1.1 HISTORY OF COMPUTING AND COMPUTERS:

History of computer starts from that time when there were no any number systems discovered and no any device for calculations.

Age of mechanical calculators:-

a. **Abacus:-** It was the earliest counting device. It has two parts called heaven and earth. It could only add and subtract. It is believed to be discovered in China, Russia or Egypt.

b. **John Napier and his rods:-** Scottish mathematician John Napier invented a principle of calculation called algorithm in 1614 AD and based on the same principle he invented some bone rods engraved with numbers in 1617 AD, which was called Napier's Bone. With the help of this device could do multiplication very faster.

c. **Slide Rule:-** Another English mathematician William Aughterd discovered a device with two rulers for calculation, which was based on John Napier's principle but used only two rulers engraved with numbers in 1620 AD, which was called Slide Rule. This device could perform multiplication and division and was the first analog device.

d. **Blaise Pascal:** French mathematician Blaise Pascal developed the first mechanical calculator in 1642 AD, which was called Pascal's Calculator. It had some cogs and gears rotating in complement to each other. It had a simple monitor to see the result, too. Calculation including addition and subtraction was possible up to 8 digits, which was a great achievement at that time. So, his work was honored by Niklaus Writh by making a programming language called 'Pascal Prog'.

e. **Stepped Reckoner:** German mathematician Baron Gottfried Wilhelm Von Leibniz modified the Pascal's machine and used the same principal to invent his new machine called Stepped Reckoner in 1671 AD. It could perform addition, subtraction, multiplication, and division and could find out square root also for the first time. It was used for calculation till 1960s before electronic or electromechanical devices came into existence.

f. **Jacquard's Loom and punch cards:** One of the textile manufacturers called Joseph Marie Jacquard discovered a mechanism for automated weaving of clothes in 1802 AD. It was based on a principle of present and absence of some homes, in which principle punch-cards were developed afterwards. So, he is called father of punch-card concept.

h. **Charles Babbage:** Charles Babbage was a great mathematician at Cambridge University. He developed two electromechanical calculators called Difference Engine (1822 AD) and Analytical Engine (1833 AD). They were very big achievements in the history of computers and calculators. Not only those calculators, he invented the working principle of computers on which modern computers are also based. So, he is known as '**father of computer'**.

i. **George Boole:** One of the greatest achievements of 19th century was the discovery of mathematical logics called 'Boolean Algebra'. He studied and presented the symbolic logics which are the foundation of modern computers. His logics provided basic idea of presenting the electric circuits with binary input and its output.

j. **Dr. Herman Hollerith:** He was a census statistician in US bureau of statistics. He is remembered in the history of computers for the following contributions.

- He invented a machine called Tabulating Machine in 1886 AD which could process on the punch cards and perform census calculating faster than ever before.
- He was the first person to use punch cards practically.
- His company that produced and sold Tabulating Machines, which was called Tabulation Machine Company was very successful at that time. He integrated some other companies doing similar type of work and founded International Business Machine (IBM) Company in 1923, which is the largest computer manufacturing company in this world till today. So, he is regarded as founder of IBM.

Age of Electromechanical Computers:

k. **Mark-I:** In 1937 prof. Howard Aiken developed an electromechanical computer (which is also called the first computer) called Mark-I. It was also called Automatic Sequence Controlled Calculator(ASCC). It was based on Charles Babbage's principle after 100 years of his death. Although it was very huge, technically very complicated, consumed a lot of electricity, generated a lot of heat, it was the milestone in history of computer. It used 18000 vacuum tubes as main memory device. In 1944 AD, Howard Aiken modified Mark-I and invented Mark-II which used 19000 vacuum tubes.

l. **ABC (Atanasoff Berry Computer):** It is also called the first electronic digital computer. It was invented by J.V.Atanasoff and Clifford Berry in 1939-1942 AD. It used 18000 valves and other 45 valves for internal logic and capacitors for storage of electrical charges. It used punch cards as secondary storage.

m. **ENIAC(Electronic Numerical Integrator And Calculator):** It was the first electronic computer developed by J.P.Eckert and J. Mauchly in 1946 AD. It used 18000 vacuum tubes, 70000 resistors and 10000 capacitors. It was the first and last computer which used decimal number system instead of binary system. It was used till 1955 AD in US armed forces.

