Introduction to Computer and Information Systems
INSY1011

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CHAPTER ONE

Overview of Computers and their Historical Development

Overview of Computers

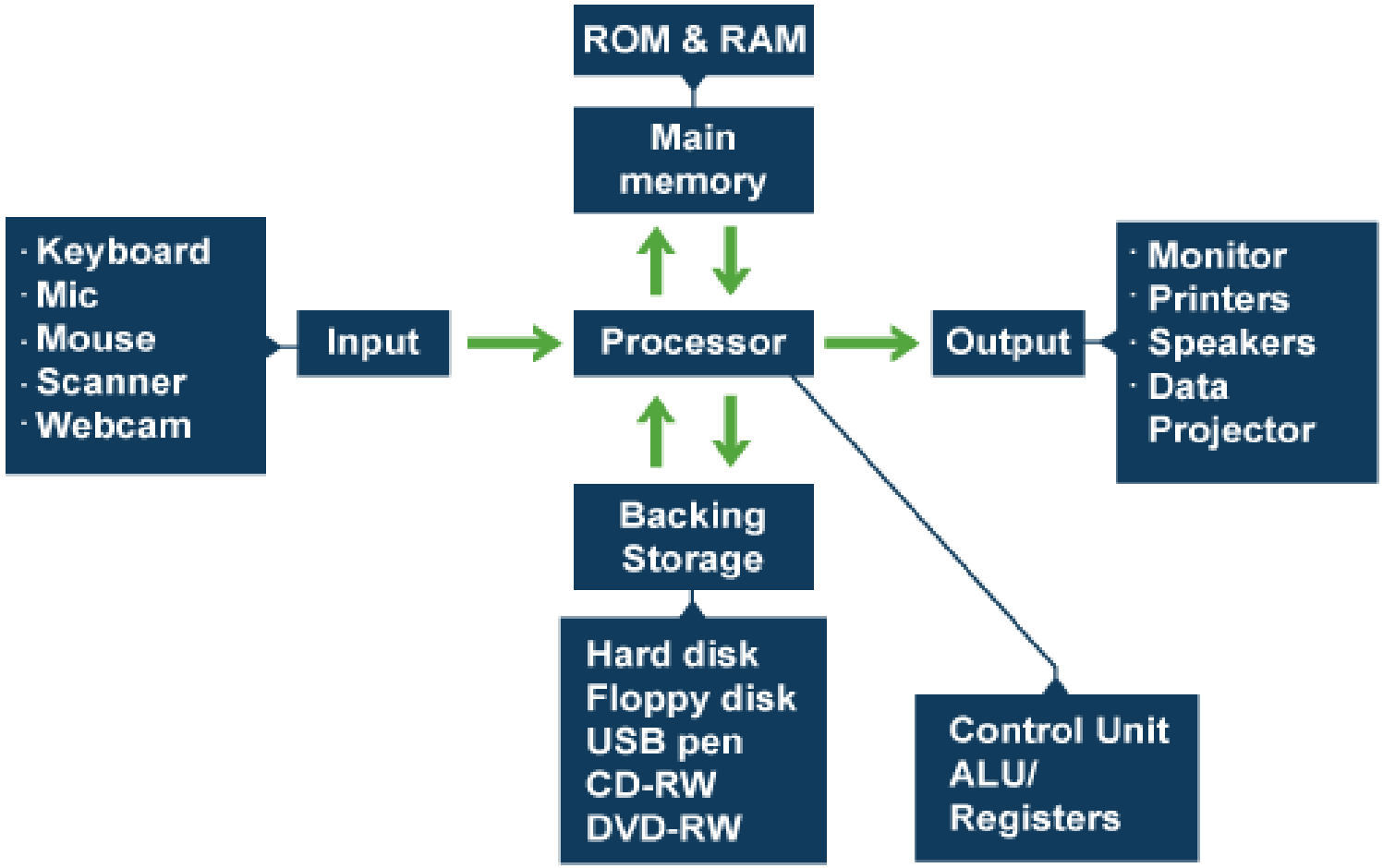
What is a Computer?

- A computer is a fast calculating device that can perform arithmetic operations.
- A computer is a fast electronic device that processes the input data according to the instructions given by the programmer/user and provides the desired information as an output.
- A computer is a machine that can receive, store, and process data to provide information. It is a set of interrelated and interconnected devices which accept raw data, process it, store and produce the result by following pre-determined instructions or a program.

Overview of Computers

- Computer as a device that transforms data. Data can be anything like marks obtained by you in various subjects. It can also be name, age, sex, weight, height, etc. of all the students in your class or income, savings, investments, etc., of a country.
- Computer can be defined in terms of its functions. It can
  - Accept data
  - Store data
  - Process data as desired
  - Retrieve the stored data when required
  - Display the result in desired format.

How a Computer Works?



