Programming Logic

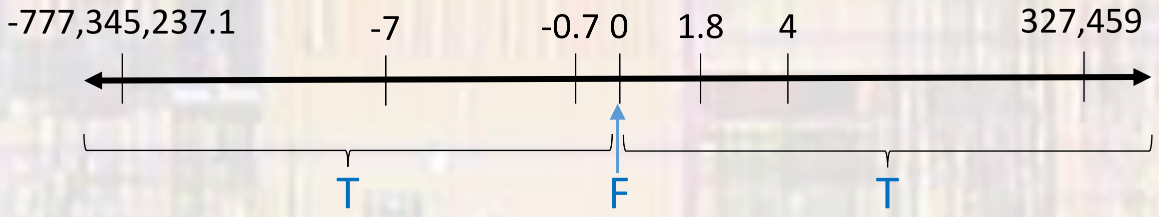
Last updated 6/16/23

These slides introduce logic concepts used in programming

Programming Logic

- Programming Logic
  - Defining the value of an expression or operand as True or False

  - In the programming world only 0 (0.0) is False
  - In the programming world any value but 0 is True



Programming Logic

- Logic in C
  - Logic Expression
    - Operation Operand → T or F
    - Operand Operation Operand → T or F
  - Operations
    - NOT – flips the evaluation of the operand
    - OR – evaluates as True if either operand is true (including both)
    - AND – evaluates as True if both operands are true

Programming Logic

- Logical NOT – flips the evaluation of the operand
  - T → F or F → T
  - ! operand

A = T
B = F

! A → F
! B → T

! (!A) → T

Logical NOT

A	! A
F	T
T	F

Programming Logic

- Logical OR – evaluates as T if either operand is T
  - op1 || op2

A = T
B = F
C = T

A || B → T
A || C → T
B || C → T

(!A) || B → F

Logical OR

A	B	A || B
F	F	F
F	T	T
T	F	T
T	T	T

Programming Logic

- Logical AND – evaluates as T if both operands are T
  - op1 && op2

A = T
B = F
C = T

A && B	→	F
A && C	→	T
B && C	→	F
(!B) && C	→	T

Logical AND

A	B	A && B
F	F	F
F	T	F
T	F	F
T	T	T

Programming Logic

- Evaluating algebraic expressions
  - Algebraic expressions can have numeric values AND logical values

	expression	→	numeric value	logical value
	7	→	7	T
	-12.5	→	-12.5	T
if A = 0	A	→	0	F
if B = 1.5, C = 3.0	2*B – C	→	0.0	F

  - The numeric values are used in calculations
  - The logical values are used in logical operations

Programming Logic

- Evaluating mixed (logical and algebraic) expressions
  - Logical values are mapped to algebraic values
    - F → 0
    - T → 1

A = 3
B = 0
C = 1.5

(!A) + 2 → 2
(A || B) - 1 → 0
(A && C) + C → 2.5

((!A) - 3) || B → T
(A && C) + (A || B) + A → 5

Programming Logic

- Additional logical operators – Comparison
  - Evaluate expression numerically but provide a logical result

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

Programming Logic

- Additional logical operators – Comparison
  - Evaluate expression numerically but provide a logical result

```
A = 3
B = 0
C = 1.5

A > B              3 > 0      → T
A < 2*C            3 > 3      → F
B == A – 3         0 == 0     → T

A || B != C && A
                   (A || B) != (C && A)
                   (T or F)  != (T and T)
                       T     !=     T      → F
```