Subject: Introduction to Computing

Topic: Matlab @ Matrix Manipulation

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Basics of Matrix

- $A = \begin{bmatrix} a_{11} & a_{21} & a_{31} \\ a_{21} & a_{22} & a_{32} \\ a_{31} & a_{32} & a_{33} \end{bmatrix}$ is a matrix of dimension 3 ×3

a_{31} = element of Matrix A, Row = 3, Column =1

- Matrix element can be real no. or imaginary no.
- Matrix having only one row or one column is called vector.
- Matrix having one column of n- elements is called column vector (dim: n×1)
- Matrix having one row of n- elements is called row vector (dim: 1×n)
- Matrix having only one element is called Scalar (dim: 1×1)
- Thus a variable "A" defined in the Matlab can be either Scalar, Vector or Matrix

Defining Matrix in Matlab

- Entry of all the elements are made inside square bracket "[]"
- Entry is made row-wise (i.e. 1st entry of all the elements of 1st row followed by next row)
- Rows are separated by Semicolon ";"

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$$

```
>> A = [1 2 3; 4 5 6; 7 8 9];
```

- **Another way**

```
>> A = [ 1 2 3;
         4 5 6;
         7 8 9]
```

Matrix Manipulation

- **Extract any element of Matrix**

>> C= A(i,j): gives an element of matrix A having i^{th} row and j^{th} column

Example:

```
>> A=[1 2 3; 4 5 6; 7 8 9];
>> C=A(2,2)

C =

     5
```

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & \boxed{5} & 6 \\ 7 & 8 & 9 \end{bmatrix}$$

Matrix Manipulation

- **Replace any element of Matrix**

>> A(i,j)=k: this element of the matrix will be replaced by value "k"

Example:

```
>> A=[1 2 3; 4 5 6; 7 8 9];
>> A(2,2)=10
```

A =

1	2	3
4	10	6
7	8	9

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$$

Matrix Manipulation

- **Extract a sub-matrix**

>> C = A (:, j): Extract elements of all the rows and j^{th} column

Example:

```
>> A=[1 2 3; 4 5 6; 7 8 9];
>> C=A(:,2)

C =

     2
     5
     8
```

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$$

Matrix Manipulation

>> C = A (i,:): Extract elements of i^{th} rows and all columns

Example:

```
>> A=[1 2 3; 4 5 6; 7 8 9];
>> C=A(3,:)
```

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$$

C =

```
     7     8     9
```

Matrix Manipulation

>> C = A (:, a:b): Extract elements of all the rows and column between a to b

Example:

```
>> A=[1 2 3; 4 5 6; 7 8 9];
>> C=A(:,2:3)

C =

     2     3
     5     6
     8     9
```

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$$

Matrix Manipulation

>> C = A (m:n, :): Extract elements of rows between m to n and all columns

Example:

```
>> A=[1 2 3; 4 5 6; 7 8 9];
>> C=A(1:2,:)
```

C =

```
1   2   3
4   5   6
```

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$$

Matrix Manipulation

>> C = A(m:n, a:b): Extract elements of rows between m to n and column between a to b

Example:

```
>> A=[1 2 3; 4 5 6; 7 8 9];
>> C=A(1:2,2:3)
```

C =

```
     2     3
     5     6
```

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$$

Matrix Manipulation

>> C = A([a b c], [p q r]): Extract elements of selective rows & columns

Example:

```
>> A=[1 2 3 4 5; 6 7 8 9 10;
    11 12 13 14 15; 16 17 18 19 20; 21 22 23 24 25];
>> C= A([ 1 3 5],[ 3 5] )
```

C =

3	5
13	15
23	25

$$A = \begin{bmatrix} 1 & 2 & 3 & 4 & 5 \\ 6 & 7 & 8 & 9 & 10 \\ 11 & 12 & 13 & 14 & 15 \\ 16 & 17 & 18 & 19 & 20 \\ 21 & 22 & 23 & 24 & 25 \end{bmatrix}$$

Matrix Manipulation

- **Adding Rows**
  - A is a matrix of dimension (m×n)
  - u is Row vector of dimension (1×n)
  - A =[A; u] adds one Row in the matrix A

Example:

>> A=[1 2 3; 4 5 6; 7 8 9]; dim: 3x3

>> u = [10 11 12]; dim: 1x3

>> A=[A; u]

A =

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

Matrix Manipulation

- **Adding Column**
  - A is a matrix of dimension (m×n)
  - v is Column vector of dimension (m×1)
  - A =[A v] adds one Column in the matrix A

Example:

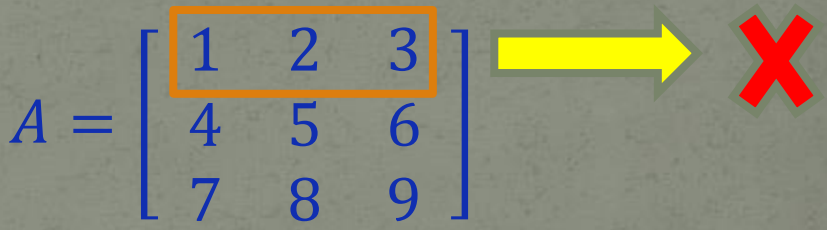
```
>> A=[1 2 3; 4 5 6; 7 8 9];   dim: 3x3
>> v = [ 10; 11; 12];         dim: 3x1
>> C=[A v]

C =

     1     2     3    10
     4     5     6    11
     7     8     9    12
```

Matrix Manipulation

- **Deleting Rows**
  - Select the row/rows you want to delete
  - Equate the selected row/rows with null matrix

Example:

```
>> A=[1 2 3; 4 5 6; 7 8 9];
>> A(1,:)=[ ]
```




```
A =

     4     5     6
     7     8     9
```

Matrix Manipulation

- **Deleting Column**
  - Select the Column/Columns you want to delete
  - Equate the selected Column/Columns with null matrix

Example:

```
>> A=[1 2 3; 4 5 6; 7 8 9];
>> A(:,2)=[]
```

A =

```
1   3
4   6
7   9
```

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$$

Matrix Manipulation

- A null assignment can have only one non-colon index.

Example:

```
>> A=[1 2 3; 4 5 6; 7 8 9];
>> A([ 1 3],1:2 )=[]
   ERROR
>> A(1:2,1:2 )=[]
    ERROR
 >> A(3,3)=[]
    ERROR
```