Evolution & History of Computers

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Evolution of Computers

Abacus
(3000 BC)

Napier Bones
(1617)

Pascaline
(1642)

Leibniz Wheel
(1685)

Mark I
(1944)

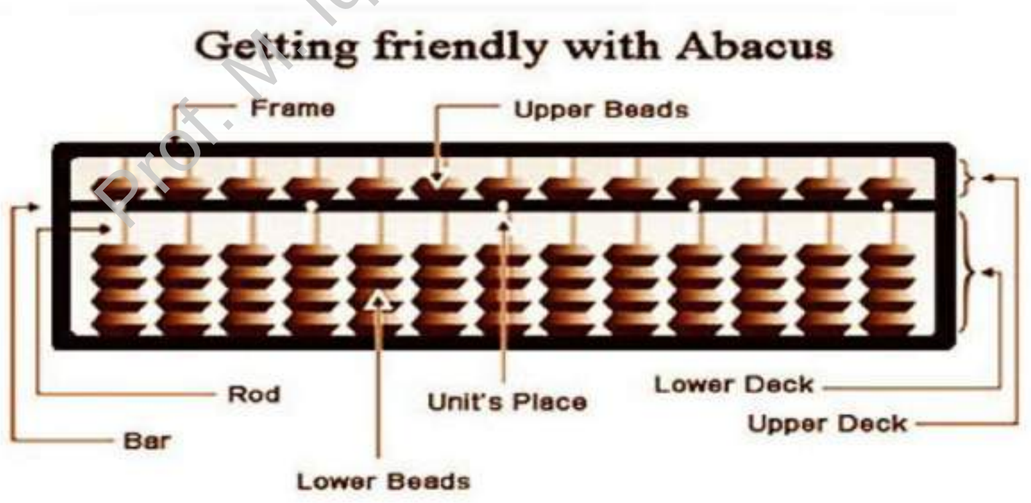
Census Machine
(1889)

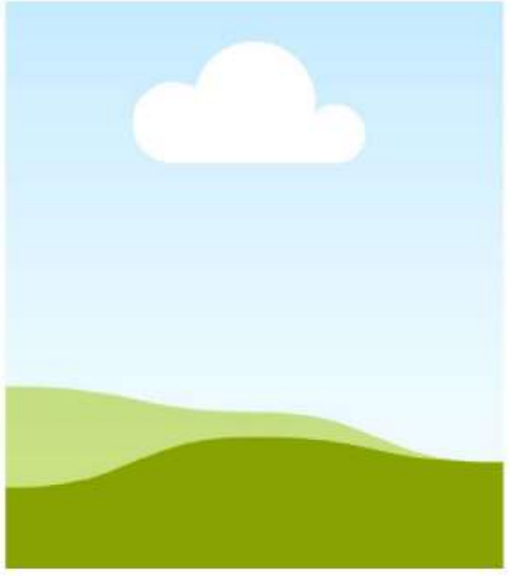
Analytical Engine
(1833)

Jacquard Loom
(1804)

Abacus (3000 BC)

- ***Calculating Machines:*** **ABACUS** was the first mechanical calculating device for counting of large numbers.
- The word ABACUS means calculating board. It consists of bars in horizontal positions on which sets of beads are inserted.
- The horizontal bars have 10 beads each, representing units, tens, hundreds, etc.





Napier's Bones:

- ***Napier's Bones:*** *was a mechanical device built for the purpose of multiplication in 1617 AD by an English mathematician John Napier.*

