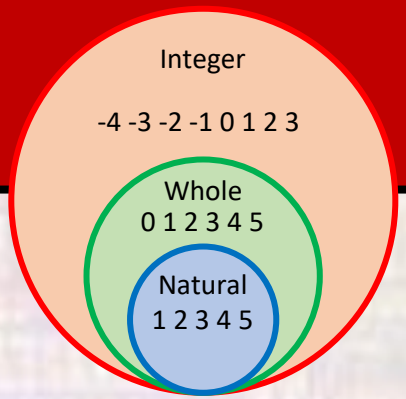
Number Review

Last updated 6/12/23

These slides review basic number concepts

Number Review



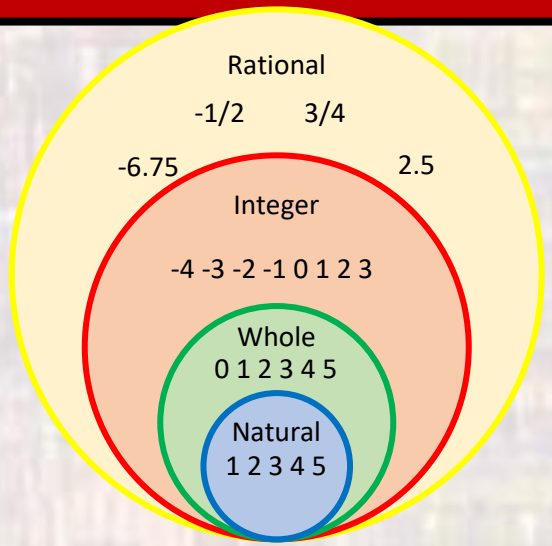
- Number Types
  - Natural Numbers
    - Any positive number that does not require a fraction to represent it
    - 12, 3456
  - Whole Numbers
    - Any positive number (+ 0) that does not require a fraction to represent it
    - 0, 22, 126
  - Integers
    - Any number that does not require a fraction to represent it
    - -1234, -23, 0, 22, 126

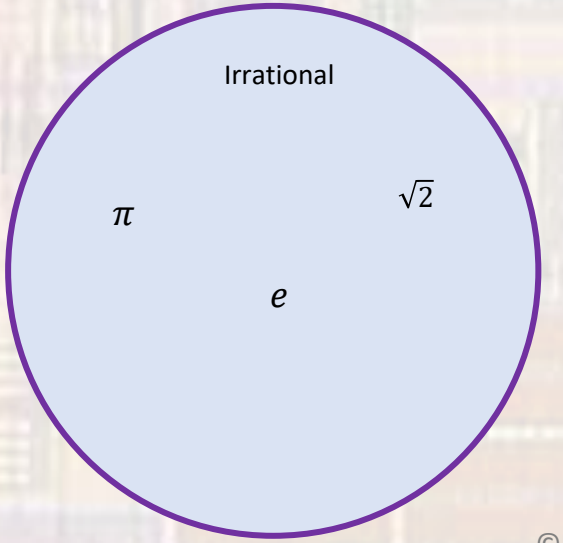
Number Review

- Number Types
  - Even Numbers
    - Integers that divided by 2 leave a remainder of 0
    - -12, 0, 22
  - Odd Numbers
    - Integers that divided by 2 leave a remainder of 1
    - -15, 1, 2345

