



# Computer Fundamentals & Programming

## Definition & History

# Definition

**Computer** is a programmable machine.

**Computer** is an electronic device that manipulates information, or data. It has the ability to **store**, **retrieve**, and **process** data.

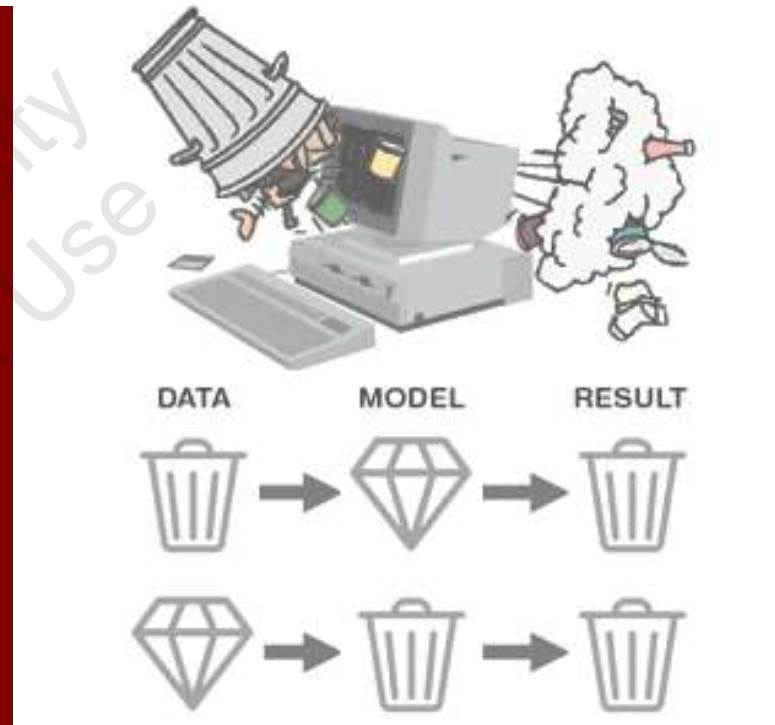
**Computer** is a machine that manipulates data according to a list of instructions (program).

**Computer** is any device which aids humans in performing various kinds of computations or calculations.

# Characteristics of today computers

SPEED	In general, no human being can compete to solve the complex computation, faster than computer.
ACCURACY	Since Computer is programmed, so what ever input we give it gives result accurately.
STORAGE	Computer can store mass storage of data with appropriate format.
DILIGENCE	Computer can work for hours without any break and creating error.
VERSATILITY	We can use computer to perform completely different types of works at the same time.
POWER OF REMEMBERING	It can remember data for us.
NO IQ	Computer does not work without instruction.
NO FEELING	Computer does not have emotions, knowledge, experience, feeling.

# GIGO



# Earliest computers

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Originally calculations were computed by humans, whose job title was computers.

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These human computers were typically engaged in the calculation of a mathematical expression.

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The calculations of this period were specialized and expensive, requiring years of training in mathematics.

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The first use of the word "computer" was recorded in 1613, referring to a person who carried out calculations, or computations, and the word continued to be used in that sense until the middle of the 20<sup>th</sup> century.

# Tally sticks - چوبخط

- A tally stick was an **ancient memory** aid device to record and document numbers, quantities, or even messages.

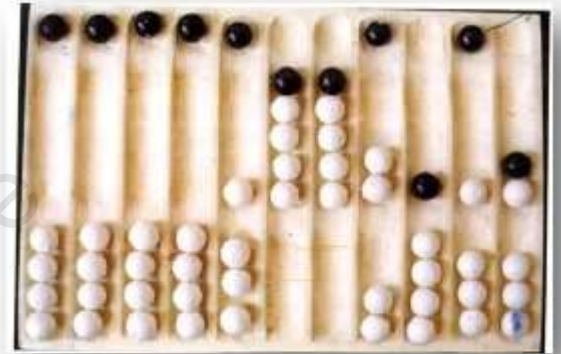


Tally sticks



# چرتکه - Abacus

- The word Abacus is derived from the Greek word 'abax', meaning 'calculating board' or 'calculating table'.
- The abacus was invented in Babylonia in 2400 B.C.
- It is a calculating tool that was in use in Europe, China and Russia, centuries before the adoption of the written Hindu–Arabic numeral system and is still used by merchants, traders and clerks in some parts of Eastern Europe, Russia, China and Africa