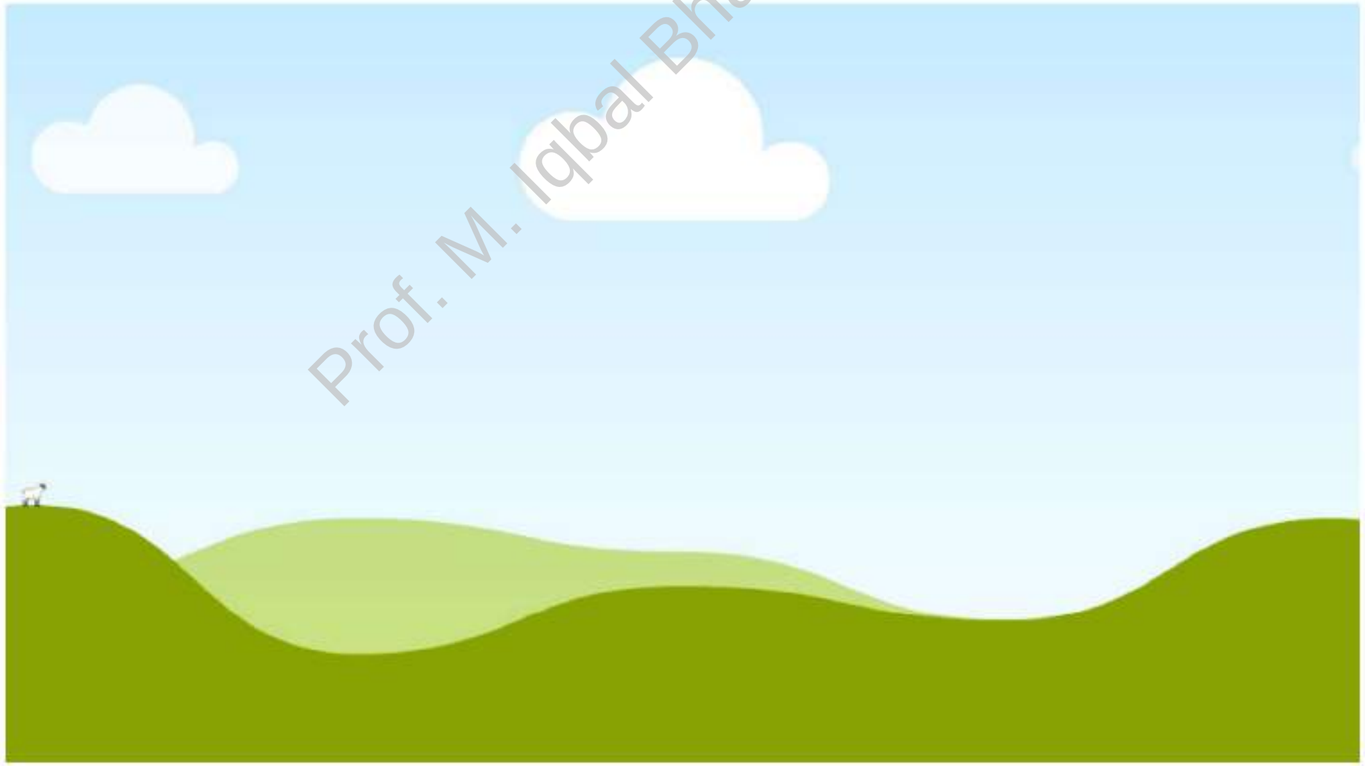
Napier Bones

(1617)


NAPIER'S BONES
Prof. M. Iqbal Bhat (JKHED)

Slide Rule:

- ***Slide Rule:*** *was developed by an English mathematician* ***Edmund Gunter*** *in the 16th century. Using the slide rule, one could perform operations like addition, subtraction, multiplication and division. It was used extensively till late 1970s.*



Pascaline (1642):

- ***Pascal's Adding and Subtraction Machine was developed by Blaise Pascal to help his father with his tax work.***
- ***First attempt towards automating.***
- ***It could add and subtract. The machine consisted of wheels, gears and cylinders.***

Pascaline

(1642)

Leibniz's Wheel (1642):

- ***Leibniz's Multiplication and Dividing Machine*** *was a mechanical device that could both multiply and divide. The German philosopher and mathematician Gottfried Leibniz built it around 1673.*

Leibniz Wheel

(1685)

Jacquard Loom (1804):

- ***Punch Card System*** *was developed by Jacquard to control the power loom in 1801.*
- *He invented the punched card reader that could recognize the presence of hole in the punched card as binary one and the absence of the hole as binary zero.*
- *The Os and 1s are the basis of the modern digital computer.*

Jacquard Loom
(1804)

None of these machines could be programmed or had memory.

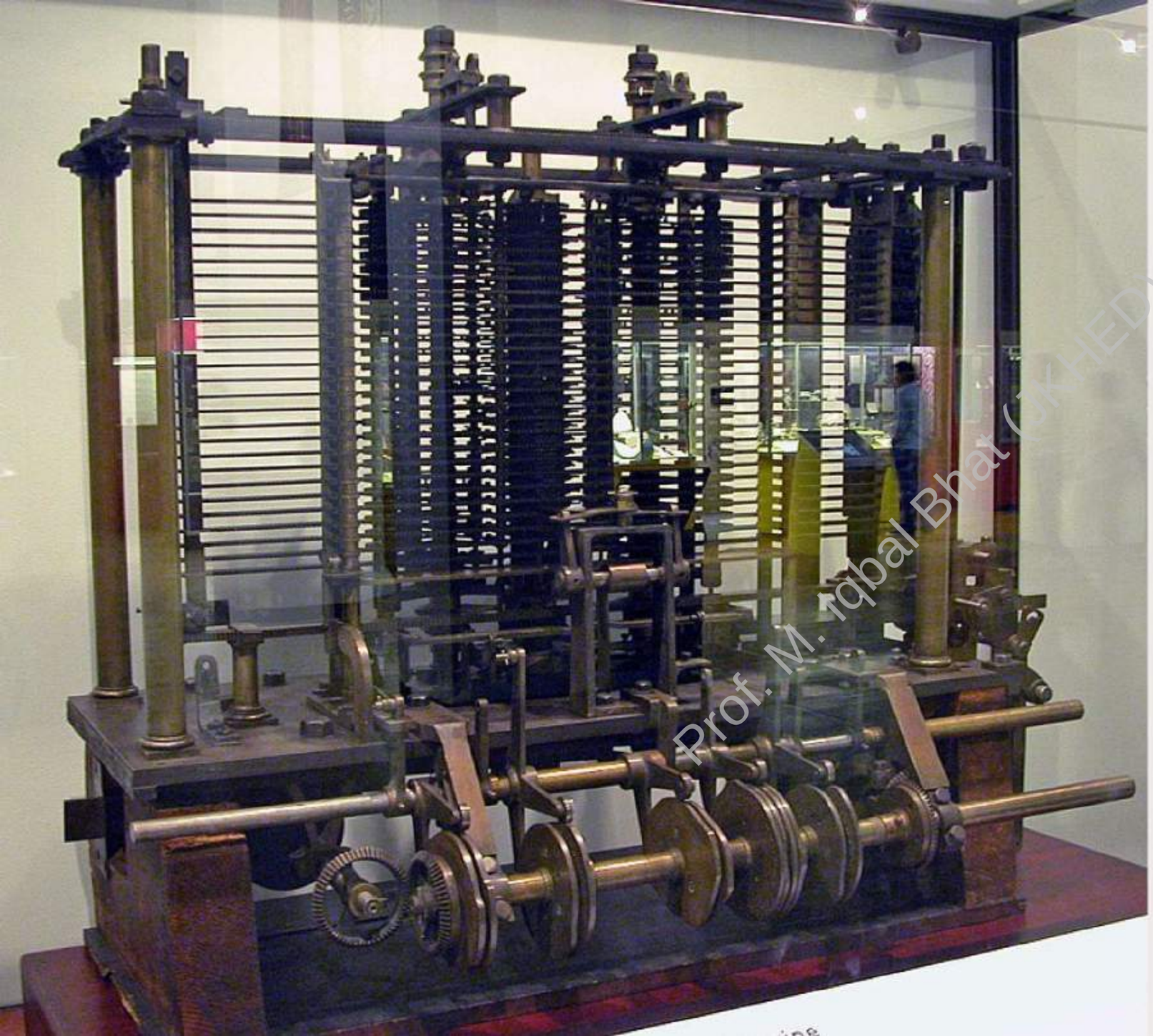
Required manual intervention throughout each step of their calculations.

