IC152 Lec 1

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About the course

- Problem solving using computers
- Exercises and examples from engineering and sciences
- Data science: driven by data
- Tools: Python, LibreOffice Calc, Linux

Evaluation

- Theory (70%)
  - Q1: 20
  - Q2: 20
  - ES: 30
- Lab (30%)
  - Weekly lab: 10
  - Lab exam: 20

Resources

- Moodle course page
  - https://students.iitmandi.ac.in/moodle/course/view.php?id=2176
- Slack channel
- HackerRank
- Google colab
- Spyder

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- HackerRank
- Others:
  - Jupyter
  - Anaconda

What you can do

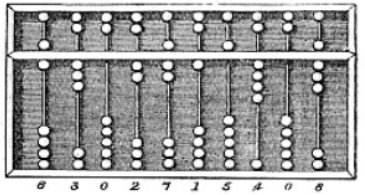
- Install Linux or make your laptop dual boot
  - Ubuntu is popular
- Install Spyder

Some computing history

Slides from lectures by Prof T A Gonsalves in 2018

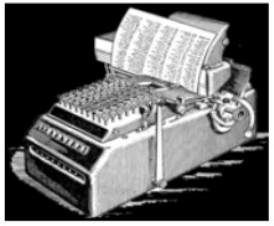
Early Computing Hardware

The Slide rule



The Chinese Abacus

The gear replaced the beads in early mechanical calculators



"History of computing hardware"
From Wikipedia, the free encyclopedia

Dictionary definition of "Computer":
(noun) a person who makes calculations, especially with a calculator

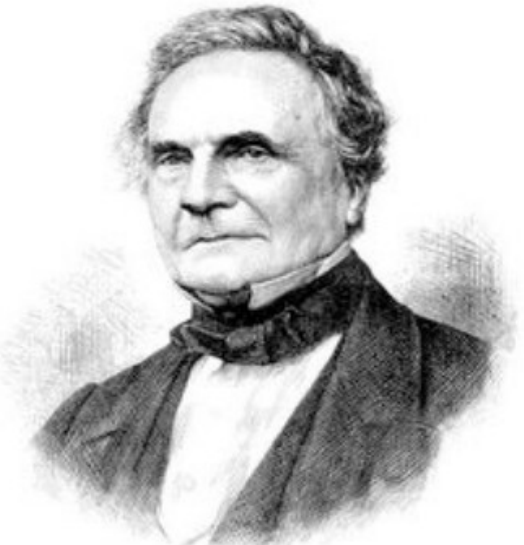
Jaquard looms

Used *punched cards* to weave *different patterns*

What IS a computer?

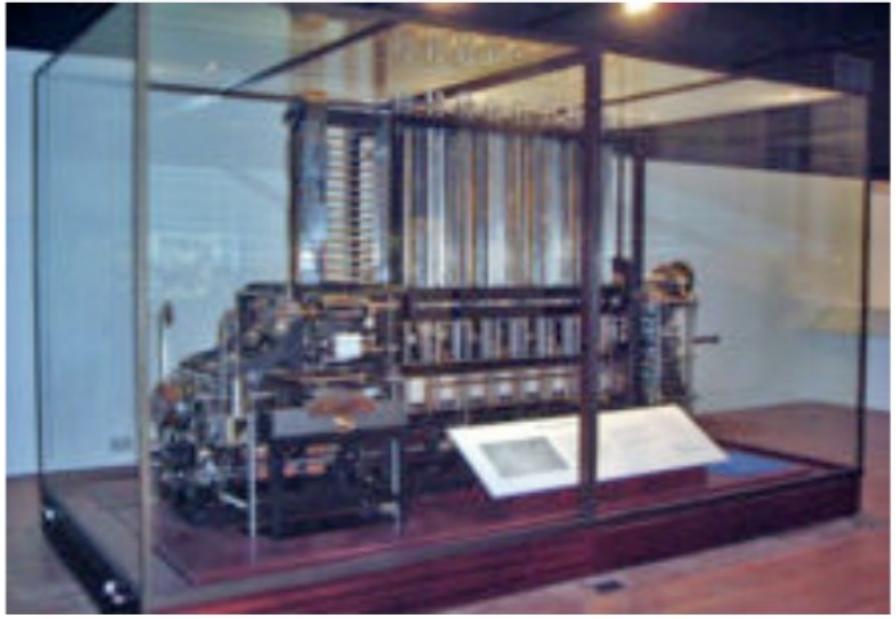
- A computer is a *flexible machine*
- Its behaviour is controlled by a *program*
- Programs reside in the *memory* of the machine
  - *Charles Babbage (1791-1871):*

"The stored program concept"



The Difference Engine

Part of Babbage's difference engine, assembled after his death by Babbage's son, using parts found in his laboratory.



