Essentials of ICT
ICT1113 – Lecture 02

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Lecture 02
Evolution of Computers
(History, Classification and Future Trends)

Learning Objectives

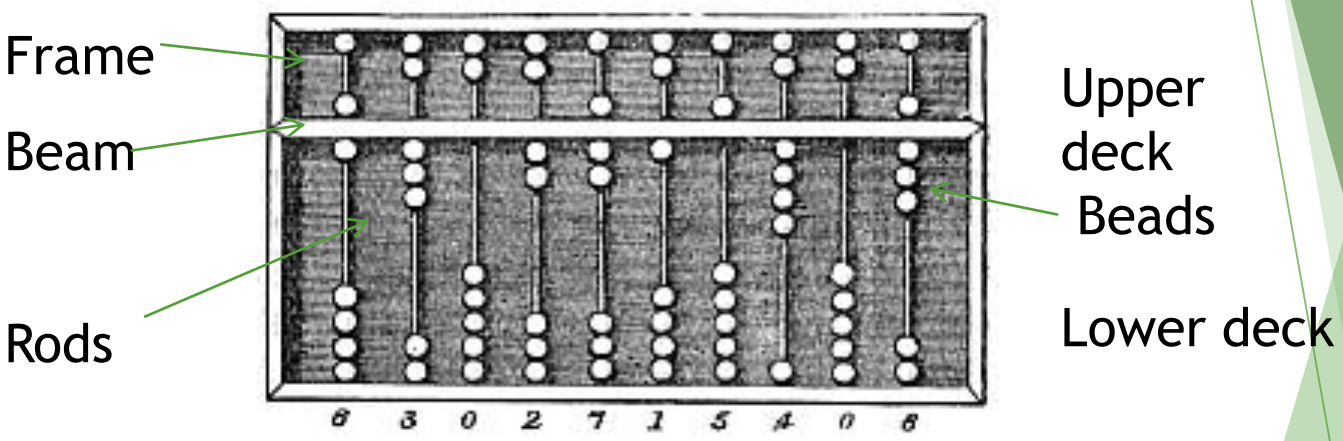
- After completing this chapter you should be able to:
  - Identify key developments related to the computer systems over the history
  - Name and explain important factors about five computer generations

Key Developments

- **Abacus -(3000 BC)**
- Pascaline (1642)
- Analytical engine (1830s)
- Punched cards (1800s)
- Tabulating machine (1890s)
- Konrad Zuse-Z1 computer (1936)
- Atanasoff-Berry Computer/ABC (1937)
- Stibbitz' Computer(1940)
- Mark I (1944)
- **ENIAC (1946)**
- Transistor (1948)
- **Von Neumann machine**
- **EDVAC (1951)**
- UNIVAC (1951)
- **IAS (1952)**
- IBM 701 EDPM Computer (1953)
- FORTRAN (1954)
- **Integrated Circuit(1958)**
- Space War Computer game (1962)
- Mouse (1964)
- ARPANET (1969)
- Intel 1103 Computer memory (1970)
- Intel 4004(1971)
- Floppy Disk (1971)
- Ethernet(1973)
- IBM 5100 (1974-1975)
- Apple I,II (1976-1977)
- VisiCalc Spreadsheet (1978)
- WordStar (1979)
- IBM PC-Home computer
- MS-DOS (1981)
- Apple Lisa (1983)
- Apple Macintosh (1984)
- MS – Windows (1985)

Abacus (3000 BC)

- An ancient calculating device



Chinese Abacus

- **Pascaline (1642)**
  - desktop calculating machine
  - entirely mechanical
  - could only do addition and subtraction
  - developed by Blaise Pascal

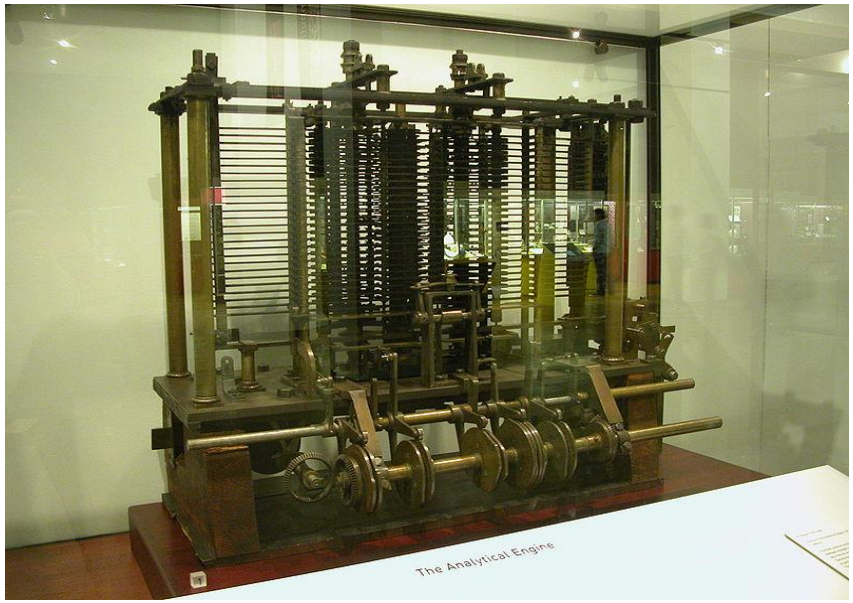
- German mathematician Baron built mechanical machine that could multiply and divide also (1670)