Earlier Abacus

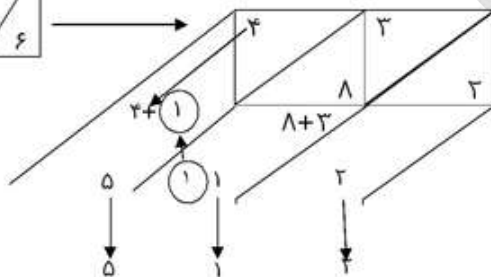


Modern Abacus

# Napier's bones – استخوان های نپیر

- Invented by John Napier in 1614.
- Allowed the operator to multiply, divide and calculate square and cube roots by moving the rods around and placing them in specially constructed boards.

×	۶	۴
۱	۰	۰
۲	۱	۰
۳	۲	۸
۴	۳	۲
۵	۴	۶
۶	۵	۲
۷	۶	۴
۸	۷	۲
۹	۸	۶



John Napier



Napier's Bones



# Napier's bones – استخوان های نپیر

1. The numbers 0-9 are written at the tops of the nine columns in a square

	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>
2		2	4	6	8	10	12	14	16	18
3		3	6	9	12	15	18	21	24	27
4		4	8	12	16	20	24	28	32	36
5		5	10	15	20	25	30	35	40	45
6		6	12	18	24	30	36	42	48	54
7		7	14	21	28	35	42	49	56	63
8		8	16	24	32	40	48	56	64	72
9		9	18	27	36	45	54	63	72	81

3. The numbers 2-9 are written down the left side

The units of the answer are written in the bottom corner

The tens are written in the top corner

2. Diagonal lines split each square in half

4. The numbers at the top are multiplied by each number on the left



1	4	6	7	8	5	3	9	9
2	0/8	1/2	1/4	1/6	1/0	0/6	1/8	1/8
3	1/2	1/8	2/1	2/4	1/5	0/9	2/7	2/7
4	1/6	2/4	2/8	3/2	2/0	1/2	3/6	3/6
5	2/0	3/0	3/5	4/0	2/5	1/5	4/5	4/5
6	2/4	3/6	4/2	4/8	3/0	1/8	5/4	5/4
7	2/8	4/2	4/9	5/6	3/5	2/1	6/3	6/3
8	3/2	4/8	5/6	6/4	4/0	2/4	7/2	7/2
9	3/6	5/4	6/3	7/2	4/5	2/7	8/1	8/1

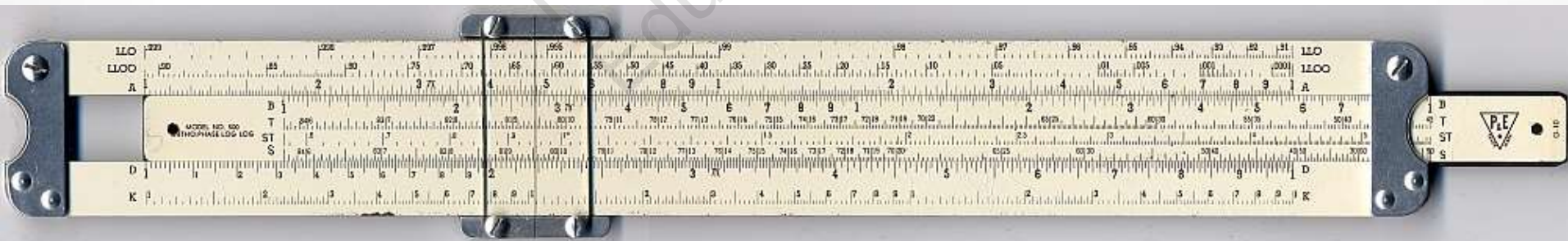
$$\begin{array}{r}
 46785399 \\
 \times 96431 \\
 \hline
 46785399 \\
 140356197 \\
 187141596 \\
 280712394 \\
 + 421068591 \\
 \hline
 4511562810969
 \end{array}$$

# خط کش محاسبه - Slide rule

- Invented by William Oughtred in 1622.
- Is based on Napier's ideas about logarithms
- Used primarily for: multiplication ضرب, division تقسیم, roots ریشه, logarithms لگاریتم, Trigonometry مثلثات
- Not normally used for addition or subtraction.