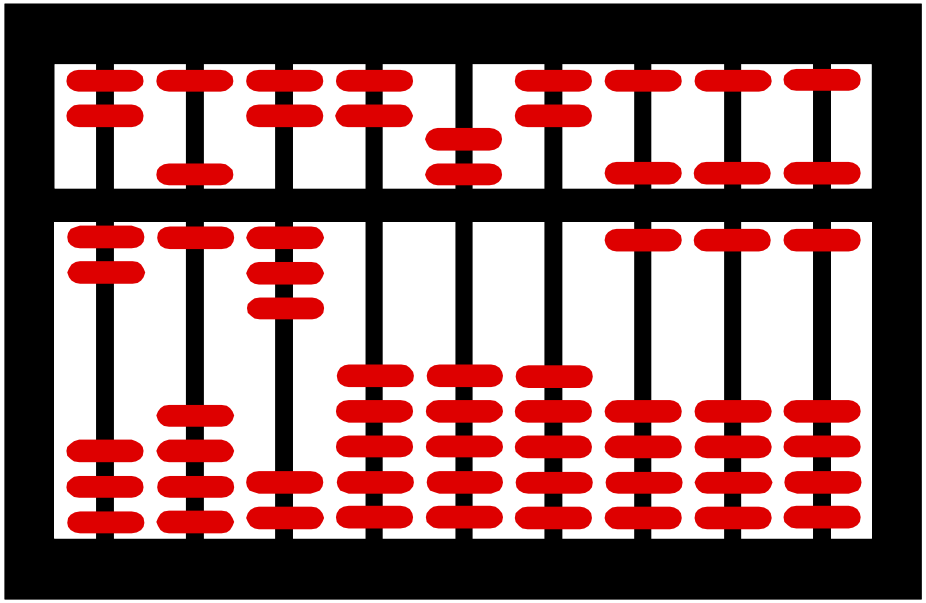
History of Computers

- The Abacus (also called counting frame)
- Pascal's calculator
- The Difference Engine/Charles Babbage
- Herman Hollerith's tabulating machine
- Mark I
- ENIAC (Electronic Numerical Integrator and Computer)
- The Von Neumann Machine
- Commercial Computers

History of Computer:

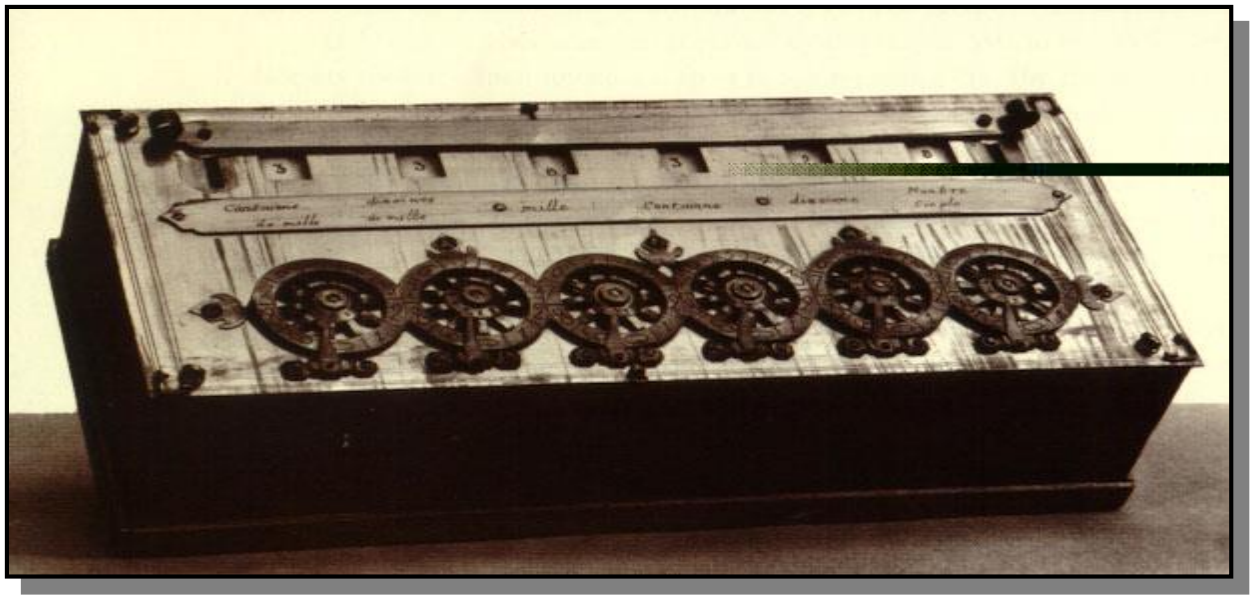
- The Abacus (base 5)

  (in ancient Babylon, China, Europe)



Ancient time

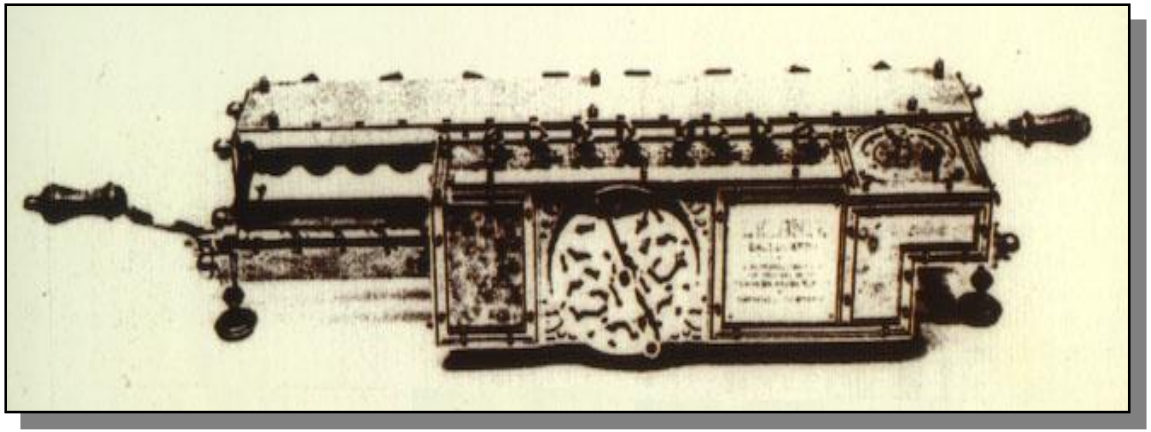
The Pascaline



1642

- The Pascaline is a mechanical calculating device invented by the French philosopher and mathematician Blaise Pascal in 1642. (+)

