MATLAB 101

Crash Course for Beginners

//

ASSIGNMENT 01

Total Marks : 25

Problem 1

2 Points

Create a **vector** like the following and assign it to a variable called **A**

$$A = [1 \;\; 2 \;\; 5 \;\; 3 \;\; 5]$$

```
% YOUR CODE HERE
A=[1,2,5,3,5]
```

```
A = 1×5
     1     2     5     3     5
```

Problem 2

2 Points

Create a **matrix** like the following and assign it to a variable called **B** and **suppress the output**.

$$B = \begin{bmatrix} 1 & 4 & 7 & 3 \\ 7 & 8 & 3 & 0 \\ 0 & 6 & 5 & 1 \\ 1 & 1 & 9 & 0 \end{bmatrix}$$

```
B=[1,4,7,3;7,8,3,0;0,6,5,1;1,1,9,0];
```

Problem 3

4 Points

Extract the **3rd row** of matrix **B** and assign it to a variable called **C**. Perform an **element-wise multiplication** between **A and C**.

Hint: matlab indexing starts at 1. So the 3rd row of matrix B is [0 6 5 1].

```
% -----------------------------------------
% C = B(3, :) is a better way of doing it
% -----------------------------------------
C=B(3,1:4)
```

```
C = 1×4
     0     6     5     1
```

```
% here A*C will generate incorrect dimension for matriz multiplicaiton error
% whereas multiplication with transpose of A and C will work just fine
% A*c = generates incorrect dimension for matriz multiplicaiton error

A'*C
```

```
ans = 5×4
     0     6     5     1
     0    12    10     2
     0    30    25     5
     0    18    15     3
     0    30    25     5
```

Problem 4

2 Points

Transpose the matrix **C** and **matrix-multiply** it with matrix A. Don,t assign it to any variable.

$$A \times C'$$

```
% multiplying A with transpose of C generates incorrect dimension error for
% matrix multiplication
% but transpose A multiplicated by C will work fine
% A*C'= generates incorrect dimension error for matrix multiplication
A'*C
```

```
ans = 5×4
     0     6     5     1
     0    12    10     2
     0    30    25     5
     0    18    15     3
     0    30    25     5
```

Problem 5

2 Points

Use the **colon operator** to create a vactor like the follows.

$$X = [\,0\ -2\ -4\ -6\ \ldots\ldots\ -100\,]$$

```
X=0:-2:-100
```

```
X = 1×51
     0    -2    -4    -6    -8   -10   -12   -14   -16   -18   -20   -22   -24   -26   -28
```

Problem 6

2 Points

Create a **10x10** matrix of **random integers** with minimum value of -10 and maximum value of 10 and assign it to a variable called **R**.

Hint : randi doc

```
R=randi([-10,10],10,10)
```

R = 10×10

2	7	8	-8	-9	0	-8	-7	-7	-4
-5	1	-9	8	-5	-3	9	3	-3	0
3	10	-2	2	-8	8	10	5	3	0
4	-9	-5	1	-7	-3	2	3	6	7
5	-1	6	-7	-5	-8	-9	-1	-9	6
-1	-8	-1	7	-2	6	-6	1	9	3
-9	10	9	3	-9	-2	-3	-4	6	-3
-6	-10	-7	-3	8	-5	7	5	0	7
9	6	-5	0	9	-2	-10	-7	-1	1
-7	7	-7	-2	0	-8	-10	4	-1	-3

Problem 7

2 Points

Extract the 1, 3, 5... 9th **column** of R. Don't assign it to any variable

Hint: Use colon operator.

```
%for i=1:2:10  %to get output of each column in one vector
%    R(:,i)
%end
R(:,1:2:10)
```

ans = 10×5

2	8	-9	-8	-7
-5	-9	-5	9	-3
3	-2	-8	10	3
4	-5	-7	2	6
5	6	-5	-9	-9
-1	-1	-2	-6	9
-9	9	-9	-3	6
-6	-7	8	7	0
9	-5	9	-10	-1
-7	-7	0	-10	-1

Problem 8

4 Points

The solution of a quadratic equation :

$$a x^2 + b x + c = 0$$

is given by,

$$x = \frac{-b \pm \sqrt{b^2 - 4 a c}}{2 a}$$

Given the valuse of a, b and c calculate the the two roots and assign them to variables called **x1** and **x2**.

```
a = 1;
b = -6;
c = 7;

% YOUR CODE HERE

x1= ((-b)+sqrt(b^2-(4*a*c)))/(2*a)
```

```
x1 = 4.4142
```

```
x2= ((-b)-sqrt(b^2-(4*a*c)))/(2*a)
```

```
x2 = 1.5858
```

Problem 9

5 Points

A general system of *m* linear equations with *n* unknowns can be written as:

$$
\begin{aligned}
a_{11}x_1 + a_{12}x_2 + \cdots + a_{1n}x_n &= b_1 \\
a_{21}x_1 + a_{22}x_2 + \cdots + a_{2n}x_n &= b_2 \\
&\vdots \\
a_{m1}x_1 + a_{m2}x_2 + \cdots + a_{mn}x_n &= b_m,
\end{aligned}
$$

where $x_1, x_2, \ldots, x_n$ are the unknowns, $a_{11}, a_{12}, \ldots, a_{mn}$ are the coefficients of the system, and $b_1, b_2, \ldots, b_m$ are the constant terms.

In a maxtrix reperesentation these equations can be written as,

$$A\,x = b$$

where,

$$
A = \begin{bmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{m1} & a_{m2} & \cdots & a_{mn} \end{bmatrix}, \quad \mathbf{x} = \begin{bmatrix} x_1 \\ x_2 \\ \vdots \\ x_n \end{bmatrix}, \quad \mathbf{b} = \begin{bmatrix} b_1 \\ b_2 \\ \vdots \\ b_m \end{bmatrix}
$$

Solution to these equations can be written in matrix form as,

$$x = A^{-1}b$$

Given the system of linear equations your task is **find the unknown variable x** in a **column vector** form.

Hint: You can use the inv() function to find the inverse of a matrix. But there is a more efficient way of calculating the results! Check out matrix left division opearor in the official documentation.

```
syms x1 x2 x3
```

```
eqn1 = 2*x1 + x2 + x3 == 2
```

eqn1 = $2\,x_1 + x_2 + x_3 = 2$

```
eqn2 = -x1 + x2 - x3 == 3
```

eqn2 = $x_2 - x_1 - x_3 = 3$

```
eqn3 = x1 + 2*x2 + 3*x3 == -10
```

eqn3 = $x_1 + 2\,x_2 + 3\,x_3 = -10$

```
[A,b] = equationsToMatrix([eqn1, eqn2, eqn3], [x1, x2, x3])
```

A =
$$\begin{pmatrix} 2 & 1 & 1 \\ -1 & 1 & -1 \\ 1 & 2 & 3 \end{pmatrix}$$
b =
$$\begin{pmatrix} 2 \\ 3 \\ -10 \end{pmatrix}$$

```
% YOUR CODE HERE
%---------------------------
% x = A\b is More efficient
%---------------------------
x=inv(A)*b
```

x =
$$\begin{pmatrix} 3 \\ 1 \\ -5 \end{pmatrix}$$

---- END -----