The London Science Museum's replica Difference Engine, built from Babbage's design.
25,000 parts, 15 tons, 8 ft high

Charles Babbage's Analytical Engine

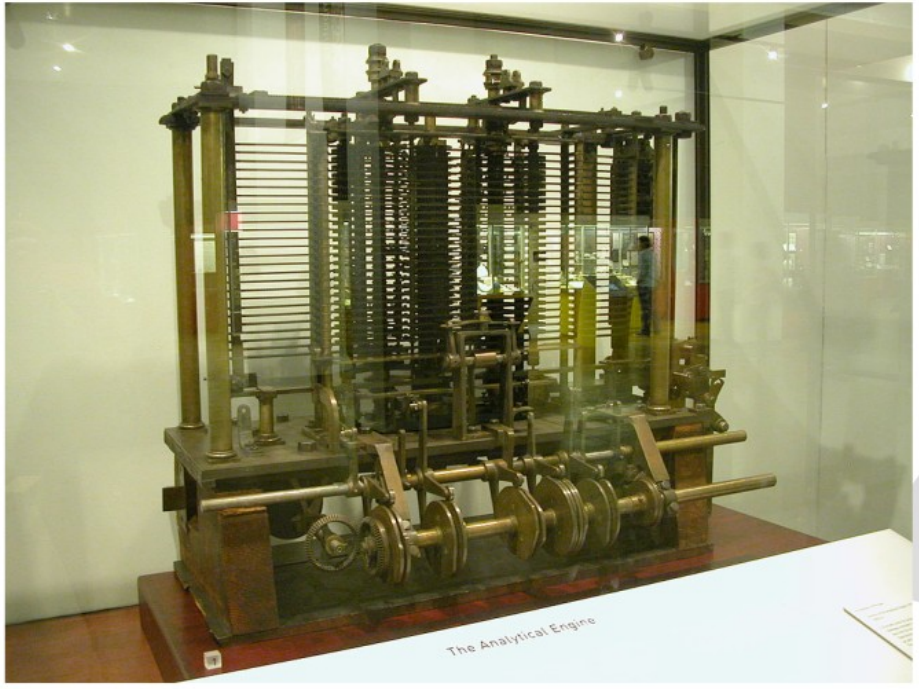


Photo by Bruno Barral

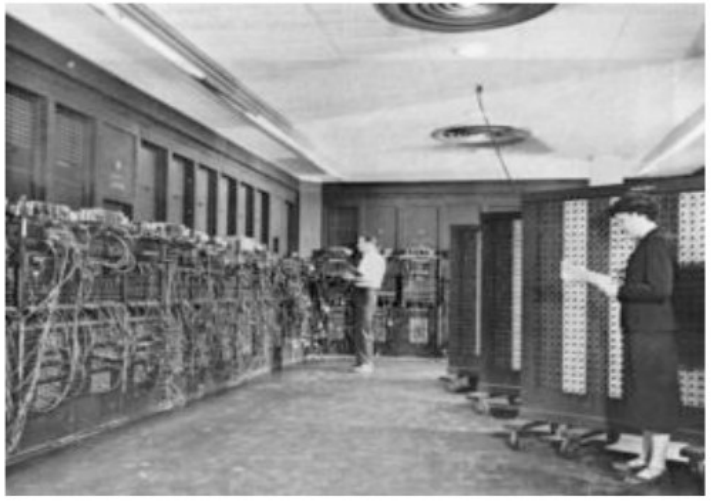
- The London Science Museum's replica Analytical Engine.
- Input of data and programs on punched cards
- Arithmetic unit for +, -, *, /, square root, comparisons
- Memory: 1,000 numbers each 40 digits (16KB)
- Turing complete