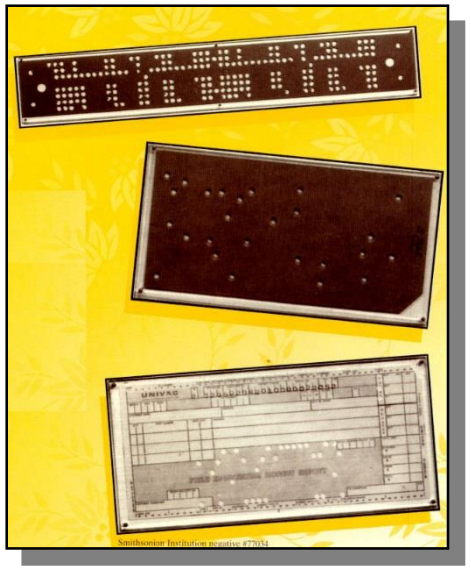
The Leibniz Wheel



1673

- The Leibniz Wheel was invented by the famous mathematician Leibniz in 1673.
- (+ , - , * , /)

Punched Cards

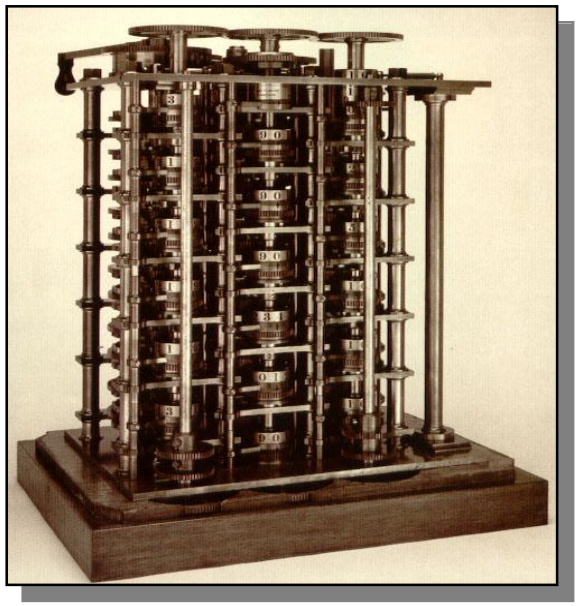


1810

- Punched Cards were used by the French weaver Joseph Jacquard in 1810. The cards carried weaving instructions for the looms, later this idea offered a great use for storing info.

Charles Babbage

- Babbage's Difference Engines were calculating machines made by Charles Babbage to produce tables of numbers that would be used by ship's navigators.



1832

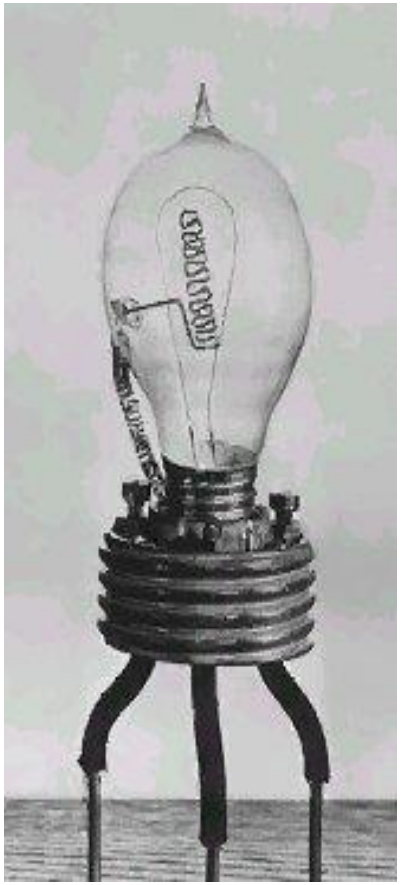
1852

This device had mechanical problems similar to those that plagued Pascal and Leibniz.

The Invention of the Vacuum Tube

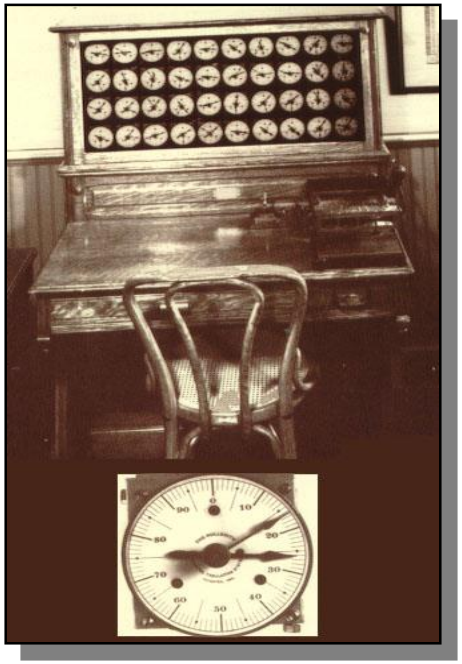
- Initially discovered by Thomas Edison, the vacuum tube formed the building block for the entire electronics industry.

- Vacuum tubes were later used as electron valves in the 20th century to build the first electronic computers.