- **Analytical engine(1830s)**
- Prof. of mathematics at the University of Cambridge, Charles Babbage designed and built difference engine
  - could only add and subtract
  - could run only one algorithm
  - Output method: punched results into copper plate
- Analytical engine (1837)
- **store** (memory):capable of holding 1,000 numbers of 50 decimal digits each
- **mill**(computation unit): perform all four arithmetic operations, comparisons and square roots
- **input** section: punched card reader
- **output** section: punched cards and printed output
- **Control**

Analytical engine Contd….

- general purpose
  punch a different program on input card , perform different computations

- most modern computers have very similar structure to analytical engine



Trial model of a part of the Analytical Engine, built by Babbage, as displayed at the Science Museum (London)

- **First computer programmer(1800s)**
  - Ada was the world's first computer programmer
  - Described a way to calculate Bernoulli numbers using the analytical engine
- **Punched Cards (1800s)**
  - represent information by the presence or absence of holes in predefined positions
- **Boolean algebra (1854) by George Boole, the foundation of the hardware design of all modern digital computers**
- **Tabulating machine** (1890s)
  - invented by Herman Hollerith to tabulate 1890 US census data
  - used punched cards

Atanasoff-Berry Computer/ABC (1937)

- Created by John Vincent **A**tanasoff and Clifford E. **B**erry of Iowa State University (US)
- The first fully electronic digital computer
- Not programmable, designed only to solve systems of linear equations
- amazingly advanced for its time
- **Used binary arithmetic**
- **Used capacitors for memory-** similar to modern DRAM
- **Used modern digital switching techniques**, vacuum tubes were used as switches
- Not completed – inadequate hardware technology

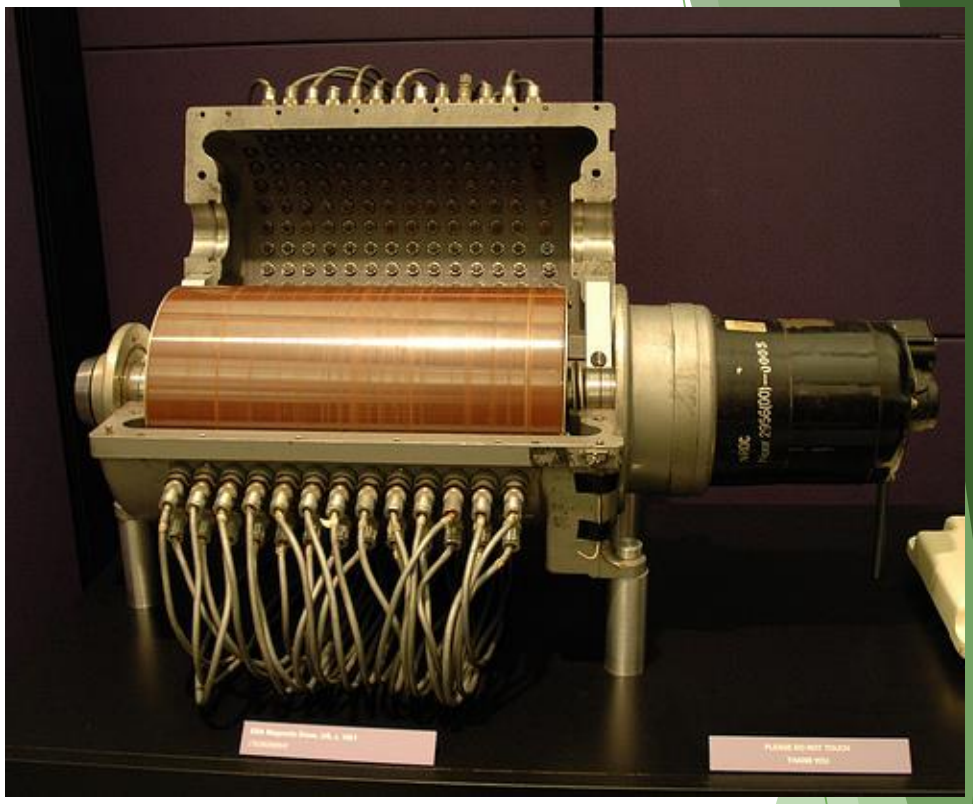
Computer Generations

- History of computer development divided into generations
- Each generation characterized by a major technological development
- Changes in terms of
  - Size
  - Cost
  - Power
  - Efficiency
  - Reliability

