Binary Number Systems

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These slides introduce binary number concepts

Binary Number Systems

- All values in a computer are implemented with 1's and 0's
  - Program instructions
  - Data values
  - Calculations
- Computer values are collected into groups
  - 8 bits → Byte
  - N Bytes → Word
- Bytes and Words do not have inherent values
  - Just a collection of 1's and 0's

Binary Number Systems

- Bytes and Words can be interpreted to have a value
  - 10011100 → interpreted as the decimal value 156
  - 10011100 → interpreted as the decimal value -100
  - 10011100 → interpreted as the character £
  - 01000101100110100101001000100100 → interpreted as the value 1234.567

- Even the computers program is defined by 1's and 0's
  - 1001110010101010 → interpreted as the command to add 2 numbers

Binary Number Systems

- We assign numbers represented by Bytes and Words a type
  - Allows us to convert them back and forth between a series of 1's and 0's and a decimal value we can better understand
- We assign symbols represented by Bytes and Words a type
  - Allows us to convert them back and forth between a series of 1's and 0's and a symbol (character) we can view and type
- Program instructions represented by Bytes and Words do not use types
  - Instructions are converted back and forth from 1's and 0's to actions using a predefined mapping

Binary Number Systems

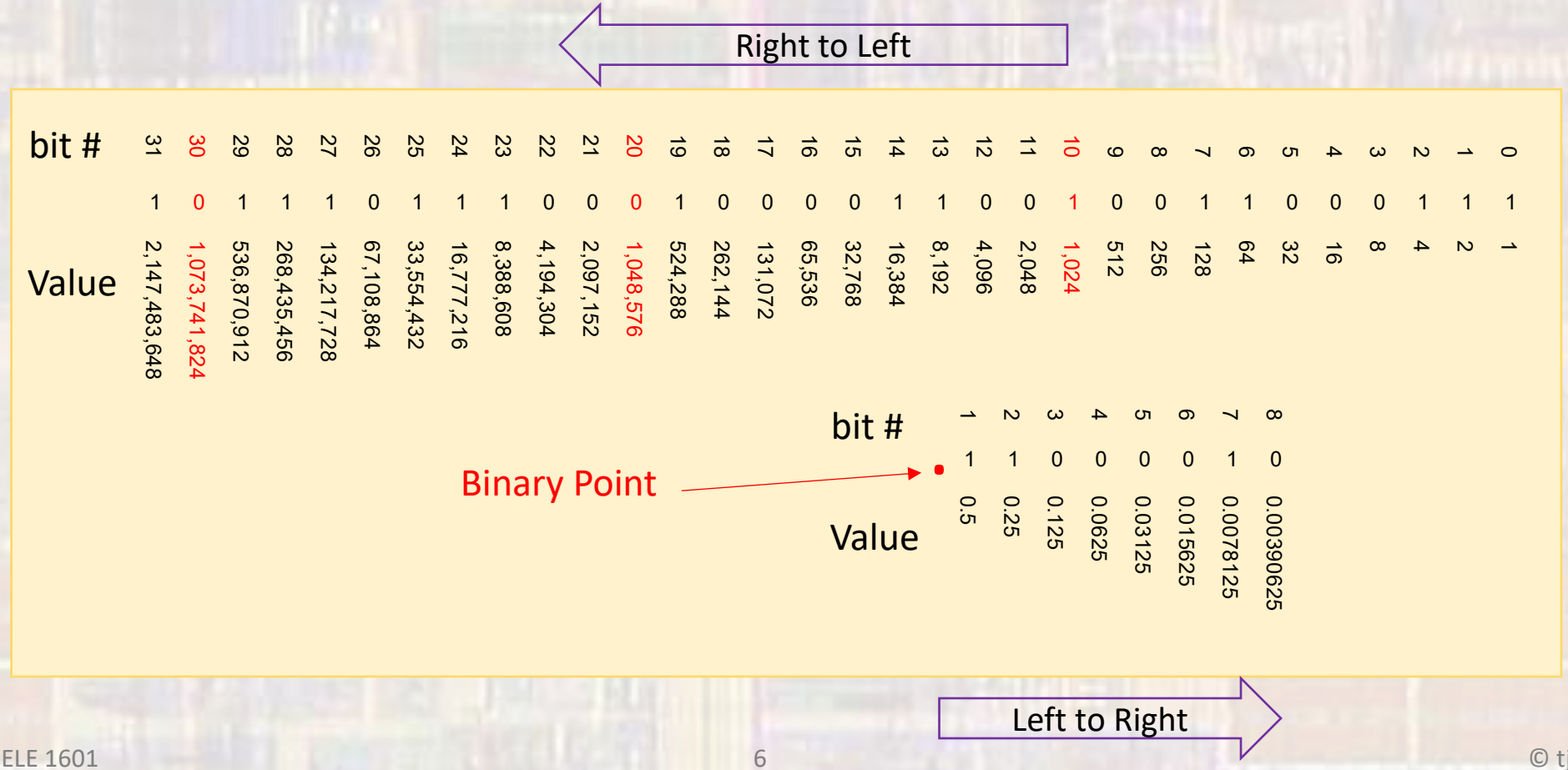
- Generalized Base 2 (binary)
  - Mathematical representation
    - ones, twos, fours, eights
    - halves, quarters, eighths
  - Base 2 → 2 individual digits
    - Range of individual digit: 0 → 1
  - Each position to the left of the binary point is 2X the previous position
  - Each position to the right of the binary point is 1/2 the previous position

1	1	0	1	.	1	0	1
Eights	Fours	Twos	Ones	binary point	Halves	Quarters	Eighths

1	1	0	1	.	1	0	1
digit x 2^3	digit x 2^2	digit x 2^1	digit x 2^0	binary point	digit x 2^{-1}	digit x 2^{-2}	digit x 2^{-3}

Binary Number Systems

- Binary Bit Values
  - Generalization, not necessarily what is used for interpreting each type



Binary Number Systems

- Primary C numerical types
  - Unsigned Binary
  - Signed Binary
  - Special Binary
  - Floating Point