1883

9- The US census of the 1880 took 9 years to compile and led to inaccurate figures. To solve the problem, Herman Hollerith invented a calculating machine that used electricity



1888

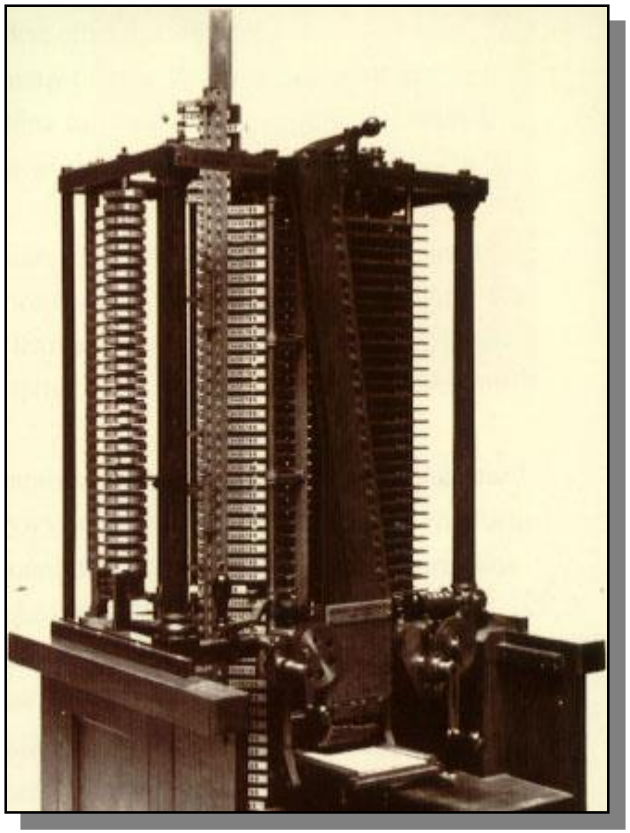
- along with punched
- cards instead of mechanical gears.

- Hollerith's machine was immensely successful. The general count of the population of the United States, then 63 million, took only 6 weeks to calculate!

- Based on the success of his invention, Herman Hollerith and some friends formed a company that sold his invention all over the world. The company eventually became known as:

    - *International Business Machines* IBM

10- A partial working model of Babbage's Analytical Engine was completed in 1910 by his son… used punched cards to store numbers. The design was no more successful than its predecessors.



1910

1943

- 11- MARK I was built by a team from IBM and Harvard University. Mark I used mechanical telephone switches to store information. It accepted data on punched cards, processed it and then output the new data.

1946

12- The ENIAC was the first US-built all-electronic computer built to perform ballistics calculations. *(Away from IBM)*

- It was 1000X faster than Mark I, but it drew a lot of power that dimmed the lights of Philadelphia when it was switched on due to the use of Vacuum Tubes.

1946

* ENIAC: 5,000 Additions / sec.
- ENIAC was made of 18,000 vacuum tubes.

ENIAC's Problems:

1- short life of vacuum tubes

2- It runs a single program, which means rewiring by a group of technicians is needed to change the program!!!

Solution: the same group of researchers worked on another version of ENIAC that can store programs on punched cards that are much easier to manage and they came up with: ➢

EDVAC ***(electronic Discrete Variable Automatic Computer)***

(was never completed!)

13- UNIVAC (Universal Automatic Calculator)

forty of these computers were sold to businesses. General Electric was the first company to acquire a UNIVAC.

1951

* The first UNIVACs were used in the US Army, Air Force, Navy, and Atomic Energy Commission.

The Effect of World War II

Back in time to the days of war…

* During WWII, the German Navy developed a cipher machine named Enigma. The Enigma machine could automatically encode a message in such a way that only another Enigma machine could read decode it.

1938

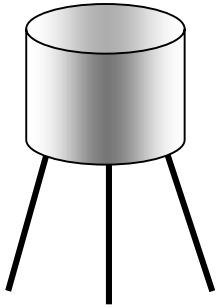
The Effect of World War II

- In 1938 the Polish Secret Service managed to steal an Enigma machine that was smuggled to England.
- Secretly the British developed a computer named Colossus that could decipher as many as 2,000 messages per day. That computer used Vacuum tubes and was the world's first entirely digital computer. Surprisingly, though Colossus presented a similar technology to that of ENIAC, it had only 2,400 compared to 18,000 in ENIAC!!!

1938

Two Inventions that changed the way computers are built!!

1- The Transistor



1946

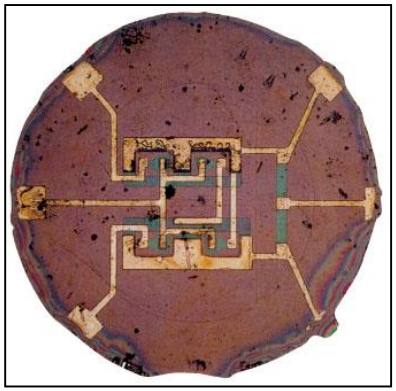
- The most significant single invention of the modern era.

  It was invented by 3 scientists at At&T's Bell Labs.

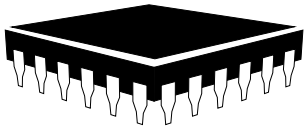
- Transistors are smaller (sometimes microscopic)
- Fast and don't need to warm up

Two Inventions that changed the way computers are built!!