First Generation (1945-1955) Vacuum Tubes

- The reason for the electronic computer was World War II
- Used vacuum tubes
- Machine language for programming
- Used magnetic drums for primary memory : limited memory
- Used punch cards for input and outputs : slow
- expensive, massive, unreliable, power consuming
  e.g. ENIAC, EDVAC, UNIVAC ,IBM 701

UNIVAC
Vacuum Tube



Magnetic Drum

ENIAC (1946)

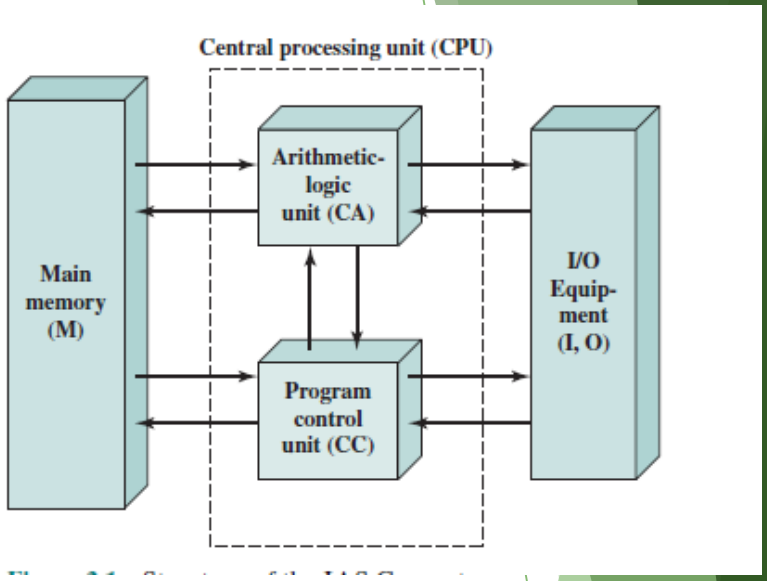
- Electronic Numerical Integrator And Computer
- Invented John Presper Eckert and John William Mauchly
- Numbers were represented in decimal form, and arithmetic was performed in the decimal system
- Consisted of 18,000 vacuum tubes and 1500 relays
- Weighted 30 tons and consumed 140 kW of power
- Had 20 registers, each could hold 10-digit decimal number
- 1000 times faster than the previous electromechanical relay computers
- Punch cards were used as input and output

ENIAC vacuum tubes in holders

Von Neumann Architecture(1947)

- “stored program technique”
- Allows to execute many different programs without changing the physical structure of the computer
- Computer as a fixed physical structure
- This idea became the base for the future generation high-speed computers and is used by modern day computers

Von Neumann Architecture(1947)



Design of the von Neumann architecture

Four basic parts

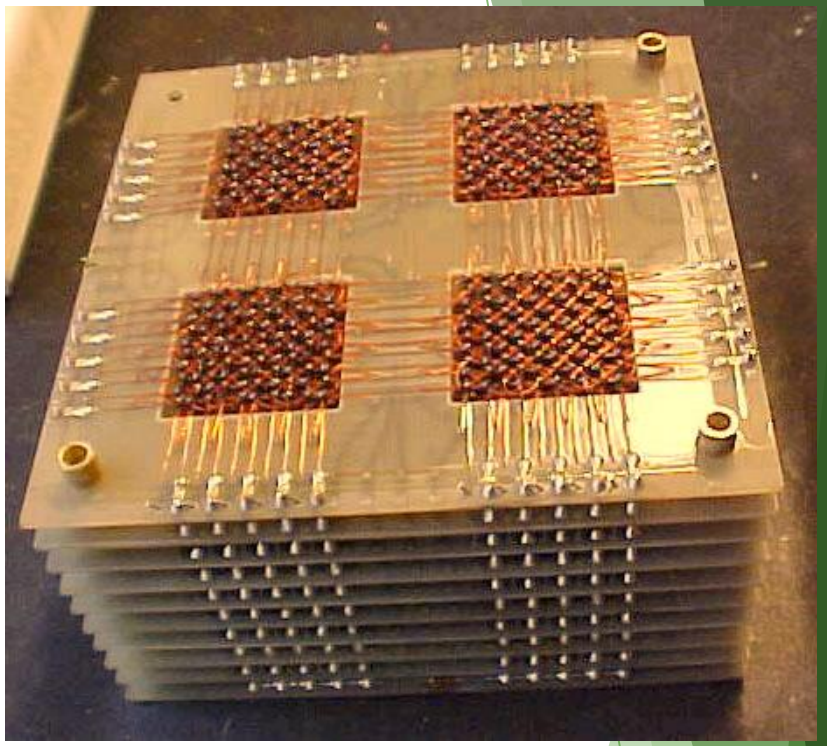
- Memory
- Arithmetic logic unit
- Control unit
- Input and output module