The First Programmer

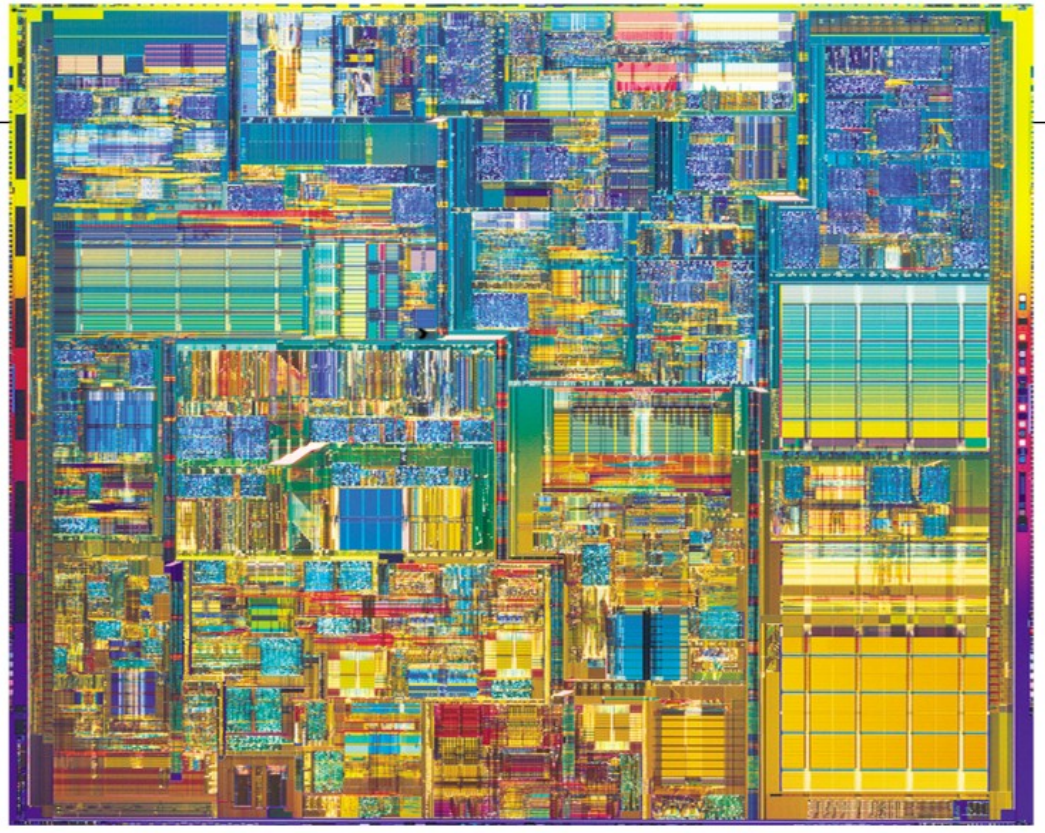
Augusta Ada King, Countess of Lovelace (December 10, 1815 – November 27, 1852), born **Augusta Ada Byron**, is mainly known for having written a description of Charles Babbage's early mechanical general-purpose computer, the analytical engine.

The programming language ADA is named after her

ENIAC – the first electronic computer



ENIAC was massive compared to modern PC standards:
17,468 vacuum tubes, 7,200 crystal diodes, 1,500 relays, 70,000 resistors, 10,000 capacitors, about 5 million hand-soldered joints.
Weighed 27 tons, 2.4 m by 0.9 m by 30 m, 167 m² floor space
150 kW of power



2000: Intel Pentium 4 Processor
Clock speed: 1.5 GHz
Transistors: 42 million
Technology: 0.18µm CMOS
Size: 1.22 cm square

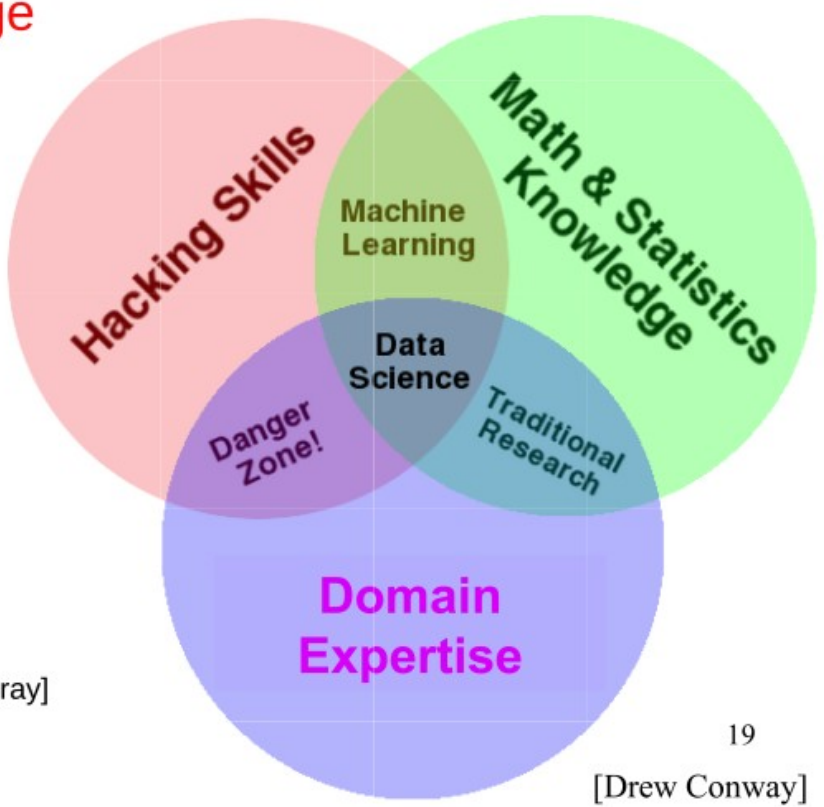
Common uses of a computer

- Store, retreive and process information
  - JEE exam registration, scoring, ranking
  - Payroll in a company
- Services
  - Online shopping, banking, ticket booking
- Perform complex tasks
  - Designing bridges, simulate aerodynamics of a racing car, complex electric circuits
- Embedded computers
  - Lifts, washing machines, Mars rovers, flying aircraft, modern vehicles

- Any questions?