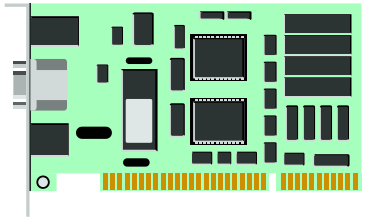
2- The (IC) Integrated Circuit



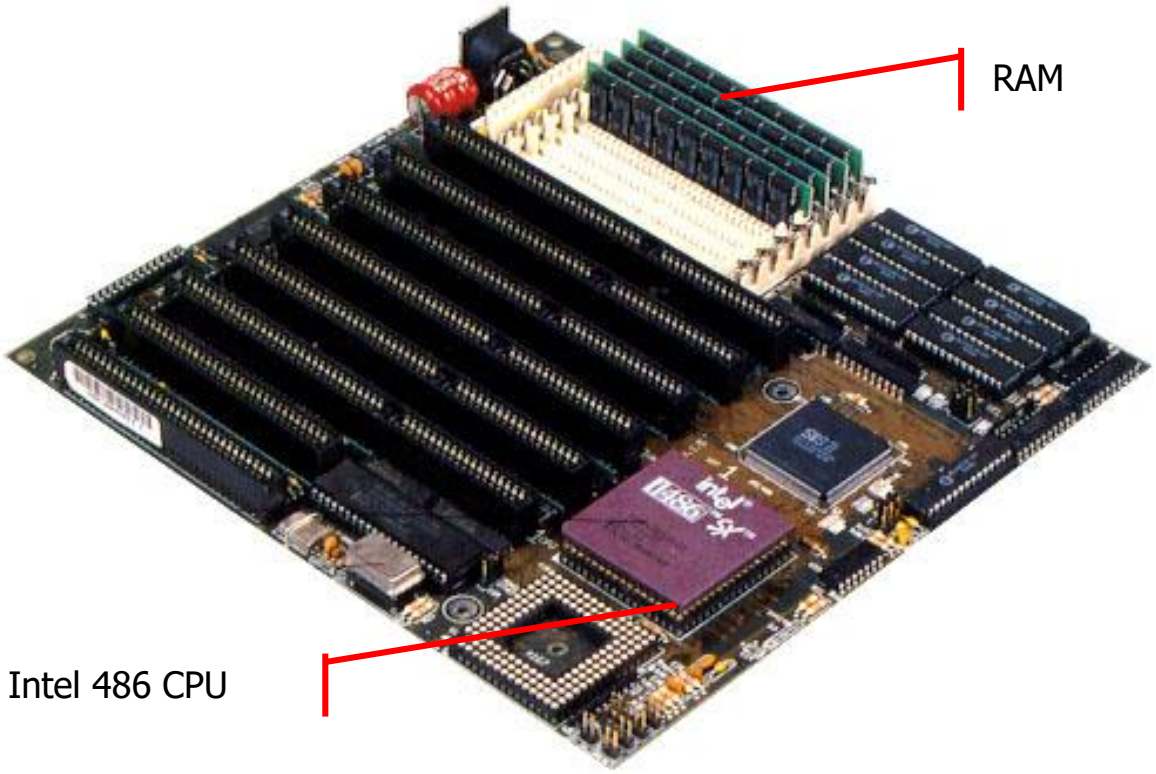
1961



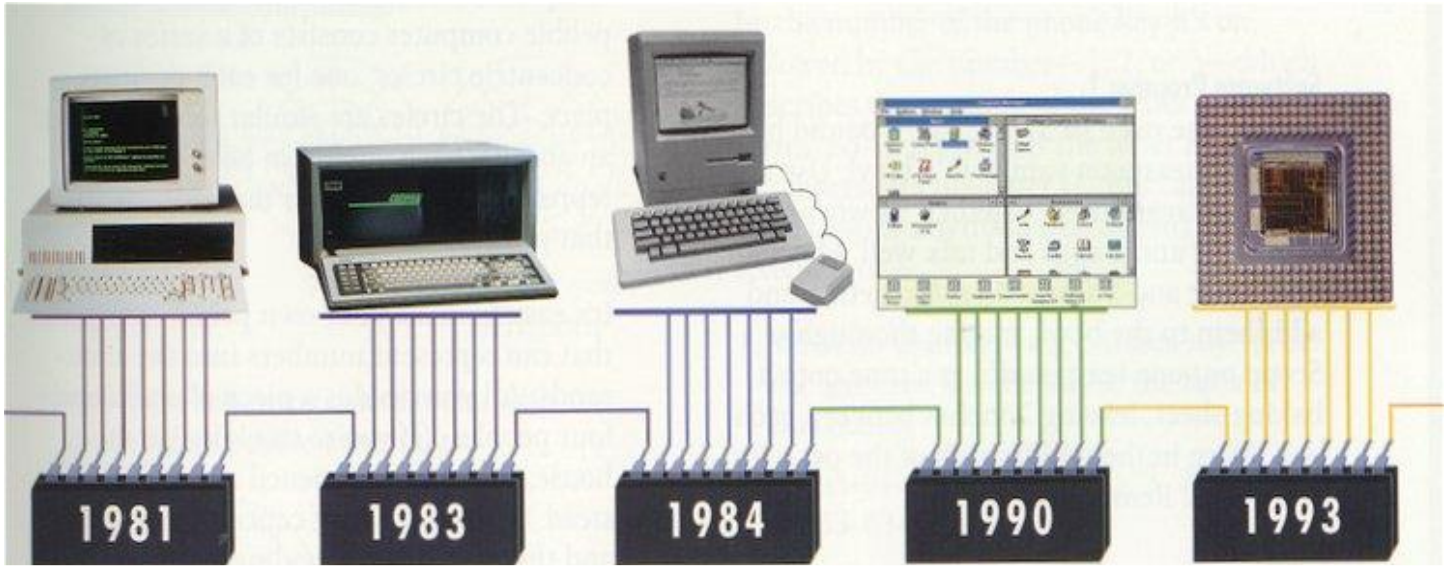
IC



How the processor (CPU) is placed on the Motherboard



1981 - 1993



The IBM PC | **The Compaq portable Computer** | **The Apple Macintosh** | **MS-Windows 3.0** | **The Pentium Chip**

Characteristics of Computers

- Computers are capable of performing highly complex tasks which human beings cannot perform efficiently.
- The following are the main characteristics of computers, which make them so powerful and unique than human being.
  - Speed
  - Accuracy
  - Diligence
  - Storage Capacity
  - Versatile

Characteristics of Computers

- **Speed**: A computer is so fast that it can perform the given task (arithmetical or logical) in few seconds as compared to man who can spend many hours for doing the same task. A computer can process millions of instructions per second.
- **Accuracy**: While doing calculations, a computer is more accurate than man. Man can make mistakes in calculations but a computer does not make mistakes, if it is provided accurate instructions.