Charle's Babbage (1823):

"Charles Babbage is also called the father of computers."

Charle's Babbage- Difference Engine (1823):

- ***An English man Charles Babbage built a mechanical machine to do complex mathematical calculations, in the year 1823.***
- ***The machine was called a <u>difference engine</u>.***
- ***It was based on mathematical principal of "finite Differences"***
- ***Used to solve Polynomial and trigonometric functions.***

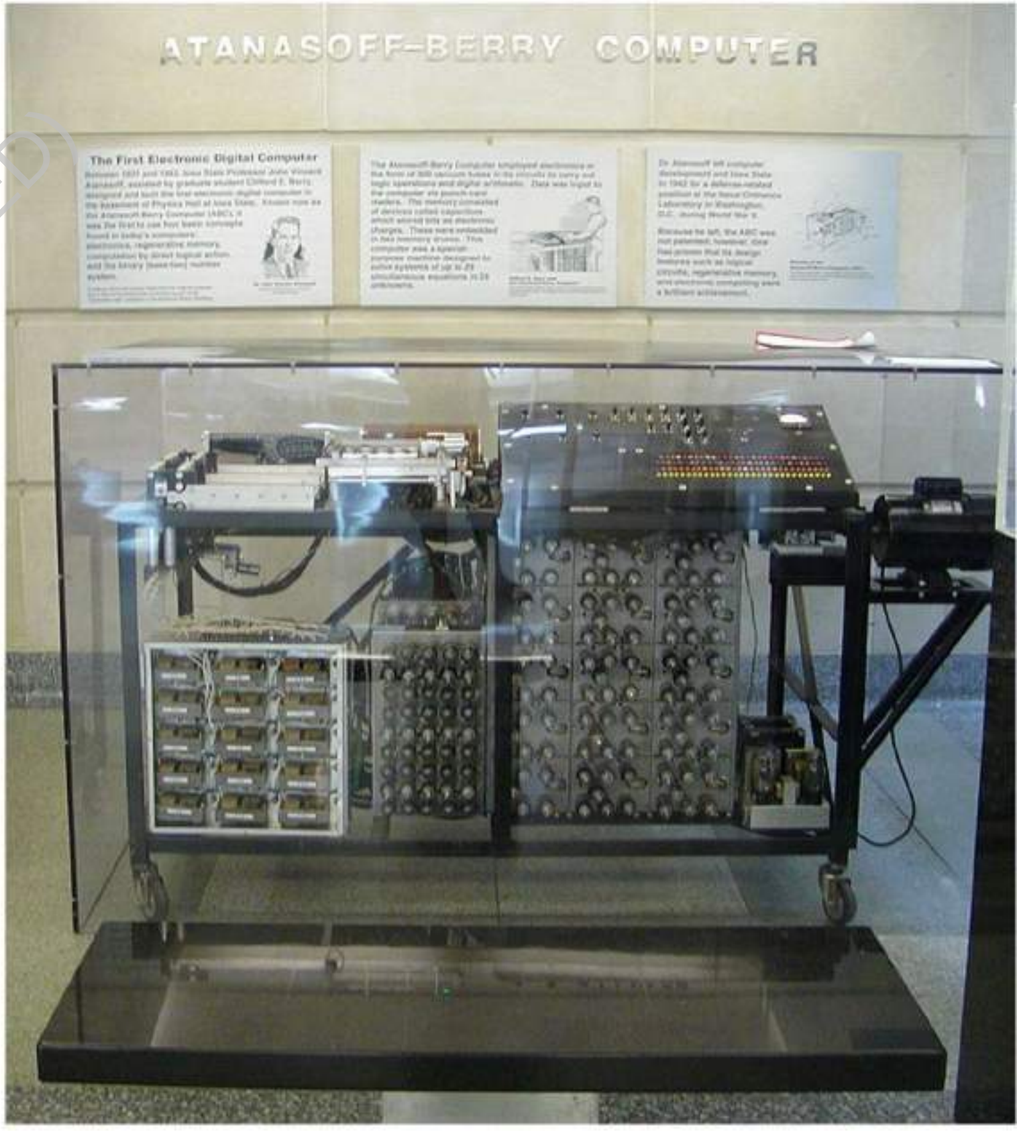


Charle's Babbage- Analytical Engine (1833):

- ***Later, Charles Babbage and Lady Ada Lovelace developed a general-purpose calculating machine, the analytical engine.***
- ***It was first programmable machine.***
- ***Lady Ada Lovelace daughter of poet Lord Byron is the first programmer and wrote program for it.***
- ***It also had conditional and branching logic.***

The Atanasoff Berry Computer (ABC)

- ***The Atanasoff–Berry Computer (ABC)*** *was the first automatic electronic digital computer invented by John Vincent Atanasoff with help of graduate student Clifford Berry.*
- *It was a binary machine built from vacuum tubes.*
- *Released in 1942.*
- *z*



ENIAC : 1945

- ***ENIAC (Electronic Numerical Integrator and Computer)*** *was the first programmable, electronic, general-purpose digital computer, completed in 1945.*
- *ENIAC was designed by John Mauchly and J. Presper Eckert of the University of Pennsylvania, U.S.*
- *It was able to solve "a large class of numerical problems" through reprogramming*
- *ENIAC was designed and primarily used to calculate artillery firing tables for the United States Army's Ballistic Research Laboratory (which later became a part of the Army Research Laboratory)*
- *Used 17468 vacuum tubes and occupied 1800 sq.ft, weighed 30 tons and consumed 174 KW of electricity.*
- *Could perform 5000 additions and 500 multiplications in a minute*
  It was decimal and not binary

The von Neumann Machine (EDVAC)