William Oughtred



Slide Rule



# Calculating Clock – ساعت محاسباتی

- Invented by Wilhelm Schickard in 1623.
- Used gears for the first time.



# Pascaline – پاسکالین

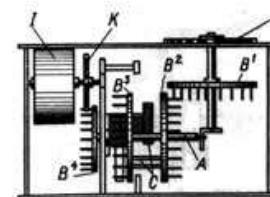
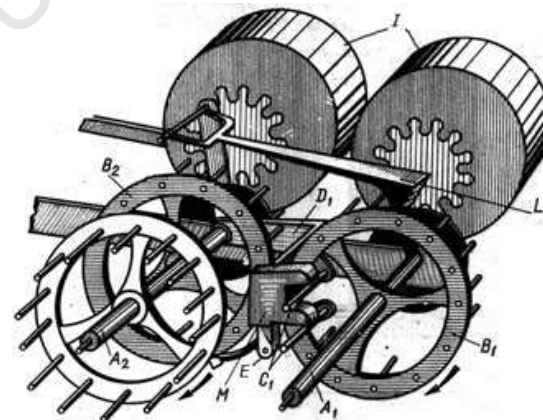
- Invented by Blaise Pascal in 1642.
- It was its limitation to addition and subtraction.
- It was expensive.



Blaise Pascal



Pascaline

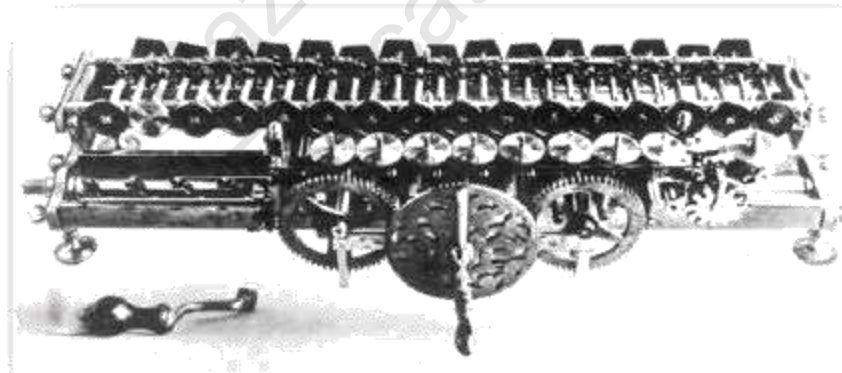


# Stepped Reckoner – محاسب پله ای

- Invented by Gottfried Wilhelm Leibniz in 1672.
- The machine that can add, subtract, multiply and divide automatically.



Gottfried Wilhelm Leibniz

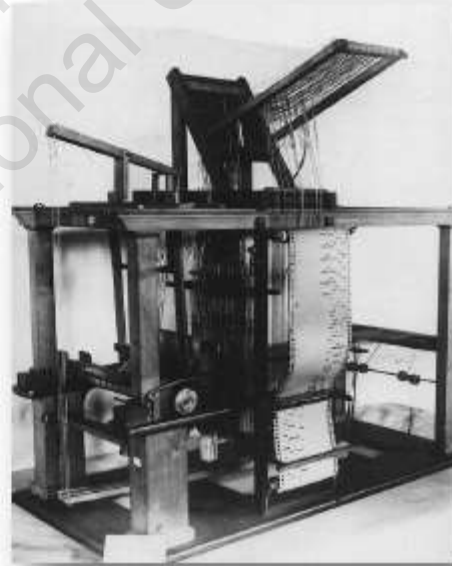


# Jacquard Loom - دستگاه بافندگی جاکوارد

- The Jacquard loom is a mechanical loom, invented by Joseph-Marie Jacquard in 1881.
- It is an automatic loom controlled by punched cards.



