A Brief History of Computing

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Before We Get Started

- Survey Results!
  - About 75% not in CS/Math
  - Avg Tech Literacy: 5.35
  - Median Tech Literacy: 5
  - Common suggested topics:
    - Machine Learning/A.I.
    - General Programming/Software
    - How does tech work (fundamentally)
  - As an aside, y'all seem to have a good sense of humor

Some of my favorite reponses

- "For no nefarious purposes, I would like to understand of hacking works"
- "I'm literally a rookie on IT, then I was "discriminated" by my CS major friends. Here to prove myself."
- "I bought and set up an SSD for a laptop." followed by "I am near tech illiterate."
- Financial Gain:
  - "[I] wrote a program to predict crypto currency using machine learning"
  - "(Trying to) analyze public company financials using python."

What is a computer?
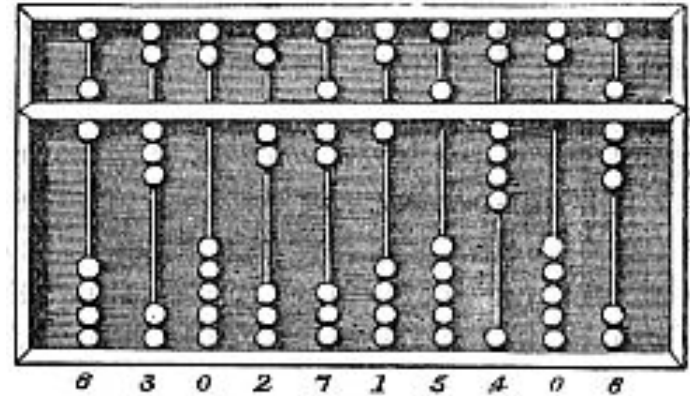
Definition - Computer

A programmable, usually electronic, device that can store, retrieve, and process data

Origin

The first use of the term comes from human "computers".

Pre-20th Century Computing

- Recording information
  - Tally Stick
  - Marked Cloth
- Processing Information
  - Abacus
  - Slide Rule

Mechanical Computers

- Charles Babbage (1791-1871)
  - The "Father of the Computer"
  - Theorized a machine able to do generic computations
  - Programmed using punch cards
  - Involved cranks and moving parts
- Analog Computers
  - Used for scientific purposes
  - Had a single intended purpose
    - Solving calculus problems
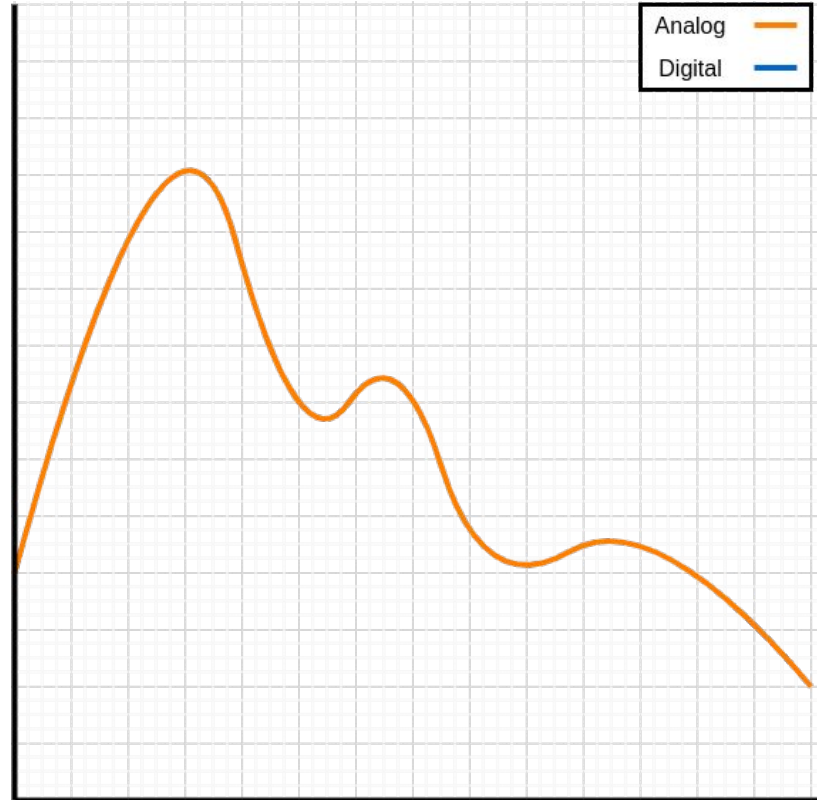   - Predicting the tides
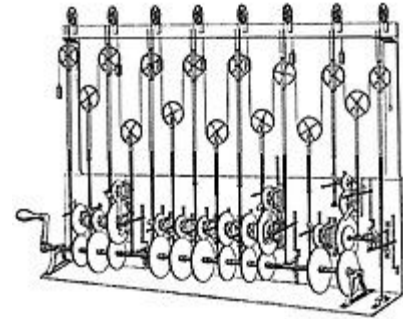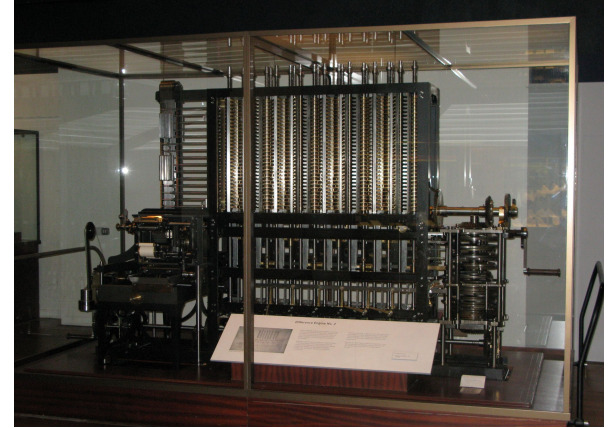
Analog vs Digital Signals

