Al-Mustaqbal University College
Department of Medical Instrumentation Techniques Engineering
Class: Third
Subject: Variables and assignment statement, logical operator part (2)
Lecturer: Dr. Ali Kareem Abbas
Lecture: (4)

Basic Mathematical Functions

Command	Description
abs(x)	Absolute value $\|x\|$ (magnitude of complex number)
sign(x)	Sign, returns -1 if $x < 0$, 0 if $x = 0$, 1 if $x > 0$
ceil(x)	Round towards plus infinity.
conj(x)	Complex conjugate.
fix(x)	Round towards zero.
floor(x)	Round towards minus infinity.
rem(x,y)	Remainder of x/y. For example, rem(100,21) is 16. Also called the modulus function. { r = x- y.*fix(x./y)}
mod(x)	Modulus after division.
imag(x)	Complex imaginary part.
real(x)	Complex real part.
round(x)	Round towards nearest integer.

Example: abs(x)

```
>> x = [1.3   -3.56    8.23   -5   -0.01];
>> y = abs(x)
ans =
        1.3   3.56   8.23   5   0.01
```

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Example: sign(x)

```
>> V = [-11   0   1.5   Inf   NaN];
>> sign(V)

ans =

     -1     0     1     1   NaN
```

Example: ceil(x)

```
>> X = [-1.9  -0.2  3.4; 5.6  7  2.4+3.6i];
>> Y = ceil(X)

Y =

   -1.0000 + 0.0000i   0.0000 + 0.0000i   4.0000 + 0.0000i
    6.0000 + 0.0000i   7.0000 + 0.0000i   3.0000 + 4.0000i
```

Example: conj(x)

```
>> Z = [0-1i   2+1i; 4+2i   0-2i];

>> Zc = conj(Z)

Zc=

  0.0000 + 1.0000i   2.0000 - 1.0000i
  4.0000 - 2.0000i   0.0000 + 2.0000i
```

Example: fix(x)

```
>> X = [-1.9   -3.4; 1.6   2.5; -4.5   4.5];

>> Y = fix(X)

Y =
    -1    -3
     1     2
    -4     4
```

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Example: floor(x)

```
>> X = [-1.9    -0.2    3.4;  5.6    7.0    2.4+3.6i];
>> Y = floor(X)

Y =
  -2.0000 + 0.0000i   -1.0000 + 0.0000i    3.0000 + 0.0000i
   5.0000 + 0.0000i    7.0000 + 0.0000i    2.0000 + 3.0000i
```

Example: rem(x,y)

```
>> a = 1:5;
>> b = 3;
>> r = rem(a,b)

r =
     1     2     0     1     2
```

Example: imag(x)

```
>>  [imag(2 + 3/2*i),   imag(sin(5*i)),   imag(2*exp(1 + i))]

ans =

   1.5000   74.2032    4.5747
```

Example: real(x)

```
>> [real(2 + 3/2*i),   real(sin(5*i)),   real(2*exp(1 + i))]

ans =

   2.0000         0    2.9374
```

Example: round(x)

```
>> X = [2.11 3.5; -3.5 0.78];

>> Y = round(X)
```

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Y =

2 4

-4 1

Relational and Logical Functions

Function	Description
any(x)	Returns a scalar that is 1 (true) if *any* element in the vector x is nonzero; otherwise, the scalar is 0 (false). Returns a row vector containing a 1 (true) in each element for which any element of the corresponding column of matrix x is nonzero, and a 0 (false) otherwise.
all(x)	Returns a scalar that is 1 (true) if *all* elements in the vector x are nonzero; otherwise, the scalar is 0 (false). Returns a row vector containing a 1 (true) in each element for which all elements of the corresponding column of matrix x are nonzero, and a 0 (false) otherwise.
find(x)	Returns a vector containing the indices of the nonzero elements of a vector x. Returns a vector containing the indices of the nonzero.
isnan(x)	Returns an array with ones where the elements of x are NaN and zeroswhere they are not.
isfinite(x)	Returns an array with ones where the elements of x are finite and zeros where they are not. For example, isfinite([pi NaN Inf -Inf]) is [1 0 0 0].
isinf(x)	Returns an array with ones where the elements of x are +Inf or –Inf and zeros where they are not.
isempty(x)	Returns 1 if x is an empty array and 0 otherwise.

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Example: any(x)

```
>> A = [0   0   3;0   0   3;0   0   3]
>> B = any(A)
B =
    1×3 logical array
     0     0     1
```

Example: all(x)

```
>> B = all(A)
B =
  1×3 logical array
    0     0     1
```

Example: isnan(x)

```
>> A = 0./[-2 -1 0 1 2]
A =
    0     0   NaN     0     0
>> TF = isnan(A)
TF =
  1×5 logical array
     0     0     1     0     0
```

Example: isfinite(x)

```
>> A = 1./[-2 -1 0 1 2]
A =
   -0.5000   -1.0000       Inf    1.0000    0.5000
```

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```
>> TF = isfinite(A)
TF =
  1×5 logical array
     1     1     0     1     1
```

Example: isinf(x)

```
>> TF = isinf(A)
TF =
  1×5 logical array
     0     0     1     0     0
```

Example 1: isempty(x)

```
>> X = zeros (3, 3)
IE = isempty (X)
X =
     0     0     0
     0     0     0
     0     0     0
IE =
  logical
   0
```

Example 2: isempty(x)

```
>> X = rand (0, 4)
IE = isempty (X)
X =
  0×4 empty double matrix
IE =
  logical
   1
```