

ECE 257 - LESSON 14

LOGICAL VARIABLES AND OPERATORS

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A.P. FELZER

IN CLASS

LOGICAL VARIABLES

1. The values of logical variables

```
>> a = true
>> b = false
```

- What values does Matlab give true and false in the command window
- What values does Matlab give true and false in the current workspace

2. Treating logical variables like numbers

```
>> a = true
>> b = false
>> c = true
>> x = a + b + c
```

- When would we want to add logical variables like in this code

RELATIONAL OPERATORS

3. Logical equality

```
>> a = 2;
>> b = 2;
>> c = 3;
>> a == b
>> a == c
```

- What does logical equality tell us
- What is `a == b` if `a = false` and `b = false`

4. More logical operators

```
>> a = 2;
>> b = 2;
>> c = 3;
>> a ~= b
>> a <= c
>> a >= c
```

- What is the logical operator `~ =`
- What are logical operators `>`, `<`, `> =` and `< =`

5. Equality of calculated values

```
>> a = 25;
>> b = exp(log(25))
>> a == b
>> a - b
>> a - b < 1e-5
```

- Why doesn't Matlab say that `a` is equal to `b`

LOGIC OPERATORS

6. Logical *and*

```
>> a = true;
>> b = true;
>> c = false;
>> d = false;
>> a & b
>> a & c
>> c & d
```

- a. How does logical *and* work

7. Logical *or*

```
>> a = true;
>> b = true;
>> c = false;
>> d = false;
>> a | b
>> a | c
>> c | d
```

- a. How does logical *or* work

8. Logical *exclusive or* (xor)

```
>> a = true;
>> b = true;
>> c = false;
>> d = false;
>> xor(a, b)
>> xor(b, c)
>> xor(c, d)
```

- a. How does logical *exclusive or* work

9. Logical *not*

```
>> a = true;
>> ~a
>> b = false;
>> ~b
>> c = 0;
>> ~c
>> d = 5;
>> ~d
```

- a. How does logical *not* work with logic variables
- b. How does logical *not* work with numbers

SOME APPLICATIONS

10. Using find to change values in a vector

```
>> a = [2 3 1 5 8];  
>> b = find (a >= 3)  
>> a(b) = 3
```

a. What is this code doing and how does it do it

11. Clipping a sinusoid

```
T = 1e-3;  
f = 1/T;  
t = linspace (0, 3*T, 300);  
x = 5*cos (2*pi*f*t);  
x3 = find (x >= 3);  
x(x3) = 3;  
plot (t, x);  
ylim ([-6 6])  
xlabel ('t');  
ylabel ('xc(t)');  
title ('Clipped sinusoid');
```

a. What's going on in this program

12. Using find to calculate the sinc function as follows

$$\text{sinc}(x) = \begin{cases} 1 & x = 0 \\ \frac{\sin(x)}{x} & \text{otherwise} \end{cases}$$

Note that we have named our function the "sinc" function since Matlab already contains the sinc function

```
x = -2: 1e-3: 2;  
xs = find (abs(x) <= 3e-3);  
sinc (xs) = 1;  
x1 = find (abs(x) > 3e-3);  
sinc (x1) = sin (pi*x(x1))./(pi*x(x1));  
plot (x, sinc)
```