Joseph-Marie Jacquard



Jacquard Loom



# Arithmometer

- A mechanical calculator invented by Thomas de Colmar in 1820.
- The first reliable, useful and commercially successful calculating machine.
- The machine could perform the four basic mathematic functions.
- The first mass-produced calculating machine.



Thomas de Colmar

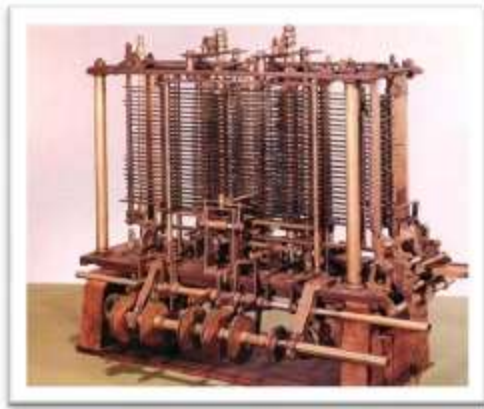


Arithmometer



# Difference Engine and Analytical Engine

- Automatic, mechanical calculator designed to tabulate polynomial functions.
- Invented by **Charles Babbage** in **1822** and **1834**
- It is the first mechanical computer.



Difference  
Engine



Analytical  
Engine



Charles Babbage



# First Computer Programmer

- In 1840, Augusta Ada Byron suggests to Babbage that he use the binary system.
- She writes programs for the Analytical Engine.



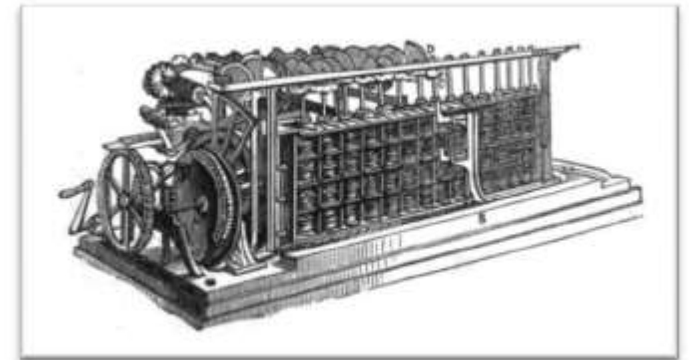
Augusta Ada Byron

# Scheutizian Calculation Engine

- Invented by Per Georg Scheutz in 1843.
- Based on Charles Babbage's difference engine with printing ability.



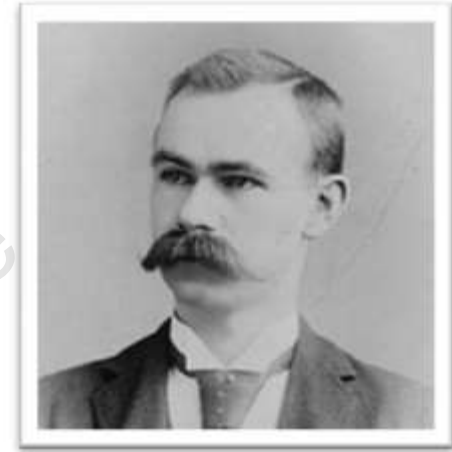
Per Georg Scheutz



Scheutizian Calculation Engine

# Tabulating Machine – ماشین جدول بندی

- Invented by Herman Hollerith in 1890.
- To assist in summarizing information and accounting.



Herman Hollerith



Tabulating Machine



# Harvard Mark 1

- Also known as IBM Automatic Sequence Controlled Calculator (ASCC).
- Invented by Howard H. Aiken in 1943.
- The first electro-mechanical computer.



Howard H. Aiken



Mark 1

# Z1

- The first programmable computer.
- Created by Konrad Zuse in Germany from 1936 to 1938.
- To program the Z1 required that the user insert punch tape into a punch tape reader and all output was also generated through punch tape.