- ***The task of entering and altering programs for ENIAC was extremely tedious.***
- *Mathematician John von Neumann gave the concept of the* ***"stored program concept."***
- *In 1945 he published the proposal for a new computer the EDVAC (Electronic Discrete Variable Computer).*
- , Unlike ENIAC, it was binary rather than decimal and was designed to be a stored-program computer.
- The EDVAC was a binary serial computer with automatic addition, subtraction, multiplication, programmed division and automatic checking with an ultrasonic serial memory[3] capacity of 1,024 44-bit words, thus giving a memory, in modern terms, of 5.6 kilobytes.
- EDVAC was delivered to the Ballistics Research Laboratory in 1949

Computer Generations

- "*Generation*" in computer talk is a step in technology. It provides a framework for the growth of computer industry
- Originally it was used to distinguish between various hardware technologies, but now it has been to extended include both hardware and softw


Vacuum Tube


Transistors


Integrated Circuit

Microprocessor


Quantum Computer

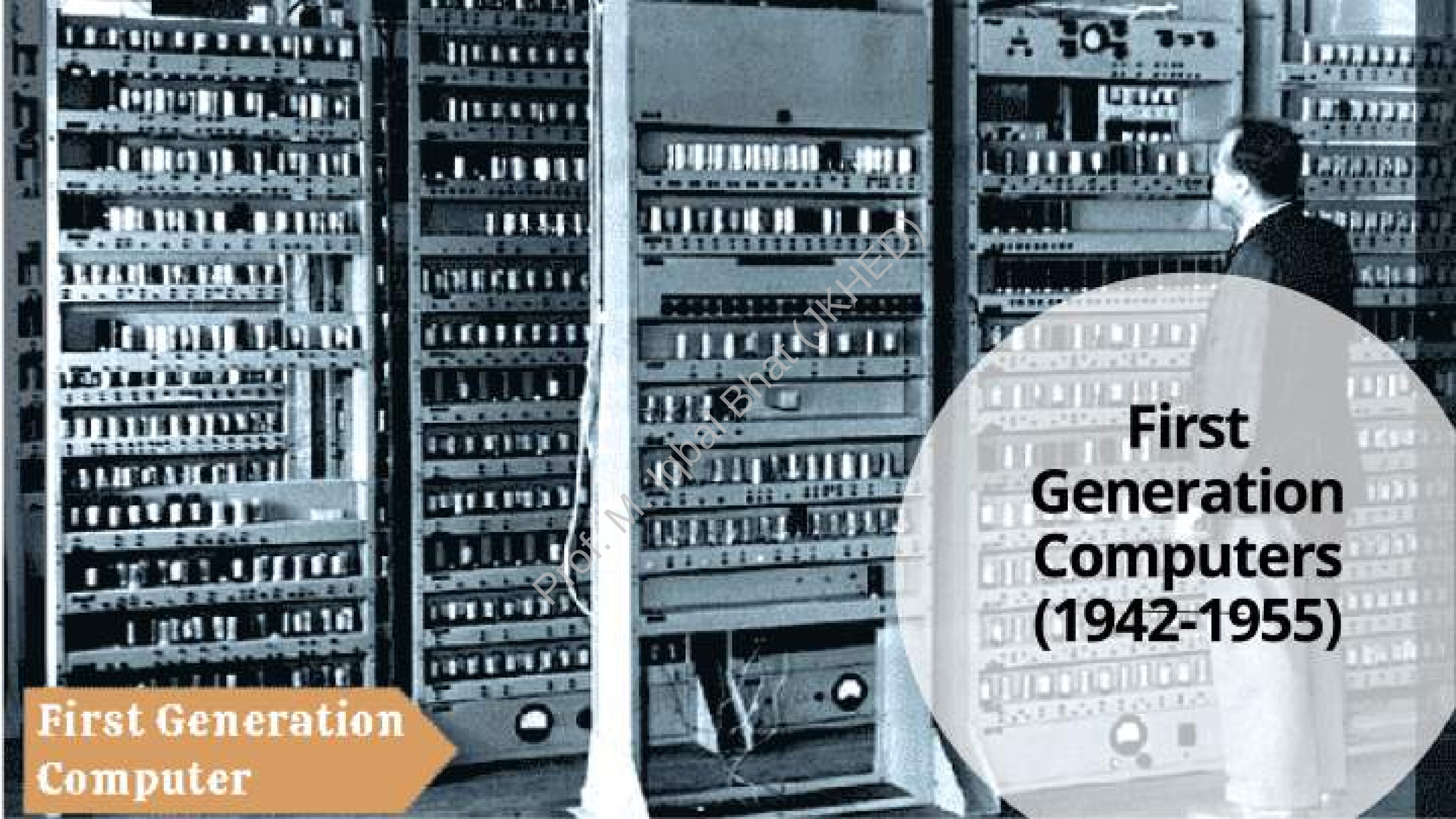

1st Generation Computer


2nd Generation Computer


3rd Generation Computer


4th Generation Computer

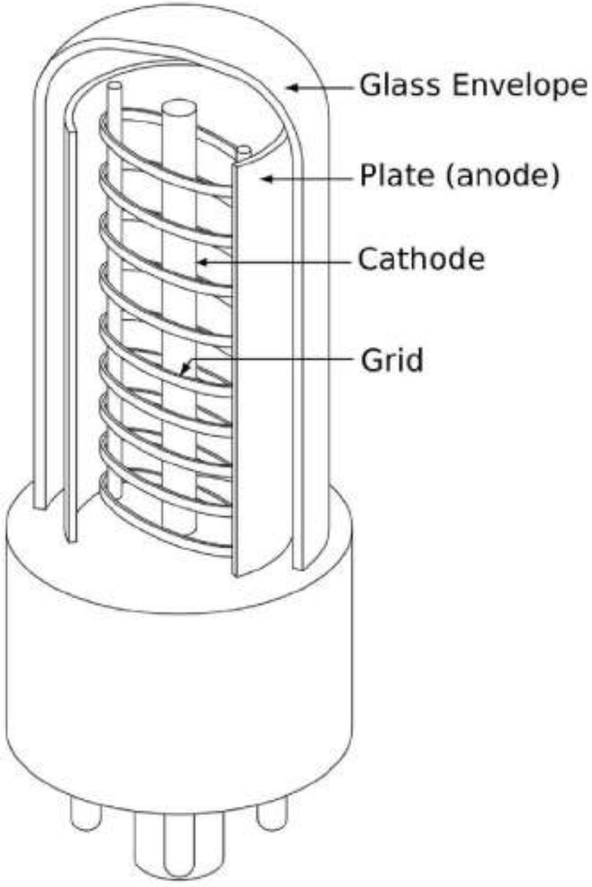

5th Generation Computer



First Generation Computers (1942-1955)

