

**WESTERN SYDNEY**  
UNIVERSITY



Module 4

# Overview of Relational Operators

# Relational Operators for Logical Operations

< Less than

> Greater than

== Equal to (equivalence)

<= Less than or equal to ( $\leq$ )

>= Greater than or equal to ( $\geq$ )

~= Not Equal to ( $\neq$ )

= is assignment

== checks equivalence

# Logical Data Type

- The *logical data type* is another MATLAB data type; it is either equal to logical 1 (true) or equal to logical 0 (false).

<b>Input</b>	<b>Output: ans =</b>	<b>Data type</b>
<b>4 &lt; 5</b>	1	Logical array
<b>4 &lt;= 5</b>	1	Logical array
<b>4 &gt; 5</b>	0	Logical array
<b>4 &gt;= 5</b>	0	Logical array
<b>4 ~= 5</b>	1	Logical array

# Review - Examples

```
Command Window
>> a=2, b=4, c=10
a =
     2
b =
     4
c =
    10
>> a>b
ans =
     0
>> a<=b
ans =
     1
>> c>a
ans =
     1
>> a==b
ans =
     0
>> a==2
ans =
     1
>> a~=b
ans =
     1
```

a equals b ?

a not equal to b ?

```
>> b^2-4*a*c>0
ans =
     0
>> c==2*b+a
ans =
     1
>> a~=0
ans =
     1
>> d=a~=0
d =
     1
>> e=b==3
e =
     0
>> f=b>=2
f =
     1
>> x=0<1<2
x =
     1
>> y=a<b<c
y =
     1
>> z=a<c<b
z =
     1
>>
>> z=(a<c)<b
z =
     1
>> z=a<(c<b)
z =
     0
```

Combined Operators:  
Work out from left to right.  
Use parenthesis to make it clear.

# Relational operations and round-off errors in numerical computations

- The `==` and `~=` commands can produce puzzling results due to round-off error.
- For example:

```
a = 0;  
b = sin(pi);  
a == b
```

```
ans =  
    0
```

# Relational operations and round-off errors

- MATLAB computes  $\sin(p)$  to within **eps** but is **not exactly zero**
  - **eps** is the minimum value MATLAB can recognise between two numbers. It is a very small number ( $2^{-52}$  or  $2.22\text{E-}16$ )
- The `==` operator properly concludes that 0 and the computed value of  $\sin(p)$  are different.

The best way to fix this is to show things to be approximately equal.

```
abs(a-b) < 1.0E-14
```

```
ans =
```

```
1
```

# Relational operators with complex numbers

- Complex numbers are numbers in the form:

$$a + bi$$

where  $a$  is the real component and  $bi$  is the imaginary component

- When using  $>$ ,  $<$ ,  $\leq$  or  $\geq$  relational operations between two complex numbers will only compare the real parts (the imaginary parts are ignored completely)
  - For example,  $2 + 4i < 2 + 7i$  returns *false*
- When using  $==$  or  $\sim=$  relational operations between two complex numbers, both the real and imaginary components are compared