Konrad Zuse

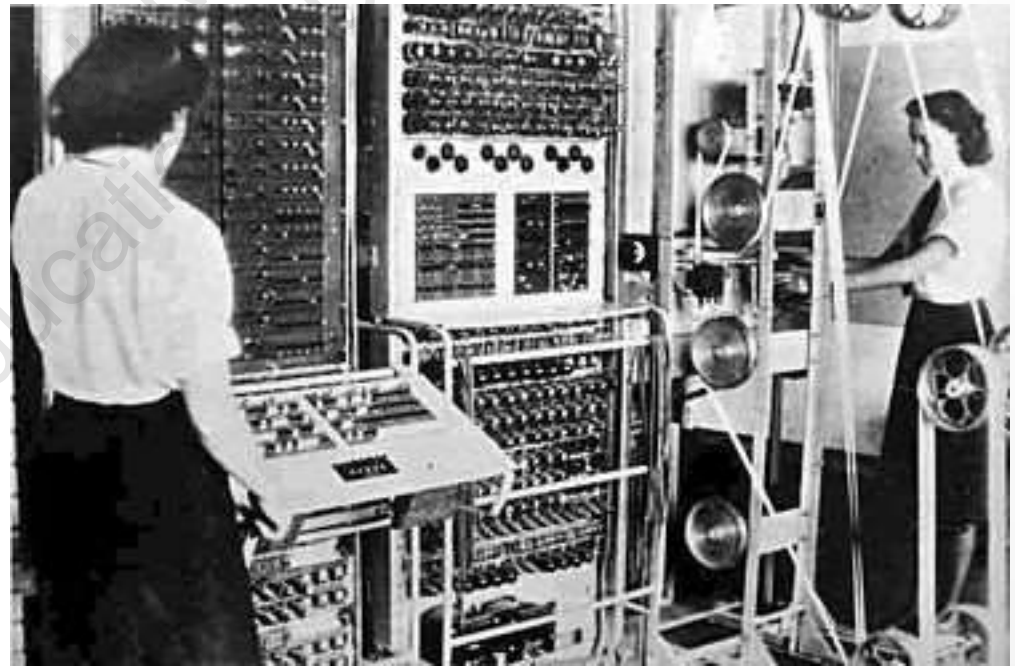


Z1

# Colossus

Colossus was a set of computers developed in Britannia in 1943-1945 .

The purpose was breaking German secret messages during world war 2.

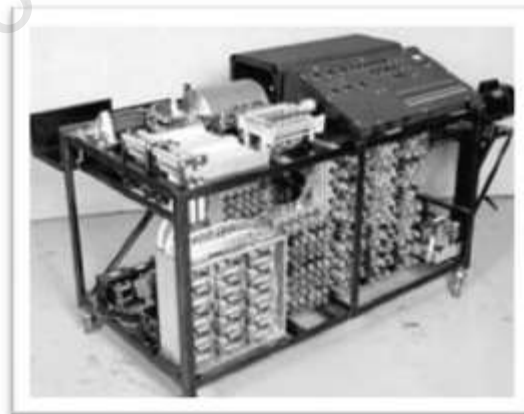


# Atanasoff-Berry Computer (ABC)

- Invented by Professor John Atanasoff and graduate student Clifford Berry at Iowa State University between 1939 and 1942.



Professor John Atanasoff



Atanasoff-Berry Computer



# ENIAC

- ENIAC stands for Electronic Numerical Integrator and Computer.
- It was the first electronic general-purpose computer.
- Completed in 1946.
- Developed by John Presper Eckert and John Mauchly.



ENIAC



# UNIVAC 1

- The UNIVAC I (UNIVERSal Automatic Computer 1) was the first commercial computer.
- Designed by John Presper Eckert and John Mauchly.



UNIVAC 1

# UNIVAC Customers

<b>Date</b>	<b>Customer</b>	<b>Comments</b>
1951	U.S. Census Bureau, Suitland, MD	Not shipped until 1952
1952	U.S. Air Force	Pentagon, Arlington, VA
1952	U.S. Army Map Service	Washington, DC. Operated at factory
1953	New York University (for the Atomic Energy Commission)	New York, NY
1953	Atomic Energy Commission	Livermore, CA
1953	U.S. Navy	David W. Taylor Model Basin, Bethesda, MD
1954	Remington Rand	Sales office, New York, NY
1954	General Electric	Appliance Division, Louisville, KY. First business sale.
1954	Metropolitan Life	New York, NY
1954	U.S. Air Force	Wright-Patterson AFB, Dayton, OH
1954	U.S. Steel	Pittsburgh, PA
1954	Du Pont	Wilmington, DE
1954	U.S. Steel	Gary, IN
1954	Franklin Life Insurance	Springfield, IL
1954	Westinghouse	Pittsburgh, PA
1954	Pacific Mutual Life Insurance	Los Angeles, CA
1954	Sylvania Electric	New York, NY
1954	Consolidated Edison	New York, NY