5th : a bus, or wire, that connects the components together and which data flows from one sub-component to another

Second Generation (1956-1965) Transistors

- Assembly languages and early versions of FORTRAN and COBOL
- Used magnetic cores for primary memory –capacity increased
- Increasing processing speed
- Used magnetic tapes and disks for secondary storage
- Smaller, Faster, Cheaper, more energy-efficient and more reliable as compared to vacuum tubes
  e.g. TX-0,PDP-1,IBM 7090,PDP-8

- Transistors



Magnetic Core

- Transistors(1947)
  - semiconductor device used to amplify and switch electronic signals and power
    - invented at Bell labs by John Bardeen, Walter Brattain ,and William Shockley
    - greatly affected the history of computers
    - 1956 Nobel Prize in physics
- FORTRAN (1954)
  - first successful HLL, introduced by IBM
- TX-0
  - first transistorized computer
  - **T**ransistorized e**X**perimental computer 0
  - Successor : TX-2

- PDP-1 (1957)
  - Minicomputer industry was born , cost $120,000
  - Visual display
- IBM 7090
  - Fastest computer in the world at that time ,performance doubled as PDP-1
- Integrated circuit (IC)(1958)
- Spacewar computer game (1962)
  - pdp-1 had visual display , student created a program

to play a game

  - world’s first video game

- PDP-8
  - **first successful commercial minicomputer**
- IBM 1401
  - Little **business oriented machine ,** Before they **produced scientific machines**
- CDC 6600 (1964)
  - first successful supercomputer
  - Faster than IBM 7094
  - Successors 7600,and Cray-1
- Computer Mouse (1964)-Douglas Engelbart

Third Generation (1965-1980) Integrated Circuits

- SSI,MSI,LSI
- Memory capacity was increased
- Speed and efficiency drastically increased
- Keyboard and monitors
- Software industry emerged
- Operating Systems

  e.g. IBM System/360 product line ,

- ARPAnet (1969)
  - Advanced Research Project Agency Network (USA)
  - Origin of Internet
- Intel 1103 computer memory(1970)
  - World's first DRAM chip
- 8" floppy disk(1971)
  - invented by IBM
- Intel 40004 (1971)
  - first microprocessor
- Intel 8008 microprocessor(1972)
- Ethernet computer networking(1973)
  - Robert Metcalfe introduced for network connections
- Apple I, Apple II (1977)
  - Introduced by Apple Computers
- VisiCalc Spreadsheet(1978)
- WordStar Software (1979)

Fourth Generation (1971-Present) Microprocessors

- Used Microprocessors
  - LSI and VLSI, millions of transistors on a single chip
- Smaller and faster computers
- more powerful, compact, reliable, and affordable
- Home computing and embedded computing
  - prices had dropped low, individual could buy their own computer
- Graphics
- Higher level languages like C and C++
- Hand held devices

- First hard disk drive for microcomputers (1980)
- MS-DOS (1981)
- The IBM PC-Home computer(1981)
  - Personal computer revolution
- 3 1/2” floppy drives(1981)
- First CD player(1982)
- Apple Macintosh ,first successful mouse driven, GUI based computer(1984)
- IBM released the personal computer PC-AT (1984)
  - introduced the 16-bit ISA bus

- MS-WINDOWS(1985)
- First CD-ROM drive(1985)
- World Wide Web (WWW)(1990)
  - Hyper Text Markup Language (HTML) also was introduced
- Intel released the Pentium 4 with 3GHz speed (2002)
  - included the Hyper-Threading (HT) technology
- Intel released the Pentium M(2003)
  - for mobile computer systems
- Intel released the dual core processor named Core Duo(2005)

Fifth Generation (Present and Beyond) Artificial Intelligence

- A project to develop intelligent computers
- methods of making computers think like human beings
- based on parallel processing hardware and AI (Artificial Intelligence) software
- Includes:
  - Robotics
  - Neural networks
  - Game Playing
  - Development of expert systems to make decisions in real life situations.
  - Natural language understanding and generation

Performance

Year	Technology	Performance/Cost
1951	Vacuum tube	1
1965	Transistor	35
1975	Integrated Circuit	900
1995	VLSI	2,400,000

Modern Day Computers

- Much advanced than earlier computers
- Help us in our day to day life
- Many different categories of computer systems available, such as:
  - Supercomputers
  - Mainframe computers
  - Minicomputers
  - Network servers
  - Personal computers

Questions ???