- Analog - A continuous signal
  - Very precise
  - Can easily be affected by noise
  - Unique
- Digital - A discrete signal
  - Precision limited by device
  - Less prone to noise
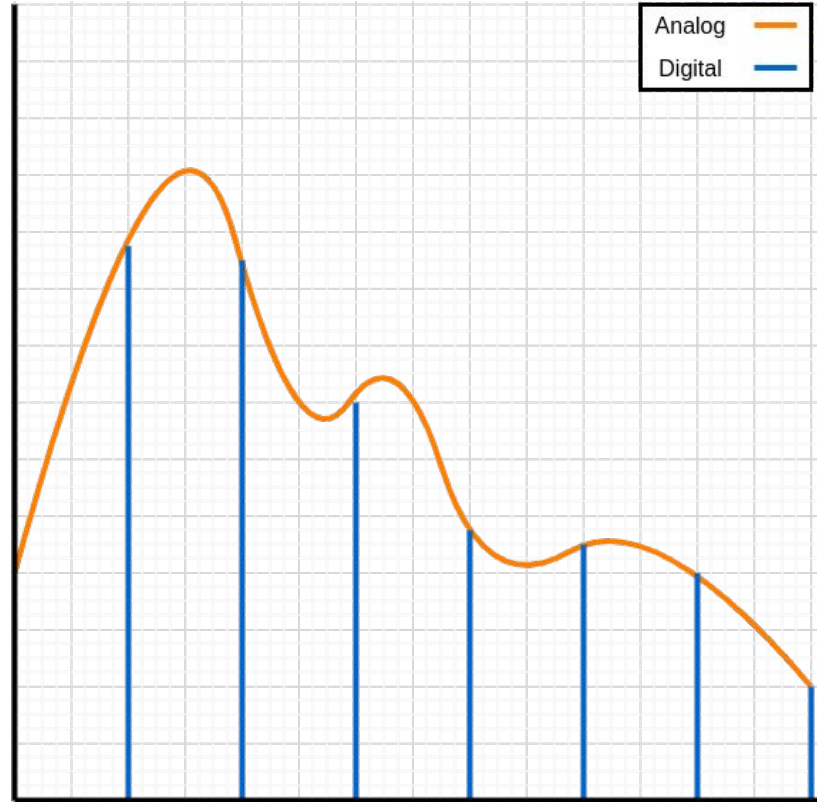 - Limited possible signals
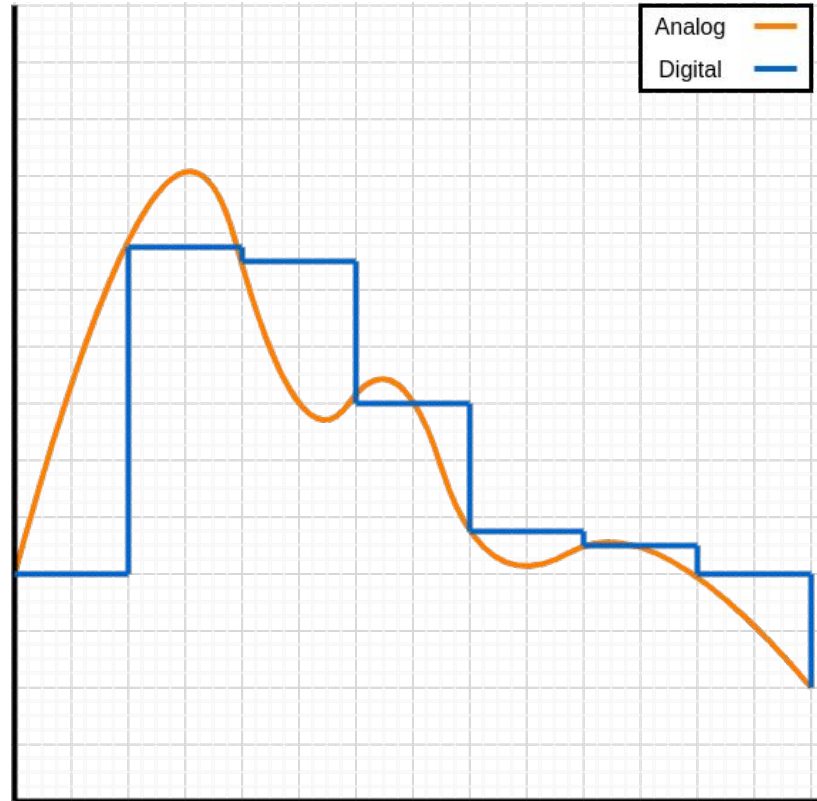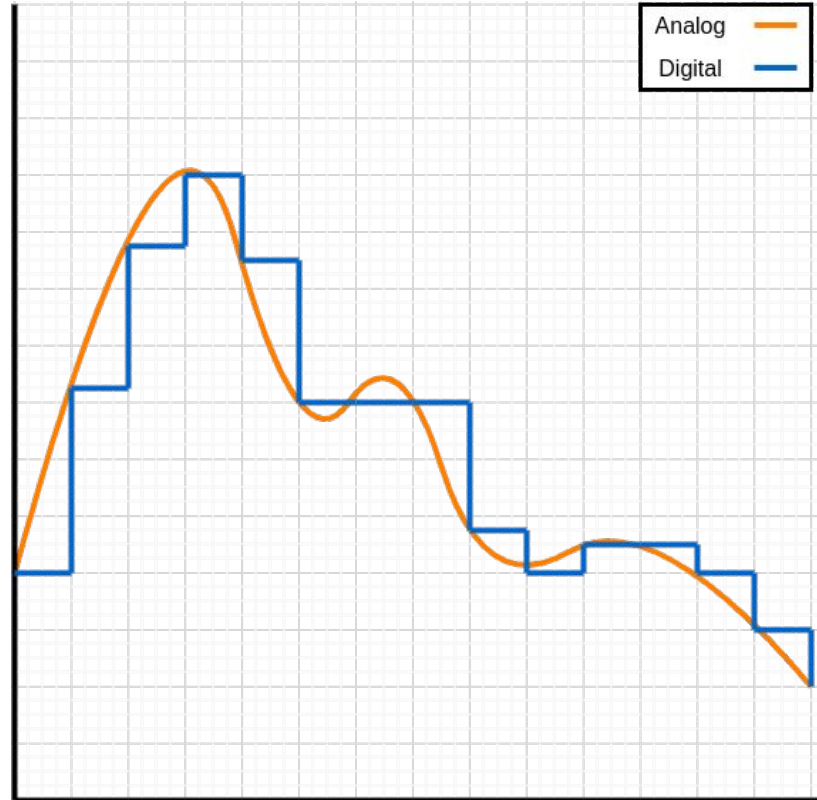
Analog vs Digital Signals