# EDVAC

- EDVAC stands for Electronic Discrete Variable Automatic Computer
- The First Stored Program Computer
- Designed by Von Neumann in 1952.
- It has a memory to hold both a stored program as well as data.



EDVAC

# The First Portable Computer

- Osborne 1 – the first portable computer.
- Released in 1981 by the Osborne Computer Corporation.



Osborne 1

# The First Computer Company

- The first computer company was the Electronic Controls Company.
- Founded in 1949 by John Presper Eckert and John Mauchly.



# Computer Generations

There are five generations of computer:

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**First generation – 1946 - 1958**

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**Second generation – 1959 - 1964**

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**Third generation – 1965 - 1970**

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**Fourth generation – 1971 - today**

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**Fifth generation – Today to future**



# The First Generation

- The first computers used vacuum tubes for circuitry and magnetic drums for memory, and were often enormous, taking up entire rooms.
- They were very expensive to operate and in addition to using a great deal of electricity, generated a lot of heat, which was often the cause of malfunctions.



Vacuum tube

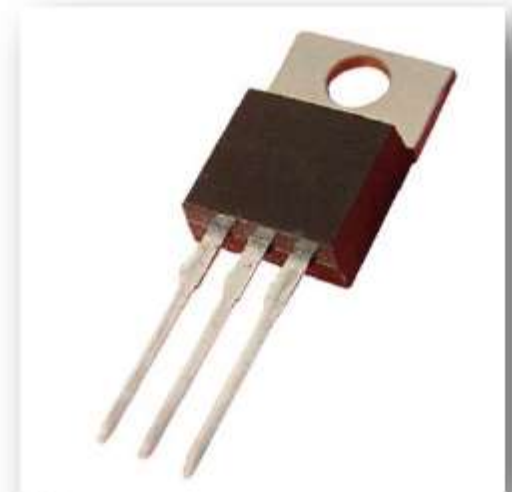
# The First Generation

- First generation computers relied on machine language, the lowest-level programming language understood by computers, to perform operations, and they could only solve one problem at a time.
- Input was based on punched cards and paper tape, and output was displayed on printouts.
- Examples:
  - – ENIAC
  - – EDSAC
  - – UNIVAC I, UNIVAC II, UNIVAC 1101



# The Second Generation

- Transistors replaced vacuum tubes in the second generation of computers.
- One transistor replaced the equivalent of 40 vacuum tubes.
- Allowing computers to become smaller, faster, cheaper, more energy-efficient and more reliable.
- Still generated a great deal of heat that can damage the computer.

