Analog vs Digital

- Analog world is based on **continuous** events, take real value
- Digital world is based on **discrete** events, take a finite number of discrete values
- The real world is inherently analog
    - Convert analog signals to digital values at the input
    - Convert digital values to analog signals at the output
- Digital is all about numbers to represent discrete events
    - Numbers allow for easy manipulation
    - Results are repeatable

Binary String

- Given a string of 1's and 0's, we need to know the **representation system** used
- Information (value) = Bits + Context (System)
- Integer Systems
    - Unsigned
    - Signed
- Floating point
    - For very large and small fractional numbers
- Codes
    - Text (ASCII/Unicode)
    - Decimal Codes

Number systems consist of

- A base (radix) r
- r coefficients [0 to r-1]

Skills

1. Converting to decimal
2. Converting from decimal
3. Binary to Octal or Hex / Octal or Hex to Binary
    A. 0x => hex in c/c++
4. Unique combinations
    A. Given n digits or base r, the range is [0 to r^n-1], form r^n numbers

Approximating large powers of 2

- 2^10 ~= 10^3
- 2^20 ~= 10^6

Binary Codes

- Using n bits we can represent 2^n distinct items
- Using binary we can represent any kind of information by coming up with a code