Analog vs Digital Signals

Analog vs Digital Signals

Analog vs Digital Signals

Binary

Definition - Binary

A number system based only on the numerals 0 and 1

Origin - Bit

A combination of the words "Binary" and "Digit".

Counting in Binary

- We use Decimal (Base-10)
- Computers use Binary (Base-2)
- The base determines the "place value"
  - $2{,}153 = 2 \times 10^3 + 1 \times 10^2 + 5 \times 10^1 + 3 \times 10^0$
  - $10110 = 1 \times 2^4 + 0 \times 2^3 + 1 \times 2^2 + 1 \times 2^1 + 0 \times 2^0$

Converting from Binary to Decimal

How do we go from 10110111 to 183?

Place	128	64	32	16	8	4	2	1
Value	1	0	1	1	0	1	1	1

128+32+16+4+2+1 = 160 + 20 + 3 = 183

Converting from Decimal to Binary

Flip it!

How do we go from 156 to 10011100?

156 / 2 = 78 Rem 0	0	1
78 / 2 = 39 Rem 0	0	0
39 / 2 = 19 Rem 1	1	0
19 / 2 = 9 Rem 1	1	1
9 / 2 = 4 Rem 1	1	1
4 / 2 = 2 Rem 0	0	1
2 / 2 = 1 Rem 0	0	0
1 / 2 = 0 Rem 1	1	0

Why do Computers use Binary?

- Simplest Digital Signal
  - Transistors
  - Noise is not a factor
- Logical Theory
  - 0 = False, 1 = True
  - The underpinning of most computer science
  - Programs are a set of instructions following logic
    - If time is 8AM: sound alarm

Alan Turing

- Seminal figure in Computer Science
- Worked as a codebreaker
  - Crucial to breaking German codes
- Father of Artificial Intelligence
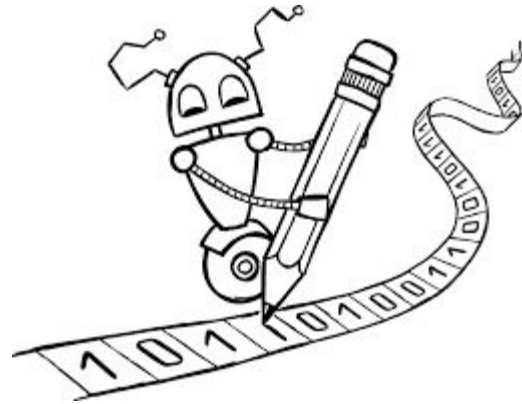 - Turing Test

Decoding Challenge!

Turing Machine

- Simple Machine
  - Components
    - A "memory" tape
    - A "head"
    - A finite set of rules
- Defined the limits and potential of computers
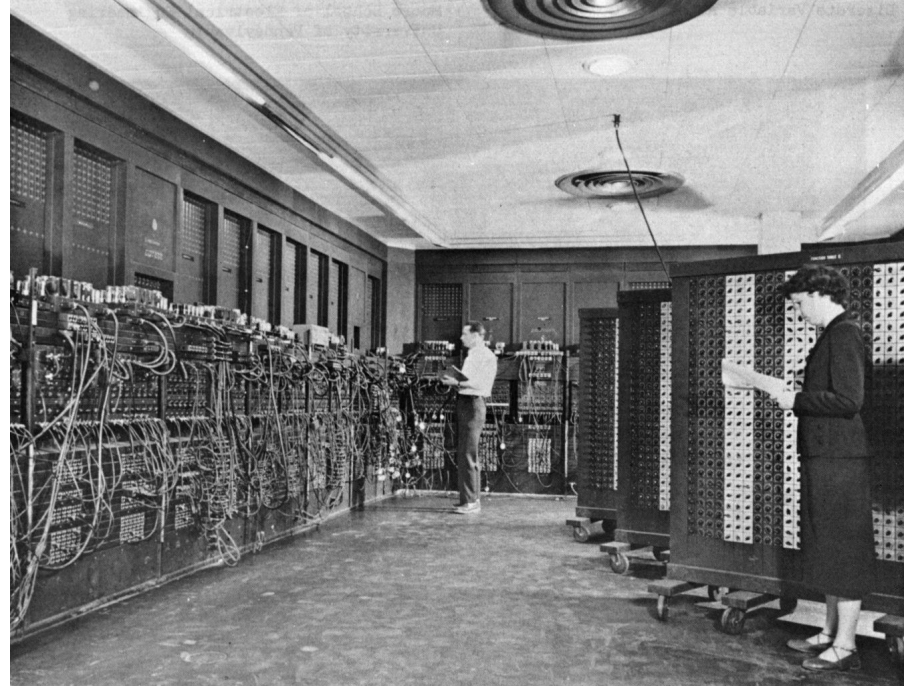- Basis of all modern computers

Yay! Now we have modern computers

ENIAC

- The first programmable, electronic, general-purpose digital computer
- Large machine
  - 30 tons
  - 1,800 sq ft
  - 18,000 Vacuum tubes
- 1,000 times faster than existing machines
- Purpose: Calculate rocket trajectories
- Operated mostly by women
  - Not credited at the time

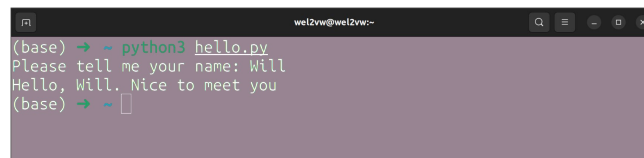# Programming the computer

- We need to tell the computer what to do
- Speaking directly to a computer is hard
- We would like a translator
- Compiler
  - Takes our instructions
  - Simplifies when possible
  - Translates them to Computer speak