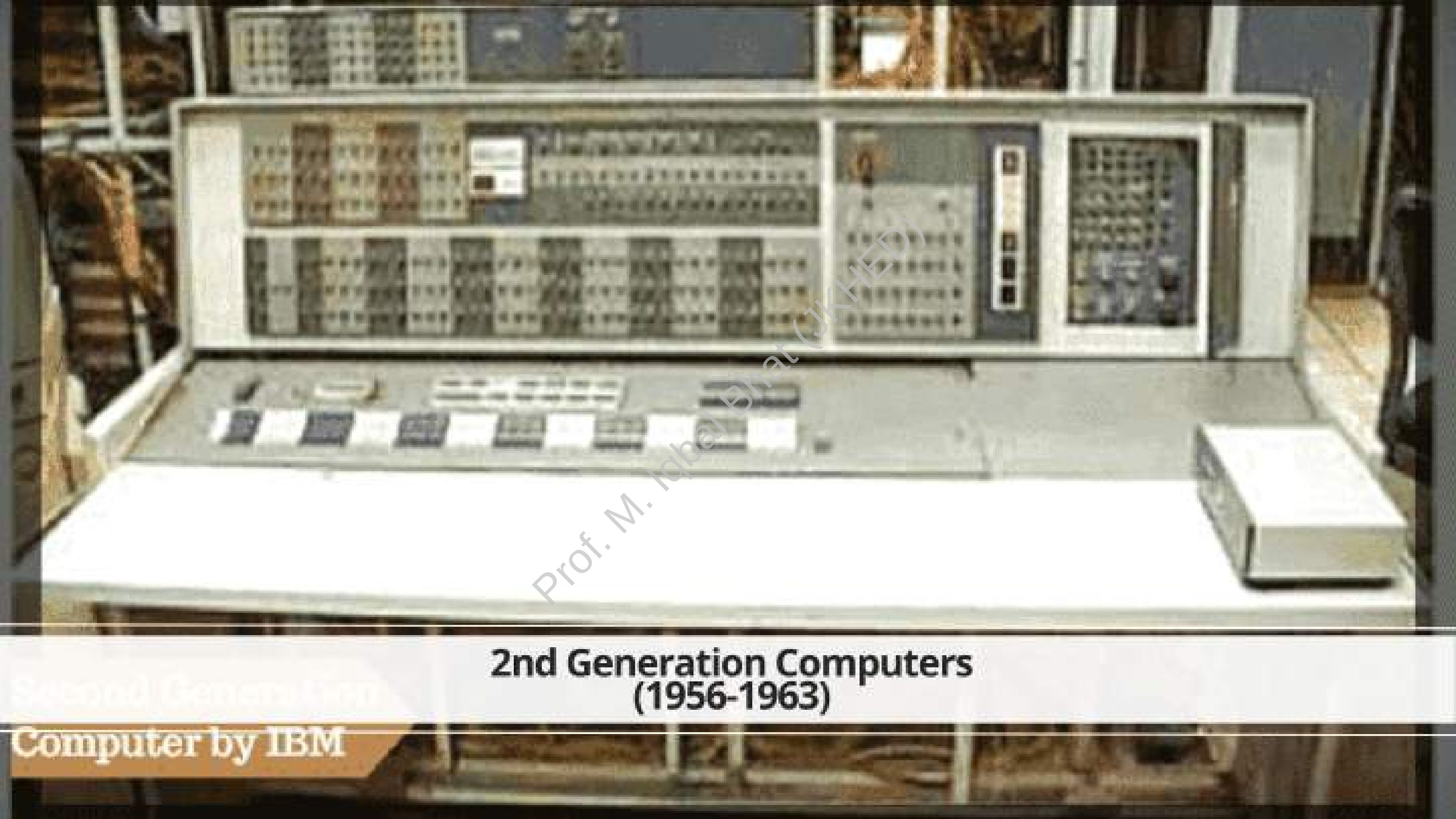
1st Generation Computers (1942-55)

- **Hardware Technology:** The first generation of computers used vacuum tubes for circuitry and magnetic drums for memory.
- The input to the computer was through punched cards and paper tapes. The output was displayed as printouts



1st Generation Computers

- **Software Technology:** The instructions were written in machine language. Machine language uses 0s and 1s for coding of the instructions. The first-generation computers could solve one problem at a time.
- **Computing Characteristics:** The computation time was in milliseconds.
- **Physical Appearance:** These computers were enormous in size and required a large room
- for installation.
- **Application:** They were used for scientific applications as they were the fastest computing device of their time.
- **Examples:** UNIVersal Automatic Computer (UNIVAC), Electronic Numerical Integrator And Calculator (ENIAC), and Electronic Discrete Variable Automatic Computer(EDVAC).

