ENGINEERING MATHEMATICS-I
MATLAB

Department of Science and Humanities

Data Types

- Data types are those which define the type of data that we are using.
- Every data type stores data that is in the form of a matrix or array.
- Some common data types are:

- Integers
- Floating point numbers
- Scalar
- Character
- Strings
- Arrays

Integers

- An integer is a whole number (not a fraction) that can be positive, negative, or zero.
- For example, the numbers 10, 0, and -25 are integers.
- When two integers are added, subtracted, or multiplied, the result is also an integer.

Integers, Continued…

For example:

```
>> 2+3

ans =

     5

>> 4-5

ans =

    -1
```

Integers, Continued…

```
>> 2*8

ans =

    16
```

- Note that when one integer is divided by another integer, the result may be an integer or a fraction.

  For example:

```
>> 6/4

ans =

    3/2
```

Integers, Continued…

```
>> 6/3

ans =

     2
```

Floating Point Numbers

- As the name indicates, floating point numbers are numbers that contain floating decimal points.
- For example, the numbers 6.5, 0.0001, and -2,345.6789 are floating point numbers.
- When a calculation includes a floating point number, it is called a "floating point calculation."

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Scalar

- Any number which is used to represent a quantity.
- This includes integers, complex numbers , floating point numbers.
- Examples of scalar data types are: 3, 4+6i, -20.45.

Character

- Single alphanumeric symbol enclosed in a single quote is a character constant.
- Example, ‘B’ and ‘6’.
- 6 and ‘6’ are different. Here, 6 is numeric constant and ‘6’ is character constant.

Strings

- Any two or more alphanumeric symbols enclosed in a single quote.
- Example, ‘INDIA’=[‘I’, ‘N’, ‘D’, ‘I’, ‘A’]

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Arrays

- List of similar data in a single row or a column.
- Elements can be numerical or character or strings.
- Examples, [1 2 3 4]; [a b c d].

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Special Types of Arrays

- The four types of arrays are:
  - zeros() function
  - eye() function
  - ones() function
  - rand() function

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Special Types of Arrays, Continued…

- Zeros() Function : It creates an array of all zeros.
- For example: >> zeros(5)
- MATLAB will execute the above statement and return the result:

ans =

```
   0   0   0   0   0
   0   0   0   0   0
   0   0   0   0   0
   0   0   0   0   0
   0   0   0   0   0
```

Special Types of Arrays, Continued…

- eye() function: It creates an identity matrix.
- For example: >> eye(4)
- MATLAB will execute the above statement and return the result:

ans =

1	0	0	0
0	1	0	0
0	0	1	0
0	0	0	1

Special Types of Arrays, Continued…

- ones() function: It creates an array of all ones.
- For example: >> ones(4,3)
- MATLAB will execute the above statement and return the result:

ans =

```
     1     1     1
     1     1     1
     1     1     1
     1     1     1
```

Special Types of Arrays, Continued…

- rand() function: It generates random numbers between 0 and 1 that are distributed uniformly.
- For example: >> rand(3, 5)
- MATLAB will execute the above statement and return the result

ans =

0.8147	0.9134	0.2785	0.9649	0.9572
0.9058	0.6324	0.5469	0.1576	0.4854
0.1270	0.0975	0.9575	0.9706	0.8003

Relational Operators:

- Relational operator compare the elements in two arrays and return logical true or false values to indicate where the relation holds.

==	Determine the equality
>=	Determine greater than or equal to
>	Determine greater than
<=	Determine less than or equal to
<	Determine less than
~=	Determine inequality

Relational Operators, Continued…

For example,

1. >> 10==20
2. >> 3==(45-42)
3. >> x=(16*64>1000)+9
4. >> [4 -1 7 5 3]<=4
5. >> sum([14 9 3 4 1 4]==4)
6. >> x=10; x~=20
7. >> 3~=4
8. >>3~=3

Logical Operators:

- The logical data type represents true or false states using the numbers 1 and 0, respectively.
- The three logical operators are **&; |;** and **~**
- The meaning of **&** operator is **AND**
- The meaning of **|** operator is **OR**
- The meaning of **~** operator is **NOT**

Logical Operator &, Continued…

For example, >> a=[1 1 1 0 0 0];

>> b=[0 0 0 1 1 1];

>> a&b

ans =

1×6 logical array

0 0 0 0 0 0

Logical Operator &, Continued…

Consider,

```
>> a=1; b=1;
>> a&b
ans =
  logical
     1
```

Logical Operator &, Continued…

Consider,

```
>> a=0; b=1;
>> a&b
ans =
logical
0
```

Logical Operator |, truth table:

- Logical operator OR (|): It is true (1), when one or both the operands are true (1), otherwise the result is false (0).

operand	operand	operand OR operand
1	1	1
1	0	1
0	1	1
0	0	0

Logical Operator |, Continued…

Consider, >>a=[1 1 1 0 0 0]; b=[0 0 0 1 1 1];

```
>> a|b

ans =

    1×6 logical array

    1   1   1   1   1   1
```

Logical Operator ~ :

It complements each element of input array, A.

The truth table of ~ is as follows:

operand	NOT operand
1	0
0	1

Logical Operator ~, Continued…

For example, consider , >> A=[1 1 1 0 0 0]; >> ~A

ans =

  1×6 logical array

   0   0   0   1   1   1

>> A=[1 2 3 1 1 0 0]; >> ~A

ans =

  1×7 logical array

   0   0   0   0   0   1   1

THANK YOU