What is Data Science?

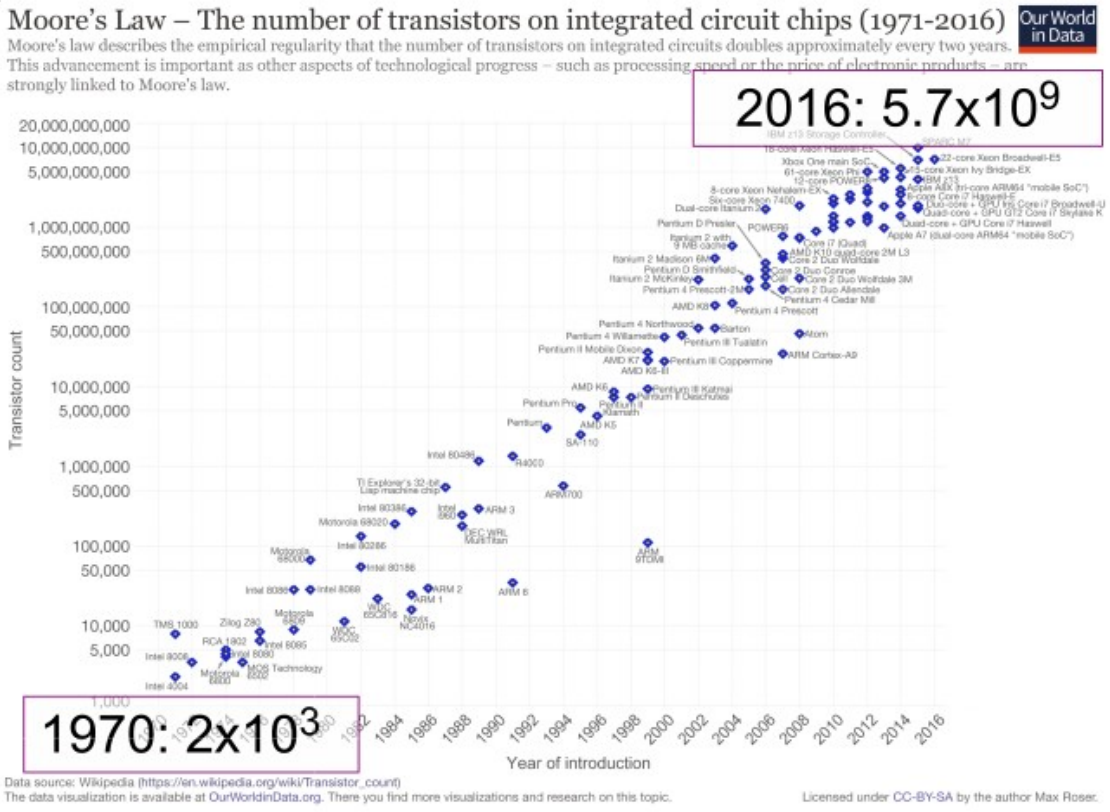
- Application of scientific processes, algorithms and systems to extract knowledge and insights from data in various forms [Wikipedia]
- Aspects of Data Science:
  - Data collection
  - Data analysis
  - Inference
  - Communication of results
- 4th paradigm of science: empirical, theoretical, computational, data science [Jim Gray]



[Drew Conway]

Fundamental Laws (informally)

1. Moore's Law: the performance of computer hardware doubles every 1.5 years



[Wikipedia]

Complicated questions

- *Is it better to start school at a younger age or older age?*
  - Some students join early, some join later
  - Do later students do better?
  - Assesment tests after first year
  - *Any connection between age and performance?*
  - Better measure: total number of years spent in school

Data-driven approach

- Collect relevant data
- Analyse the data
- More insights, better solutions
- Other questions:
  - Average fuel efficiency of a new car
  - Efficacy of a new drug
  - What is the next thing you will buy on Amazon?
  - Make a robot perform an action based on what is in front of it (eg. self-driving car; eg. Spot, the robot dog from Boston Dynamics (Google this for a cool video.))