Number Review

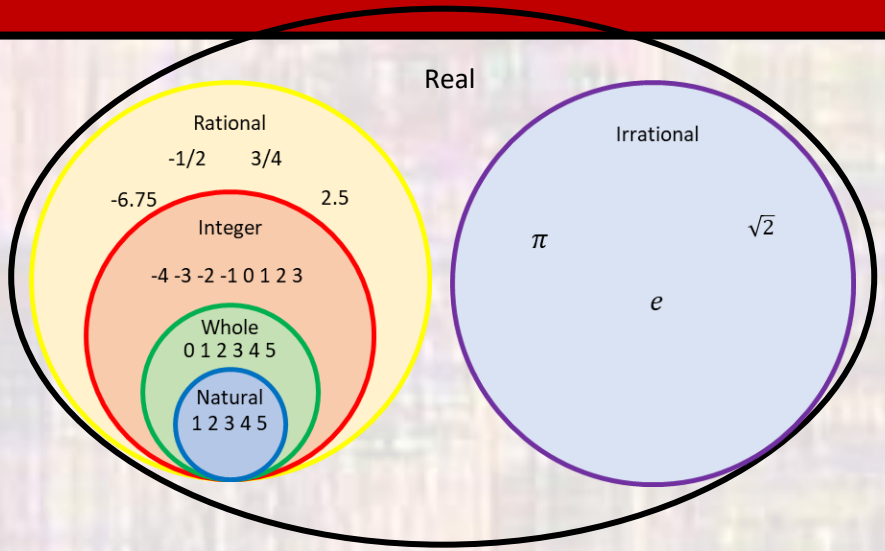
- Number Types
  - Rational Numbers
    - Any number that can be written as a fraction
    - Represented by a finite number of digits
    - -3.56, 5, 2345.567
  - Irrational Numbers
    - Any number that cannot be written as a fraction
    - Requires an infinite number of digits
    - PI, $\sqrt{2}$
  - Decimal Numbers
    - Rational numbers written with a decimal point
    - -13.45, 23456.7



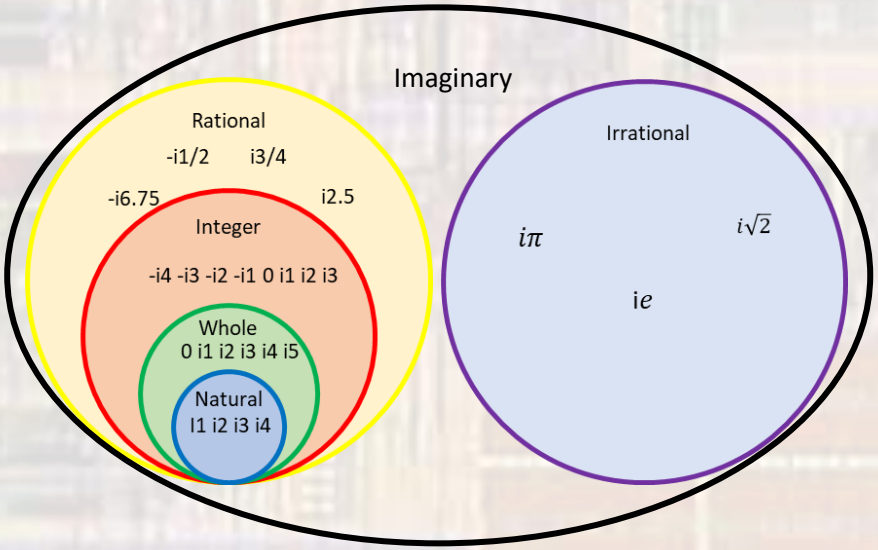


Number Review

- Number Types
  - Real Numbers
    - All numbers on the number line
    - -24.3, 0, 5, $\sqrt{13}$