Characteristics of Computers

- **Diligence**: A computer does not suffer from the human traits of tiredness. Man will be tired and bored while doing millions of calculations but a computer, being a machine, does this job very efficiently and without any tiredness and bored.
- **Memory**: A computer has much more memory or storage capacity than human being. It can store millions of data and instructions, which can be retrieved and recalled even after a number of years. This is not possible in case of human brain.

Characteristics of Computers

- **Versatility**: A computer can perform various types of jobs. most computers today are considered to be general-purpose computers .On a computer system, we can listen to songs while typing text or play games while working on any other package, do calculations, make drawings, surf the net, send e-mail, etc.
- **Reduction in Manpower**: Earlier, the work in industries/factories was done by a number of persons. But with computers, it can be completed by a few persons and that too more accurately and efficiently. The advent of computer has reduced the need of manpower.

Characteristics of Computers

Paper Work can be Reduced: The use of computer reduces the burden of paper work in any organization. For example, record of each student of a school can be kept in the computer itself rather than keeping manual files for each student. Also, information regarding any student can be obtained easily and quickly with the help of a computer.

Characteristics of Computers

- **Power of Remembering**: Computer has the power of storing any amount of information or data. Any information can be stored and recalled as long as you require it, for any numbers of years. It depends entirely upon you how much data you want to store in a computer and when to lose or retrieve these data.
- **Durability and Reliability**: Computers are durable and extremely reliable devices. They can operate error-free over long periods of time.

Limitations of a Computer

Despite having various advantages, computers do have the following limitations that are the strengths of human beings. These are:

- **No Intelligence (No IQ)**: A computer is a machine and obviously has no intelligence of its own. Each and every instruction must be given to the computer for doing a task. Man has an intelligence and it is the man who invented computer and gives it all the instructions and logic to work. A computer cannot take decisions on its own and it is the main drawback of computer.

Limitations of a Computer

Computers do not have intelligence of their own, they work according to the instructions given by humans.

- **No Decision-Making Ability**: Computers cannot take any decisions. Human beings assist the computer to take the decisions. For example, suppose a street Man is selling flowers. If such kind of flowers are already in our house, we will decide not to purchase them. Taking decision in this way, without the assistance of human beings, is not possible by a computer.

Limitations of a Computer

- **No Emotions and Feelings**: Computers are far away from emotions and certainly being machines, they cannot have feelings and instincts. No sense of feeling since computers are instructed machines.
- Computers doesn’t have their own input
- Data interpretation and analysis is always left for human beings

Data Vs Information

- Data are raw facts about the organization and its business transactions. Most data items have little meaning and use by themselves.
- Data are plain facts. When data are processed, organized, structured or presented in a given context so as to make them useful, they are called Information.
- Data in themselves are fairly useless. But when these data are interpreted and processed to determine its true meaning, they become useful and can be called Information.
- Data is computer's language. Information is our translation of this language.

Data Vs Information

Data

- raw facts
- no context
- just numbers and texts

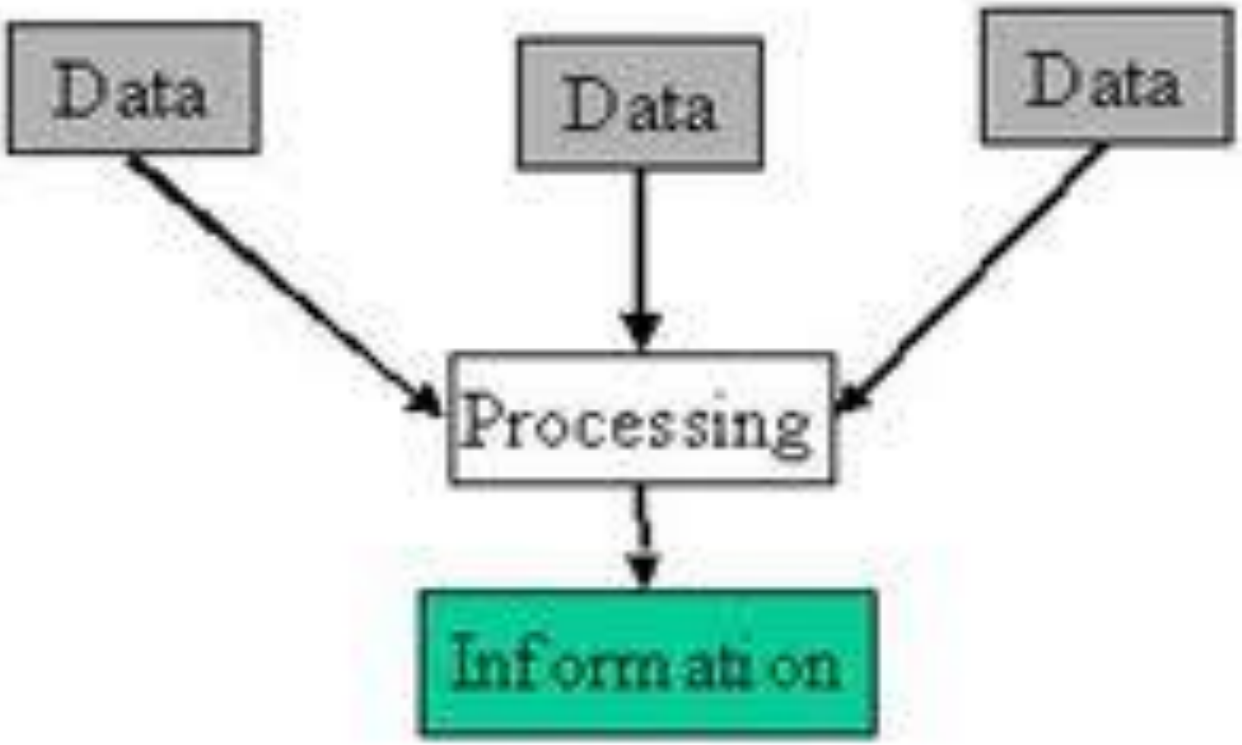
Information

- data with context
- processed data
- value-added to data
  - summarized
  - organized
  - analyzed