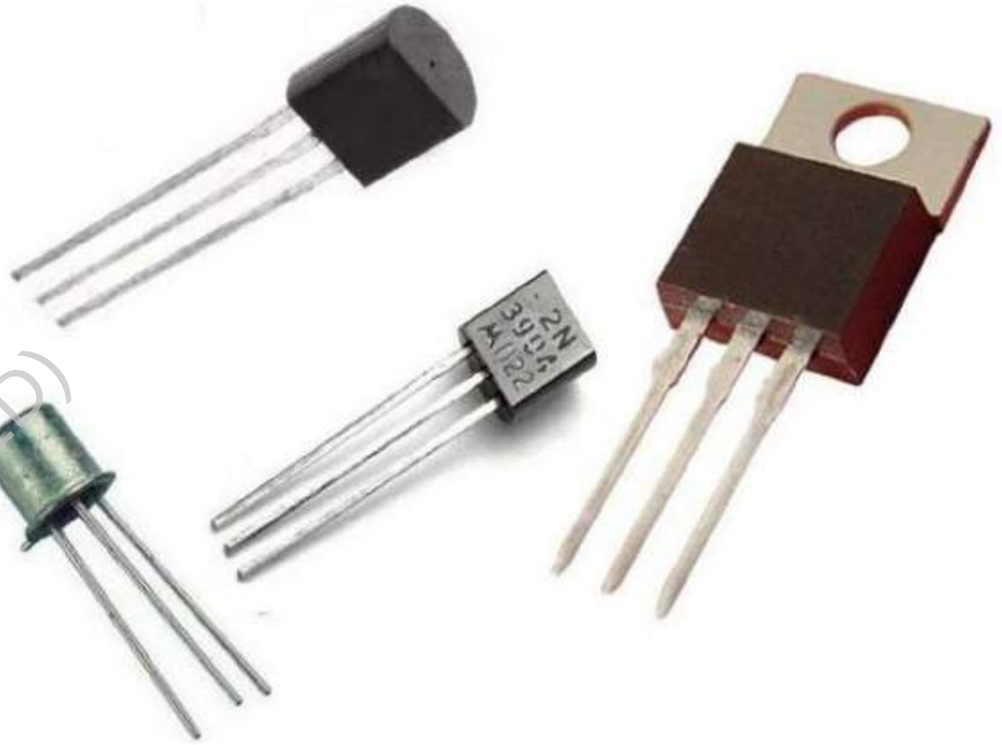


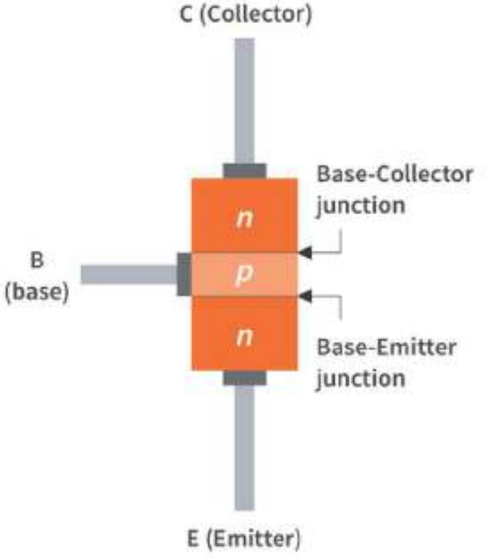
2nd Generation Computers (1956-1963)

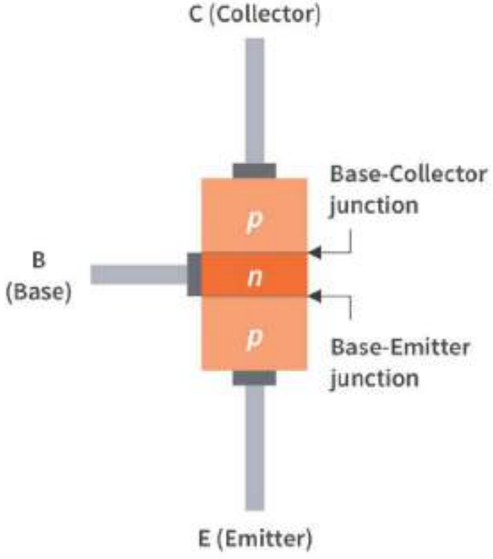
Computer by IBM

2nd Generation Computers (1956-63)

- **Hardware Technology:** Transistors replaced the vacuum tubes of the first generation of computers. Transistors allowed computers to become smaller, faster, cheaper, energy efficient and reliable.
- The second generation computers used magnetic core technology for primary memory. They used magnetic tapes and magnetic disks for secondary storage. The input was still through punched cards and the output using printouts.
- They used the concept of a stored program where instructions were stor of computer.







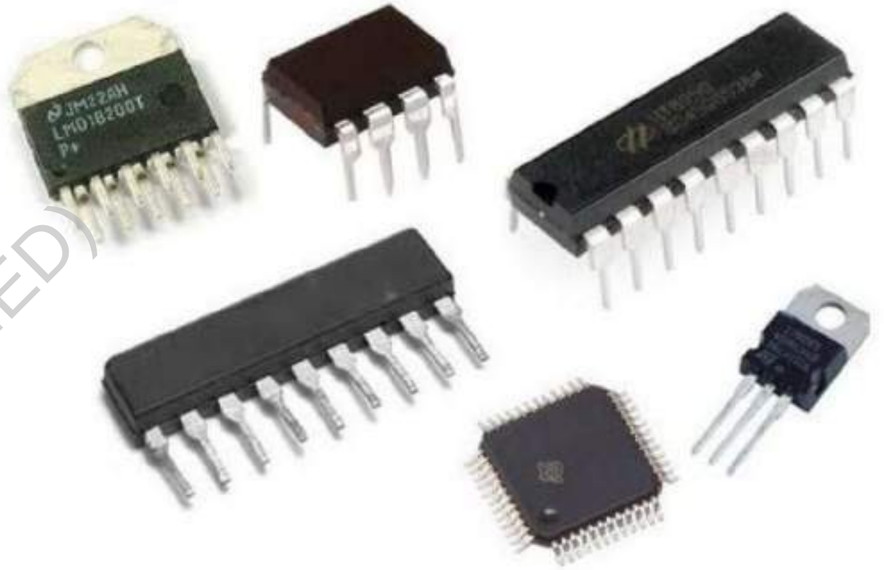
2nd Generation Computers (1956-63)

