,2,2,3,5),ncol = 3); A

## [,1] [,2] [,3]  
## [1,] 1 2 3  
## [2,] 3 2 5

B = matrix(c(2,0,1,1,-1,2),ncol = 2); B

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

C = t(A); C

## [,1] [,2]  
## [1,] 1 3  
## [2,] 2 2  
## [3,] 3 5

D = t(B); D

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

A %\*% B

## [,1] [,2]  
## [1,] 5 5  
## [2,] 11 11

C %\*% D

## [,1] [,2] [,3]  
## [1,] 5 -3 7  
## [2,] 6 -2 6  
## [3,] 11 -5 13

### Special matrices

# Diagonal matrix  
E = diag(c(1,2,3)); E

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

A; diag(A)

## [,1] [,2] [,3]  
## [1,] 1 2 3  
## [2,] 3 2 5

## [1] 1 2

Square matrix: n x n matrix  
Symmetric matrix: A = t(A)  
0-matrix and 1-matrix (Note 1-matrix is denoted as J)  
Identity matrix: 1 on the diagnoal; also note IA = AI = A

### Inverse of matrices

For a matrix A, a matrix B is said to be an inverse matrix if:  
AB = BA = I  
(A must be a square matrix) (not all square matrix has an inverse)

A = matrix(c(1,2,3,4),ncol = 2); A

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

B = solve(A); B

## [,1] [,2]  
## [1,] -2 1.5  
## [2,] 1 -0.5

A %\*% B

## [,1] [,2]  
## [1,] 1 0  
## [2,] 0 1

B %\*% A

## [,1] [,2]  
## [1,] 1 0  
## [2,] 0 1