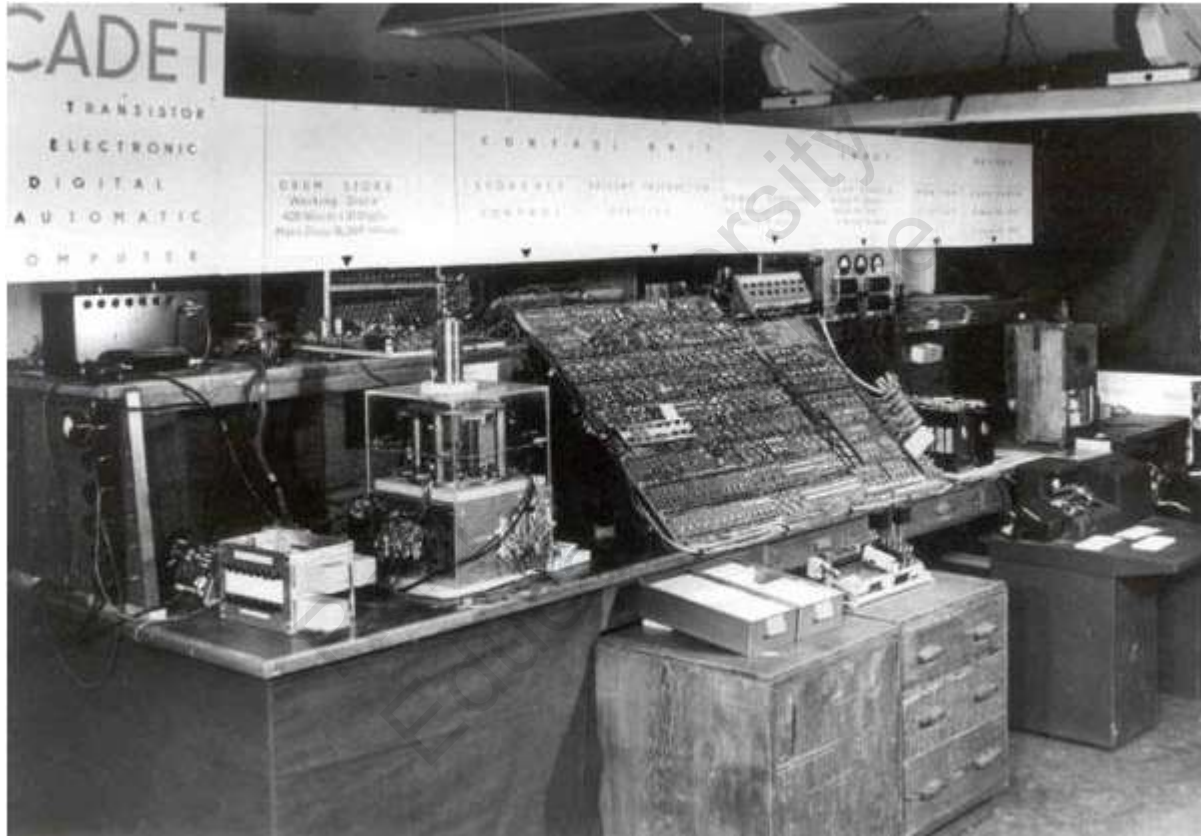


Transistor

# The Second Generation

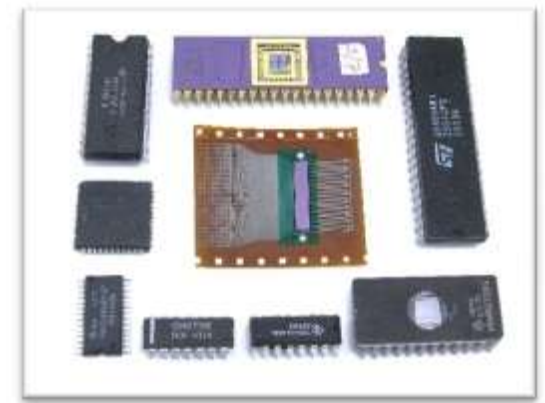
- Second-generation computers moved from cryptic binary machine language to symbolic, or assembly, languages, which allowed programmers to specify instructions in words.
- Second-generation computers still relied on punched cards for input and printouts for output.
- These were also the first computers that stored their instructions in their memory, which moved from a magnetic drum to magnetic core technology.
- Examples: UNIVAC III, RCA 501, Philco Transact S-2000, NCR 300 series, IBM 7030 Stretch, IBM 7070, 7080, 7090 series

# The Second Generation



# The Third Generation

- The development of the integrated circuit was the sign of the third generation of computers.
- Transistors were miniaturized and placed on silicon chips, called semiconductors, which drastically increased the speed and efficiency of computers. It could carry out instructions in billionths of a second.
- Much smaller and cheaper compare to the second generation computers.