Programming Language

- A common language between human and compiler
- Requirements:
  - Simple
  - Expressive
  - Non-ambiguous
- Early Languages
  - FORTRAN, Lisp, BASIC
- Modern Languages
  - C/C++, Python, Java, Javascript

```python
def say_hello(name):
    print("Hello, " + name + ". Nice to meet you")

def main():
    name = input("Please tell me your name: ")

    say_hello(name)

main()
```
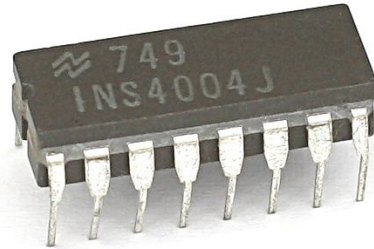
```
wel2vw@wel2vw:~
(base) ➜ ~ python3 hello.py
Please tell me your name: Will
Hello, Will. Nice to meet you
(base) ➜ ~ []
```

Personal Computers

- The ENIAC was too big
  - A requirement of its components
- MOSFET
  - Metal-oxide-silicon field effect transistor
  - Can be tiny and mass produced
- Intel 4004
  - Released in 1971 for $60 (~$450 today)
  - First single-chip microprocessor (The CPU)

Personal Computers cont.

- Computer parts continued to become affordable and smaller
- Moore's Law
  - The number of transistors on a CPU doubles every two years
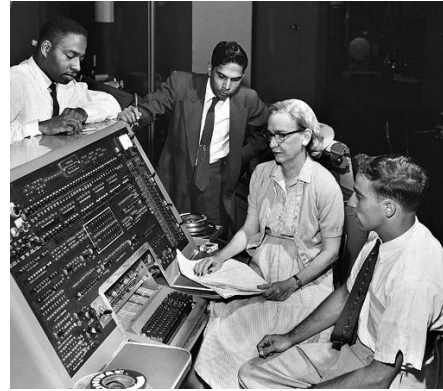 - Computation power continues to grow
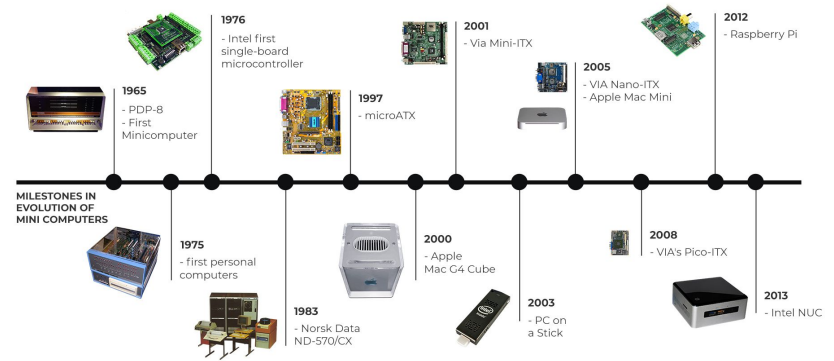
Some Important People

Grace Hopper

- Earned a Ph.D. in Mathematics from Yale in 1934
- Joined Navy Reserves in WWII
- Created first "compiler"
- Highly influential in first programming languages
- Fun Facts
  - Helped coin the term computer "bug"
  - Nicknamed "Grandma Cobol"

Dennis Ritchie and Ken Thompson

- Researchers at Bell Labs
- Created the Unix operating system
    - Basis of many other operating systems
    - MacOS, Linux, Android, etc.
- Created the C programming language and its predecessor
    - One of the (still) most used and influential programming languages
    - Influenced Go (Google's language), Swift (Apple's language), C++, Rust, Python, etc.
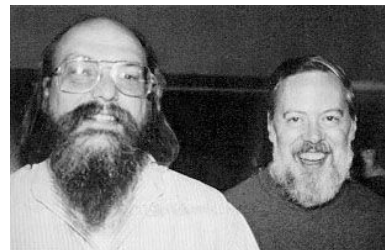
Donald Knuth

- Earned a PhD in mathematics from Cal Tech in 1963
- Crucial in the understanding of algorithmic complexity
- Prolific Writer on various subjects
  - Computer Programming
  - Mathematics
  - Religion and Computer Science
  - If you find an error in his texts, he awards you 256 cents (1 hexadecimal dollar)