MONASH University

MONASH
ENGINEERING
ENG1060

LOGICAL OPERATORS

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GROUP OF EIGHT AUSTRALIA

LOGICAL OPERATORS

- Relational operators check if a statement is true or false
  - E.g. A = 5;
    A > 2

Relational Operator	Description
<	Less than
<=	Less than or equal to
>	Greater than
>=	Greater than or equal to
==	Equal to (double equals)
~=	Not equal to

- Logical operators can combine multiple relational operators
  - E.g. Check if A is greater than 2 AND less than 10

LOGICAL OPERATORS

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- Logical operators consist of AND, OR, and NOT

Logical operator	Description
&	**AND**
|	**OR**
~	**NOT** (Invert)

- Truth tables:

a	b	a & b
0	0	0
0	1	0
1	0	0
1	1	1

a	b	a | b
0	0	0
0	1	1
1	0	1
1	1	1

a	~a
0	1
1	0

LOGICAL OPERATORS: EXAMPLES

- Check if x is between –π and π

  (x >= -pi) & (x <= pi)

- Check if month is equal to 3, 7 or 11

  (month == 3) | (month == 7) | (month == 11)

- Check if month is not equal to 3, 7 or 11 and storing into z

  z = ~((month == 3) | (month == 7) | (month == 11))

LOGICAL OPERATORS WITH MATRICES

- Logical operators also work on matrices
  - Make sure matrices are the same size

```
>> A = [ 2 4 6 8 ]; B = [ 2 1 0 -1 ];

>> ~( A > 2 )
ans =
    1    0    0    0

>> ~~( A > 2 )
ans =
    0    1    1    1
```

```
>> A = [ 2 4 6 8 ]; B = [ 2 1 0 -1 ];

>> ( A ~= B ) & ( B <= 0 )
ans =
    0    0    1    1

>> ( A > B ) & ( A < 10 )
ans =
    0    1    1    1
```

RECALL: ADDRESSING MATRICES WITH LOGICALS

- You can address matrices using logical values
  - The logical() function creates a variable with a logical data type

```
>> A = [ 6 4 2 0 -2 ];
>> index = logical([0 1 1 1 0]);

>> B = A(index)
B =
     4     2     0
```

- This is very handy when you require only data that meet specific conditions

SHORT-CIRCUIT LOGICAL OPERATORS

- Not all relational conditions need to be checked when using logical operators

- Example of unnecessary checking

  (index <= length(A)) & (index > 0)

  – If the 1st condition is false, no point checking the second condition

- Short-circuit operators stop and gives a true or false result as soon as possible
  – Short-circuit AND: &&
  – Short-circuit OR: ||

SHORT-CIRCUIT LOGICAL OPERATORS

- Short circuiting &&:
  - Expr1 && Expr2
  - If Expr1 is false, Expr2 will not be evaluated

- Short circuiting ||:
  - Expr1 || Expr2
  - If Expr1 is true, Expr2 will not be evaluated

- General rules:
  - The && and || operators only works on scalars
  - Use && and || in if-statement conditions
  - Use & and | everywhere else

a	b	a & b
0	0	0
0	1	0
1	0	0
1	1	1

a	b	a | b
0	0	0
0	1	1
1	0	1
1	1	1

a	~a
0	1
1	0

SUMMARY

- Logical operators and truth tables
- Using logicals as indices for matrix addressing
- Short circuiting operators

- With the following code, what happens if the logical function is not used?

```
>> A = [ 6 4 2 0 -2 ];
>> index = logical([0 1 1 1 0]);

>> B = A(index)
```