Integrated Circuit

# The Third Generation

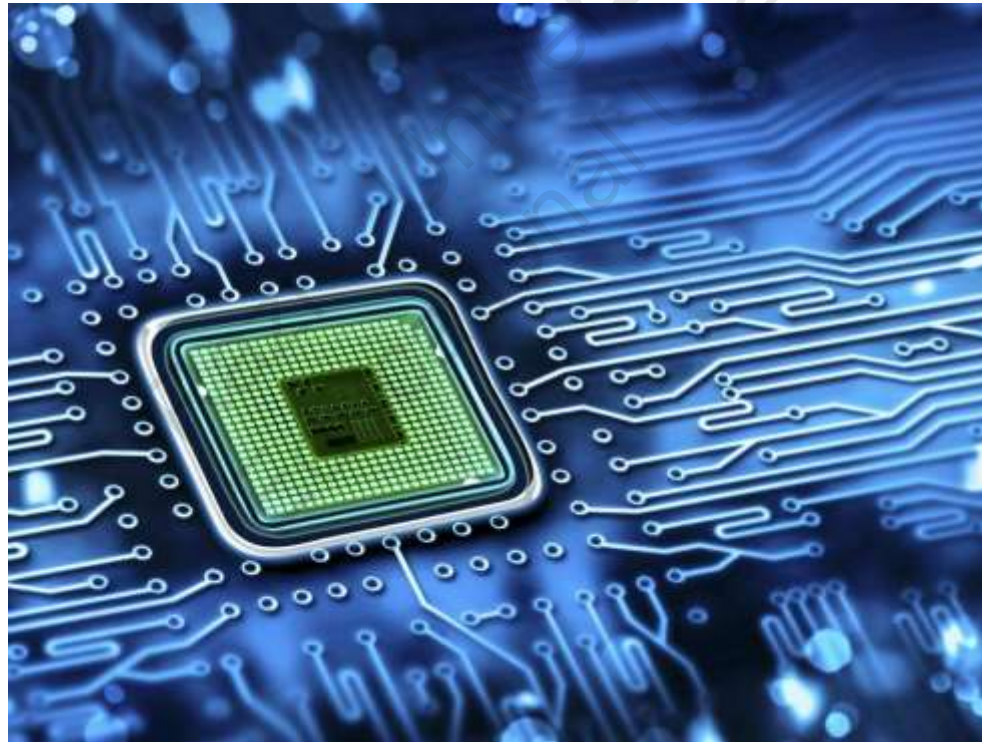
- Users interacted with third generation computers through keyboards and monitors and interfaced with an operating system, which allowed the device to run many different applications at one time with a central program that monitored the memory.
- Computers for the first time became accessible to a mass audience because they were smaller and cheaper than their predecessors.
- Examples: Burroughs 6700, Control Data 3300, 6600, 7600, Honeywell 200, IBM System/360, System 3, System 7

# The Third Generation



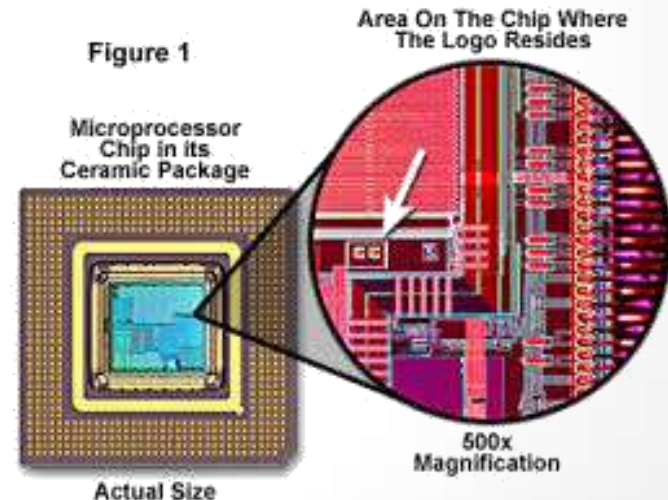
# The Fourth Generation

- The microprocessor brought the fourth generation of computers, as thousands of integrated circuits were built onto a single silicon chip.



# The Fourth Generation

- As these small computers became more powerful, they could be linked together to form networks, which eventually led to the development of the Internet.
- Fourth generation computers also saw the development of GUIs, the mouse and handheld devices.





# The Fifth Generation

- Based on Artificial Intelligence (AI).
- Still in development.
- The use of parallel processing and superconductors is helping to make artificial intelligence a reality.
- The goal is to develop devices that respond to natural language input and are capable of learning and self-organization.
- There are some applications, such as voice recognition, that are being used today.