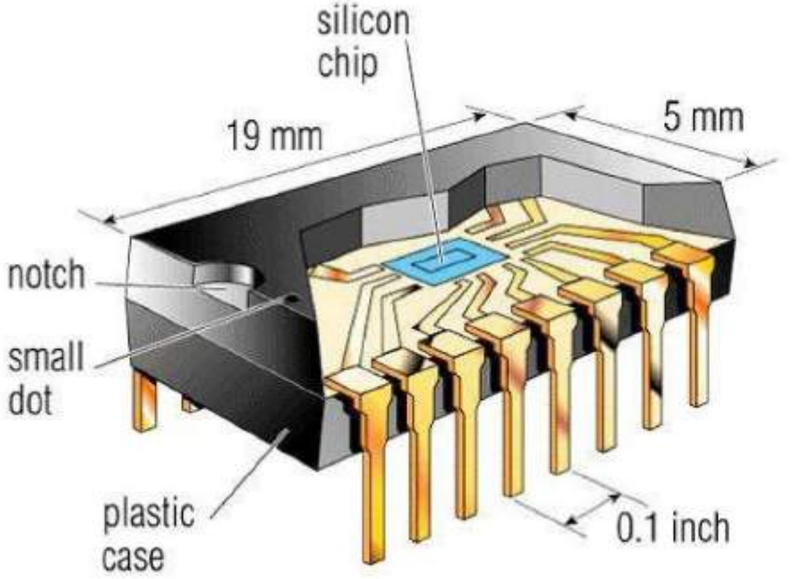
- **Software Technology** The instructions were written using the assembly language. Assembly language uses mnemonics like ADD for addition and SUB for subtraction for coding of the instructions. It is easier to write instructions in assembly language, as compared to writing instructions in machine language. High-level programming languages, such as early versions of COBOL and FORTRAN were also developed during this period.
- **Computing Characteristics** The computation time was in microseconds.
- **Physical Appearance** Transistors are smaller in size compared to vacuum tubes, thus, the size of the computer was also reduced.
- **Application** The cost of commercial production of these computers was very high, though less than the first-generation computers. The transistors had to be assembled manually in second generation computers.
- **Examples** PDP-8, IBM 1401 and CDC 1604.

3rd Generation Computers (1964-1971)

3rd Generation Computers (1964-71)

- **Hardware Technology:** Hardware Technology The third generation computers used the Integrated Circuit (IC) chips. In an IC chip, multiple transistors are placed on a silicon chip. Silicon is a type of semiconductor.
- The use of IC chip increased the speed and the efficiency of computers, manifold.
- The keyboard and monitor were used to interact with the third-generation computer, instead of the punched card and printouts.





3rd Generation Computers (1964-71)

- **Software Technology**. Software Technology The keyboard and the monitor were interfaced through the operating system. Operating system allowed different applications to run at the same time. High-level languages were used extensively for programming, instead of machine language and assembly language.
- **Computing Characteristics** The computation time was in nanoseconds.
- **Physical Appearance** The size of these computers was quite small compared to the second generation computers.
- **Application:** Computers became accessible to a mass audience. Computers were produced commercially and were smaller and cheaper than their predecessors.
- **Examples** IBM 370, PDP 11.

4th Generation Computers (1971-1980)

4th Generation Computers (1971-80)

- **Hardware Technology:** Hardware Technology They use the Large Scale Integration (LSI) and the Very Large Scale Integration (VLSI) technology. Thousands of transistors are integrated on a small silicon chip using LSI technology. VLSI allows hundreds of thousands of components to be integrated into a small chip.
- This era is marked by the development of microprocessors. The microprocessor is a chip containing millions of transistors and components, and, designed using LSI and VLSI technology.
- This generation of computers gave rise to Personal Computer (PC).
- Semiconductor memory replaced the earlier magnetic core memory, resulting in fast random access to memory. Secondary storage device like magnetic disks became smaller in physical size and larger in capacity.
- The linking of computers is another key development of this era. Computers were linked to form networks that led to the emergence of the Internet.
- This generation also saw the development of pointing devices like mouse and handheld devices.

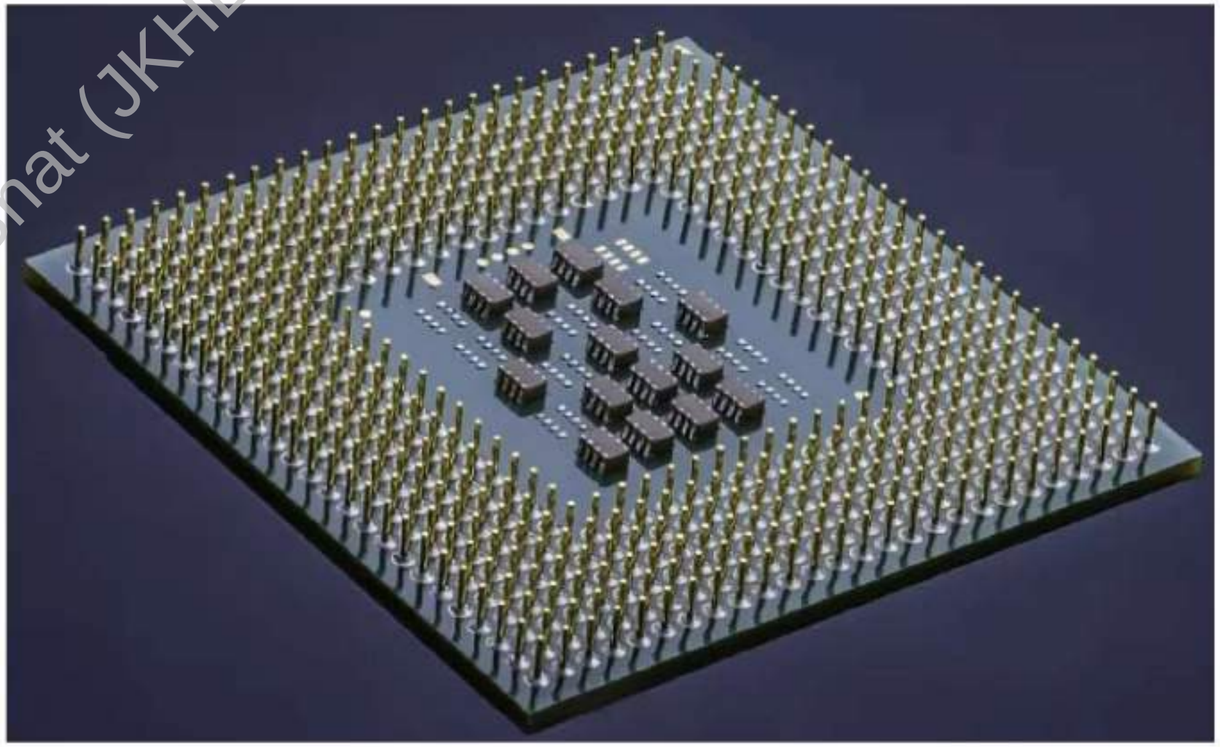
4th Generation Computers (1971-80)

