

### Relational and Logical Operators (§§ 4.2 & 4.3)

#### I. Review of Relational Operators (section 4.2)

<	less than	>	greater than
<=	less than or equal	>=	greater than or equal
==	equal	~=	not equal

Can apply to different classes of variables:

##### a. two scalars

→ results in a single value, 0 if false, 1 if true, resulting variables are of class “logical”

e.g.  $x = (7 < 6)$  →  $x = 0$  (false)

##### b. a scalar and a vector (array)

→ results in a logical vector(array) of the same size as the original vector (array), compares the scalar to each value in the vector and returns a true or false for each comparison

e.g.,  $y = (2 >= [1\ 2\ 3])$  →  $y = [1\ 1\ 0]$  (true, true, false)

##### c. two vectors (arrays) of the same size

→ results in a logical vector of the same size as the two vectors (arrays), compares the two vectors element by element

e.g.  $z = ([1\ 2\ 3] \sim [3\ 2\ 1])$  →  $z = [1\ 0\ 1]$  (true, false, true)

##### d. text strings

i. text strings can be defined by enclosing in single quotes (literals)

ii. text strings are vectors of type char where each character is a separate element

iii. work like other scalars and vectors except ASCII value is compared

e.g.  $h = ('D' == 'Dons')$  →  $h = [1\ 0\ 0\ 0]$  (true, false, false, false)

#### II. Basic logical operators (section 4.3)

Name	MATLAB operator	Function
and	&	true if both connected statements are true
or	(i.e., shift - \)	true if either connected statement is true
not	~	makes a true statement false or vice-versa
xor	xor(A,B)	true if A & B differ, false if both are the same

III. Truth Table (complete based on previous)

A	B	~A	A or ( ) B	A and (&) B	XOR(A,B)
True(1)	True(1)				
True(1)	False(0)				
False(0)	True(1)				
False(0)	False(0)				

IV. Creating a truth table in MATLAB

- Create two variables A & B that follow the pattern of A and B above (use the numbers 0 and 1)
- Transpose A & B to make them column vectors (e.g.  $A = A'$ )
- Concatenate into an array with the various operators to form a truth table  
e.g.,  $[A, B, \sim A, A|B, \dots]$  you finish out the array.
- This should create a truth table equivalent to the one above in MATLAB.

V. Order of precedence

- Parenthesis  $()$
- arithmetic and logical NOT  $+ - / * \sim$
- relational operators  $< > ==$
- logical AND  $\&$
- logical OR  $|$

VI. Practice: Suppose that  $x = [-3, 0, 0, 2, 5, 8]$  and  $y = [-5, -2, 0, 3, 4, 10]$ . Find the results of the following operations by hand. Use MATLAB to check your results. Note parts a-d are from chapter 4, problem 11 in your text (pg 243).

- $z = y < \sim x$
- $z = x \& y$
- $z = x|y$
- $z = \text{xor}(x,y)$

using the *find* command (use help to explore the nature of the find function)

- What are the indices of the true values for z in part a.
- What are the x & y values corresponding to the true cases in part b above.

VII. Try functions in Table 4.3-4 in your text