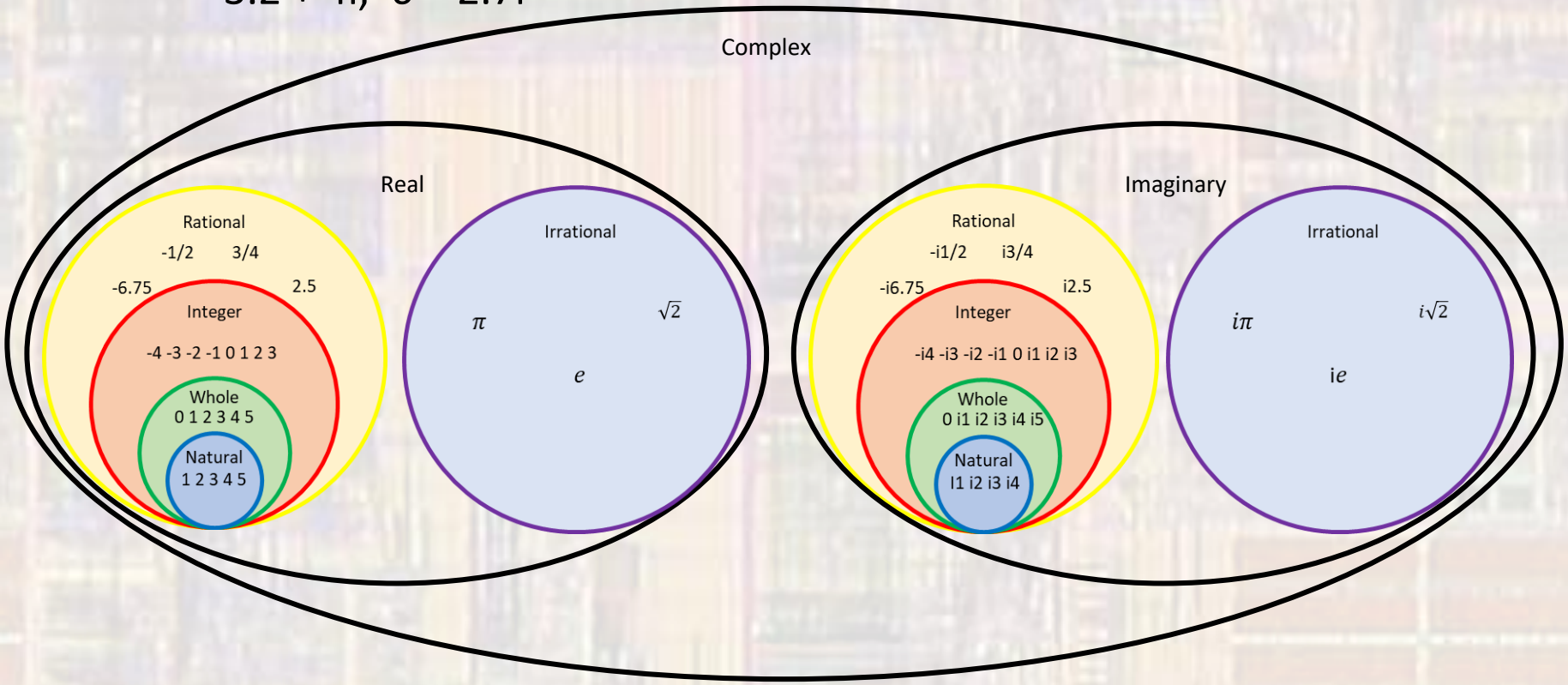


  - Imaginary Numbers
    - Real number multiplied by the imaginary unit i
      (j for EEs sometimes)
    - -4.3i, $\sqrt{2}$i, 5i



Number Review

- Number Types
  - Complex Numbers
    - Numbers that include both a Real part and an Imaginary part
    - -3.2 + 4i, 6 – 2.7i



Number Review

- Notation
  - Long form

    23456.78

  - Scientific Notation

    2.34567×10^4

  - Engineering Notation
    - Exponents are factors of 3

      23.45678×10^3

    - E.g.

      $123456789.012 \rightarrow 123.456789012 \times 10^6$

      $0.000234 \rightarrow 0.234 \times 10^{-3} \rightarrow 234 \times 10^{-6}$

Number Review

- Engineering Notation Units

Engineering Notation Units									
Value	10^{-12}	10^{-9}	10^{-6}	10^{-3}	10^{0}	10^{3}	10^{6}	10^{9}	10^{12}
Name	pico	nano	micro	milli		Kilo	Mega	Giga	Tera
Symbol	p	n	u	m		K	M	G	T

Number Review

- Numbers in computers
  - Computers store numbers with a finite resolution
    - # of bits – to be discussed later
  - Natural numbers, Whole numbers and Integers
    - can be stored if they do not exceed a system dependent magnitude
  - Rational numbers (Decimal numbers)
    - can be stored if they do not exceed a system dependent magnitude
    - can be stored if they do not exceed a system dependent resolution
      - Otherwise, they are truncated in some fashion
  - Irrational numbers
    - must be truncated to be stored in a computer
  - Some programming languages support Imaginary and Complex numbers
    - Subject to the limitations outlined above

Number Review

- Numbers in computers
  - We will primarily use two types of numbers
  - Integers
    - Subject to magnitude limitations
    - Sometimes we will force them to be positive
      - Called unsigned integers
    - When they can be positive or negative
      - Called signed integers or just integers
      - Often abbreviated as ‘int’
  - Floating Point numbers
    - Decimal numbers subject to magnitude limitations
    - Often abbreviated as float