- **Software Technology**. Software Technology Several new operating systems like the MS-DOS and MS Windows developed during this time. This generation of computers supported Graphical User Interface (GUI). GUI is a user-friendly interface that allows user to interact with the computer via menus and icons. High-level programming languages are used for the writing of programs.
- **Computing Characteristics** The computation time is in picoseconds.
- **Physical Appearance** They are smaller than the computers of the previous generation. Some can even fit into the palm of the hand.
- **Application** They became widely available for commercial purposes. Personal computers became available to the home user.
- **Examples** The Intel 4004 chip was the first microprocessor. The components of the computer like Central Processing Unit (CPU) and memory were located on a single chip. In 1981, IBM introduced the first computer for home use. In 1984, Apple introduced the Macintosh.

5th Generation Computers (1980-till date)

5th Generation Computers (1980-till date)

- **Hardware Technology:** The period of the fifth generation is 1980-till date. In the fifth generation, the VLSI technology became ULSI (Ultra Large Scale Integration) technology, resulting in the production of microprocessor chips having ten million electronic components. This generation is based on parallel processing hardware and AI (Artificial Intelligence) software. AI is an emerging branch in computer science, which interprets means and methods of making computers think like human beings.



5th Generation Computers (1980-till date)

- All the high-level languages like C and C++, Java, .Net etc. are used in this generation. Advanced Operating Systems.
- Development of true artificial intelligence
- Development of Natural language processing
- Advancement in Parallel Processing
- Advancement in Superconductor technology
- More user-friendly interfaces with multimedia features
- Availability of very powerful and compact computers at cheaper ra
- **Advantages of Fifth Generation of Computer**
- » Very large storage capacity.
- » Long bit processor builds.
- » Artificial Intelligence Language developed.
- » Advancement in Parallel Processing.
- » Advancement in Superconductor technology.
- » These computers are much smaller in size than other generation

Generation (Period)	Key hardware technologies	Key software technologies	Key characteristics	Some representative systems
First (1942-1955)	• Vacuum tubes • Electromagnetic relay memory • Punched cards secondary storage	• Machine and assembly languages • Stored program concept • Mostly scientific applications	• Bulky in size • Highly unreliable • Limited commercial use and costly • Difficult commercial production • Difficult to use	• ENIAC • EDVAC • UNIVAC I • EDSAC • IBM 701
Second (1955-1964)	• Transistors • Magnetic cores memory • Magnetic tapes • Disks for secondary storage	• Batch operating system • High-level programming languages • Scientific and commercial applications	• Faster, smaller, more reliable and easier to program than previous generation systems • Commercial production was still difficult and costly	• Honeywell 400 • IBM 7030 • UNIVAC LARC • CDC 1604

Generation (Period)	Key hardware technologies	Key software technologies	Key characteristics	Some rep. systems
Third (1964-1975)	· ICs with SSI and MSI technologies · Larger magnetic cores memory · Larger capacity disks and magnetic tapes secondary storage · Minicomputers; upward compatible family of computers	· Timesharing operating system · Standardization of high-level programming languages · Unbundling of software from hardware	· Faster, smaller, more reliable, easier and cheaper to produce than previous generation · Commercially, easier to use, and easier to upgrade · Scientific, commercial and interactive on-line applications systems	· IBM 360/370 · PDP-8 · CDC 6600 · PDP-11

Generation (Period)	Key hardware Technologies	Key software technologies	Key characteristics	Some rep. systems
Fourth (1971-1980)	· ICs with VLSI technology · Microprocessors; semiconductor memory · Larger capacity hard disks as in-built secondary storage · Magnetic tapes and floppy disks as portable storage media · Personal computers · Supercomputers based on parallel vector processing and symmetric multiprocessing technologies · Spread of high-speed computer networks	· Operating systems for PCs with GUI and multiple windows on single terminal screen · Multiprocessing OS with concurrent programming languages · UNIX operating system with C programming language · Object-oriented design and programming · PC, Network-based, and supercomputing applications	· Small, affordable, and reliable, and easy to use PCs · More powerful and reliable mainframe systems and supercomputers · Totally general purpose machines commercially · Rapid software development possible · Easier to produce · Easier to upgrade	· IBM PC and its clones · TRS-80 · Apple II · CRAY-1 · CRAY-X/MP · VAX 9000 · CRAY-2

Generation (Period)	Key hardware technologies	Key software technologies	Key characteristics	Some rep. systems
Fifth (1980-Present)	· ICs with ULSI technology · Larger capacity main memory, hard disks with RAID support · Optical disks as portable read-only storage media · Notebooks, powerful desktop PCs and workstations · Powerful servers, supercomputers · Internet · Cluster computing	· Micro-kernel based, multithreading, distributed OS · Parallel programming libraries like MPI & PVM · JAVA · World Wide Web · Multimedia, Internet applications · More complex supercomputing applications	· Portable computers · Powerful, cheaper, reliable, and easier to use desktop machines · Powerful supercomputers · High uptime due to hot-pluggable components · Rapid software development possible · Totally general purpose machines commercially, · Easier to produce easier to upgrade	· IBM notebooks · Pentium PCs · Workstations SUN · SGI Origin 2000 · PARAM 10000 · IBM SP/2