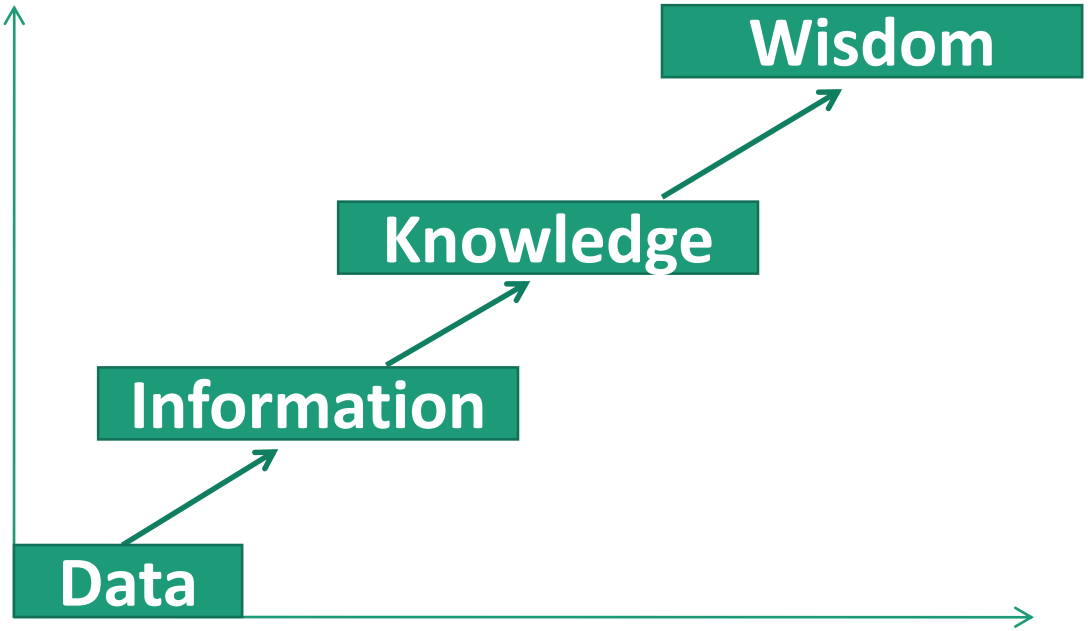
Information

- Information is data that has been refined and organized by processing and purposeful intelligence.
- Information is data processed for some purpose
- Information is any form of communication that provides understandable and useful knowledge for the person receiving it.
- Information can only be considered to be 'real' Info if it meets certain criteria i.e.
  - it must be communicated to the recipient
  - it must be in a language that is understood
  - it must be in a suitable form
  - it must be relevant for achieving some purpose

Information is created from data



Summary



Knowledge Spectrum

Information Communication Technology (ICT)

- ICT refers to technology that provides access to information through telecommunications.
- ICT refers to technologies and systems supporting the collection, processing, dissemination, access, and prevention of data or information.
- ICT focuses primarily on communication technologies such as the Internet, wireless networks, cell phones, and other communication media.
- ICT has become a major factor in social and economic development of the society.

Information Communication Technology (ICT)

Benefits of ICT includes:

- Manufacturing, service and tourism sector.
- Fast response to natural disasters
- Governance and administrative effectiveness.
- Education, research and communication of research results.
- Global market and research information.
- Employment opportunities
- Data and information gathering and distribution

Generation of Computers

- Computers can be classified in to five different generation based on the following criterion;
    - Basic electric components
    - Basic secondary storage device
    - Operating system
    - Machine language
    - Access time
- Computer generations are categorized by dramatic improvements in the hardware, typically better increases in speed and reliability

First Generation (1950s)

- Used vacuum tubes as components for the electronic circuit.
- Punched cards were the main source of inputs, and magnetic drums were used for internal storage.
- Operate in a speed of milliseconds (thousands of a second) and could handle more than 10,000 additions each second.
- Most applications were scientific calculations.

Second generations (early 1960s)

- Transistors were the main circuit components. Transistors are solid state devices made from silicon which is smaller, cheaper, faster, dissipate less energy and more reliable than vacuum.
- The transistor was invented in Bell Labs.
- Magnetic tapes (similar with home tape caste), used for main storage,
- Operate in microseconds (millionths of a second) with more than 200,000 additions possible each second.
- Business applications became more common, with large data files stored on magnetic tape and disk
- COBOL and FORTRAN were introduced during this period.

Third generation (late 1960s, early 1970s)

- This generation was characterized by the solid-state integrated circuit (IC).
- New input/output methods such as optical scanning and plotters.
- Software became more important with sophisticated operating systems and improved programming languages,

Fourth generation (late 1970s - present)

- Greatly expanded storage capabilities and improved circuitry.
- Has a large-scale integrated circuits (LSIC) which has several hundred thousands of transistors placed on one tiny silicon chip.
- very-large-scale-integration (VLSI) produced a chip containing a microprocessor.
- Magnetic disks became the primary means of internal storage.
- Computer memory operated at speeds of Nano seconds (billionths of a second) with large computers capable of adding 15 million numbers per second.

Fifth generation (Future)

- These computers will allow a simple and natural methodology for solving.
- This generation will begin with the creation and use of a computer with artificial intelligence (AI).
- AI indicates the ability to perform humanlike thinking and reasoning.
- These computers will have intelligent processors i.e., processors which can draw inferences.
- Users will also be able to interact with them in natural languages such as English, German etc.

Application Areas of Computers

Why we use Computers?

