

A matrix is a rectangular grid of #'s

Ex:
$$\begin{bmatrix} 1 & 3 \\ 4 & 7 \\ 2 & 5 \end{bmatrix}$$

3x2

$$\begin{bmatrix} 1 & 2 & 3 \\ -1 & 7 & 4 \\ 2 & 5 & 9 \end{bmatrix}$$

3x3

An $m \times n$ matrix has m rows + n columns

Special case: vectors!

$$[1 \ 3 \ -2 \ 4]$$

row vector
($1 \times n$ matrix)

$$\begin{bmatrix} 2 \\ 1 \\ 7 \\ 3 \end{bmatrix}$$

column vector
($m \times 1$ matrix)

How can we make 'in MATLAB?

$$\begin{bmatrix} 8 & 6 & 7 \\ 5 & 3 & 0 \end{bmatrix}$$

Use

$$[8, 6, 7; 5, 3, 0]$$

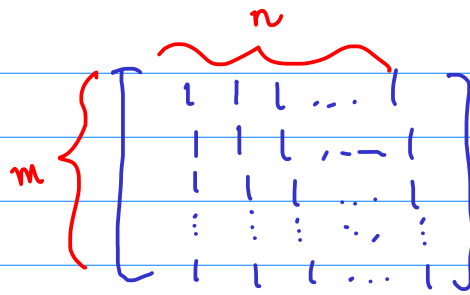
Special Matrices:

Zero matrix:

$$\begin{bmatrix} 0 & 0 & 0 & \dots & 0 \\ 0 & 0 & 0 & \dots & 0 \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & \dots & 0 \end{bmatrix}$$

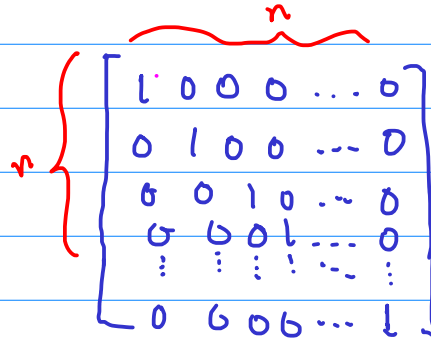
MATLAB command: `zeros(m,n)`

Ones Matrix :



MATLAB command: `ones(m,n)`

Identity Matrix :



MATLAB command: `eye(n)`

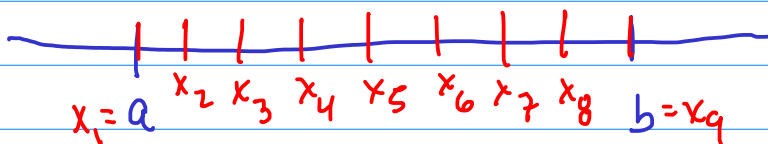
Index arrays :

`[3 4 5 6 7 8]`
`[1 2 3 4 5 6]`
`[2 4 6 8 10 12]`
`[7 10 13 16 19 22 25]`

MATLAB command: `[3:8]` \rightsquigarrow `[3 4 5 6 7 8]`
`[1:6]` \rightsquigarrow `[1 2 3 4 5 6]`
`[2:2:12]` \rightsquigarrow `[2 4 6 8 10 12]`
`[7:3:25]` \rightsquigarrow `[7 10 13 ...]`

Tak's question: `[2:2:11]` \rightsquigarrow `[2 4 6 8 10]`

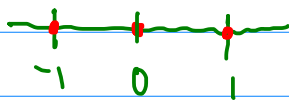
Linearly spaced Arrays :



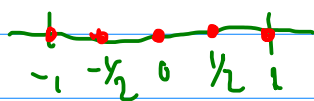
$[x_1 x_2 x_3 x_4 x_5 x_6 x_7 x_8 x_9]$

Matlab Command: $\text{linspace}(a, b, 9)$

Example: $\text{linspace}(-1, 1, 3)$ $\rightarrow [-1 \ 0 \ 1]$



$\text{linspace}(-1, 1, 5)$ $\rightarrow [-1.0 \ -0.5 \ 0 \ 0.5 \ 1.0]$



Reading Assignment:

- Chapter 1 of primary text
- Chapter 1 of WHIL

Matrix Entries and Submatrices

S'pose we have a matrix A

Def: The (i, j) entry of A is the entry in the i^{th} row and j^{th} column

Ex: $A = \begin{bmatrix} 1 & 3 \\ 2 & 9 \\ 4 & 1 \end{bmatrix}$ The $(3, 1)$ entry is 4
The $(2, 2)$ entry is 9

MATLAB command $A(i, j)$ is the (i, j) entry!

Def: A submatrix of A is a matrix we get by just choosing subsets of the rows + columns

$A = \begin{bmatrix} 1 & 3 \\ 2 & 9 \\ 4 & 1 \end{bmatrix}$ $B = \begin{bmatrix} 1 & 3 \\ 2 & 9 \end{bmatrix}$ Submatrix

$$C = \begin{bmatrix} 1 & 3 \\ 4 & 1 \end{bmatrix} \text{ submatrix}$$

$$D = \begin{bmatrix} 1 \\ 2 \end{bmatrix} \text{ submatrix}$$

MATLAB command :

$A(1:2, :)$ is the same as B

$A(:, :1)$ is the same as A

$1:2:3 \rightsquigarrow [1\ 3]$ $\left\{ \begin{array}{l} A(1:2:3, :) \end{array} \right.$ is the same as C

$\left\{ \begin{array}{l} A([1\ 3], :) \end{array} \right.$ is the same as C

$A(1:2, 1:2)$ is the same as B

$A(1:2, 1)$ is the same as D