

Bits and Bytes

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Topics

- Why bits?
- Representing information as bits
 - Binary/Hexadecimal
 - Byte representations
 - » numbers
 - » characters and strings
 - » Instructions
- Bit-level manipulations
 - Boolean algebra
 - Expressing in C

Why Don't Computers Use Base 10?

Base 10 Number Representation

- That's why fingers are known as "digits"
- Natural representation for financial transactions
 - Floating point number cannot exactly represent \$1.20
- Even carries through in scientific notation
 - 1.5213×10^4

Implementing Electronically

- Hard to store
 - ENIAC (First electronic computer) used 10 vacuum tubes / digit
- Hard to transmit
 - Need high precision to encode 10 signal levels on single wire
- Messy to implement digital logic functions
 - Addition, multiplication, etc.

Binary Representations

Base 2 Number Representation

- Represent 15213_{10} as 11101101101101_2
- Represent 1.20_{10} as $1.0011001100110011[0011]\dots_2$
- Represent 1.5213×10^4 as $1.1101101101101_2 \times 2^{13}$

Electronic Implementation

- Easy to store with bistable elements
- Reliably transmitted on noisy and inaccurate wires