The following are some of the capability of Computers, which are reasons to use Computers.

- Store and process large amount of information with high speed and accuracy
- Transmit information across continents via communication channels
- Simulate events
- Perform complex mathematical computations and make comparisons
- Monitor ongoing industrial operations
- Perform repetitive processes with great ease, speed, and reliability

- Computers have become an essential part of modern human life.
- computers have evolved in terms of increased computing power and decreased size.
- Life in today’s world would be unimaginable without computers.
- Computers have made human lives better and happier.
- Engineers, architects, jewelers, and filmmakers all use computers to design things. Teachers, writers, and most office workers use computers for research, word processing and emailing.
- Small businesses can use computers as a point of sale and for general record keeping.

Application area of Computers

- Learning Aids: learning toys
- Entertainment: games
- Commercial or business applications: text processing
- Scientific research applications: space technology
- Information Utilities : internet
- Electronic Banking and Service: e-commerce, ATM
- Shopping from Home

Application area of Computers

- Household Control: Security
- Weather and Environment: weather forecasting
- Transportation: air crafts are aided by computers
- Medical and Health Care: blood pressure, heart rate
- Routine and Dangerous Tasks: war
- Consultant (Expert system)

TYPES OF COMPUTERS

There are different types of Computers. Their difference is depending on different categories of characteristics.

- Based on Size, Cost and Performance
- Based on their Purpose
- Based on their Technology Used or Data processing

TYPES OF COMPUTERS

Based on Size, Cost and Performance, Computers can be classified into:

- Super computers
- Mainframe computers
- Minicomputers
- Microcomputers

Supercomputer

- They are the fastest and most expensive computers.
- They have high processing speed compared to other computers.
- They have also multiprocessing technique. One of the ways in which supercomputers are built is by interconnecting hundreds of microprocessors.
- Supercomputers are mainly being used for whether forecasting, biomedical research, remote sensing, aircraft design and other areas of science and technology. Examples of supercomputers are CRAY YMP, CRAY2

Supercomputer

Mainframes

- These types of computers are generally 32-bit microprocessors.
- They operate at very high speed, have very large storage capacity and can handle the work load of many users.
- They are generally used in centralized databases.
- They are also used as controlling nodes in Wide Area Networks (WAN).
- Example of mainframes are DEC, ICL and IBM 3000 series.

Mainframes

Minicomputer

- Minicomputers are designed to support more than one user at a time.
- It possesses large storage capacity and operates at a higher speed.
- Minicomputer is used in multi-user system in which various users can work at the same time.
- This type of computer is generally used for processing large volume of data in an organization.
- They are also used as servers in Local Area Networks

Microcomputer

- Microcomputer is at the lowest end of the computer range in terms of speed and storage capacity.
- Its CPU is a microprocessor. The first microcomputers were built of 8-bit microprocessor chips.
- The most common application of personal computers (PC) is in this category.
- The PC supports a number of input and output devices. An improvement of 8-bit chip is 16-bit and 32-bit chips.
- Examples of microcomputer are IBM PC, PC-AT .

Types of Computers Based on their Purpose/Function

- General-Purpose Computers
- Special-Purpose Computers

General Purpose Computers

- They are designed to solve variety of problems through the use of “store program concept”.
- A program or set of instructions designed to solve a problem is read and stored into the memory and then executed by the computer one by one.
- The same computer can be applied to solve another set of problem using different program.
- General purpose computers are more flexible and versatile.

General Purpose Computers

- Computers that follow instructions for general requirements such as sales analysis, financial accounting, invoicing, inventory, management information etc. are called General Purpose Computers.
- Almost all computers used in offices for commercial, educational and other applications are general purpose computers.
- Examples : Microcomputers, Mini computers, Super computers etc

General Purpose Computers

- These Computers can be used for almost any purpose
  - Typewriter
  - video editor
  - Accounts tracker
  - Database / address book
  - DVD / CD Player
  - and many others…

Special Purpose Computers

- Computers designed from scratch to perform special tasks like scientific applications and research, weather forecasting, space applications, medical diagnostics etc. are called Special Purpose Computers.
- They are designed to solve a single type of problem, that is their components and function are uniquely adapted to a specific situation involving specific application

Special Purpose Computers

Example:

- The public telephone box
- Traffic control system
- Ticket machines (used in grocery, super market etc.)
- Pocket calculators etc.
- Counters

- Most analog computers are special purpose computers.

Based on their Technology Used or Data processing

- Computers can be categorized based on the technology used or data processing as:
  - Analog Computers
  - Digital Computers
  - Hybrid Computers

Analog Computers

- Analog computers are special purpose computers that represent and store data in continuously varying physical quantities such as current, voltage or frequency.
- These computers are programmed for measuring physical quantities like pressure, temperature (Thermometer), speed (Speedometer) etc. and to perform computations on these measurements.
- Analog computers are mainly used for scientific and engineering applications.

Analog Computers

Examples

- Thermometer
- Voltmeter
- Speedometer
- Gasoline pomp – Contains an analog Computer that converts the flow of pumped fuel into two measurements the price of the delivered gas and the quantity of pumped fuel.

- They are special purpose computers.

Digital Computers

- Digital computers are mainly general purpose computers that represent and store data in discrete quantities or numbers.
- In these computers, all processing is done in terms of numeric representation (Binary Digits) of data and information.
- Although the user enter data in decimal or character form, it is converted into binary digits (0's and l's).

Hybrid Computers

- Hybrid computers incorporate the technology of both analog and digital computers.
- These computers store and process analog signals which have been converted into discrete numbers using analog-to-digital converters.
- They can also convert the digital numbers into analog signals or physical properties using digital-to-analog converters.
- Hybrid computers are mainly used in artificial intelligence (robotics) and computer aided manufacturing (CAM).