n. **John Von Neumann:** He was a mathematician and in 1945 AD discovered a principle of stored program. So, he is called the 'father of stored program'. Before his principle, programs required for the computers were integrated and written permanently in chips, so modification of program was not possible. But after Neumann, such programs were stored inside computer in some storage media, so modification was easy and flexible.

o. **EDSAC(Electronic Delay Storage Automatic Computer):** It was invented by Maurice Wilkes in 1949. It also used vacuum tubes. Although started after EDVAC, it was completed before EDVAC. So, it became the first stored program computer.

p. **EDVAC(Electronic Discrete Variable Automatic Computer):** It was developed by J.P. Eckert and J.Mauchly in 1952. Although started before, it was completed after EDSAC. So, some people say it as the first stored program computer. It also used vacuum tubes and some internal storage.

q. **UNIVAC (Universal Automatic Computer):** It was the first computer manufactured for commercial use and general purpose digital computer. Before this, all the computers were used either for defense or census. It was also developed by J.P.Eckert and J.Mauchly in 1961.

1.2 GENERATION OF COMPUTERS

Computers are generally classified into different generations according to the memory device used in the computers. So, the term 'generation' was used to distinguish between varying hardware technologies. The custom of referring to the computer era in terms of generation came into wide use only after 1964. There are totally five generations till today. When generations go up, the following characteristics are in effect:

Characteristics	***Effect***
Size	Decrease
Speed	Increase
Power Consumption	Decrease
Heat Generation	Decrease
Complexity	Decrease
Storage Capacity	Increase
Storage Devices	More flexible and more capacity
Price of Computer	Decreased
Use of user's friendly software	Increase
Processing Capability	Increase

First Generation:

This generation computer used vacuum tubes or valves as memory device.

Characteristics

- Very big size, unreliable and slower than other generations.
- Thousands of valves were used in a single computer. So, they produced large amount of heat and used to burn out frequently. Due to this reason, massive air-conditioning was required.
- Manual assembly of components into functioning unit was required.
- Operating speed in terms of millisecond.
- Punch cards used as secondary storage.
- Machine level programming used.
- Cost was very high and not available for commercial use.

Examples: - Mark-I, UNIVAC, ENIAC etc.

Second Generation:

This generation computer used transistors and diodes as memory device.

Characteristics:

- Smaller sized than first generation because 1000 valves were replaced by one transistor
- Faster processing speed and was measured in microsecond range.
- Heat generation and power consumption was lesser than first generation.
- Magnet core memory used as internal storage.
- Magnet tapes used as secondary storage.
- High level language used as programming.
- Little bit faster I/O devices.
- Examples: IBM 1401, ICL 2950/10 etc.

Third Generation:

This generation computer used "integrated Circuits (IC)".

Characteristics:

- Smaller in size, more reliable, generated less heat, consumed less power and less prone to hardware failure as compared to previous generations.
- Processing speed increased to nanosecond and even faster.
- Computers became portable because of personal or desktop computers. Mass use on general and personal purpose.
- Semi conductor memory used as primary storage.
- Massive use of high level language.
- Magnetic disks were used as secondary storage.
- Keyboard and monitors as input and output devices were introduced for the first time.
- Example: IBM 360 series, UNIVAC 9000 etc.

Fourth Generation:

This generation computer used microprocessors or VLSI technology.

Characteristics:

- Highly accurate and totally reliable.
- Operation speed increased beyond picoseconds and MIPS (Million of Instruction per Second).
- Massive use of magnetic and optical storage devices with capacity more than 100 GB.
- Multiprocessing, Multiprogramming, multimedia and distributed computing possible.
- Smallest computers called micro, laptop, notebook, palmtop and even smaller computers are being developed.
- Advancement in software and high level language.
- Artificial Intelligence in software part on some extent used.

Fifth Generation:

This generation computer used Artificial Intelligence and Bio-chips as memory device.

Characteristics:

- Acceptance of parallel processing in full fledges.
- Because of the use of super conductor materials like Bio-chips and GaAs as memory device, the speed will be very high.
- Use of AI will make computers intelligent and knowledge based.
- Large subsets of natural languages will be used and made more users friendly.
- PROLOG (Programming Logic) as Operating system.

Summary:

Generation	***Time Duration***	***Memory Devices Used***
First	1942-1955	Vacuum tubes or valve
Second	1955-1964	Transistor
Third	1964-1975	IC
Fourth	1975-till now	VLSI and Microprocessor
Fifth	1990 onwards	AI and Bio-chips

1.3 TYPES OF COMPUTERS:

Computers can be classified according to size, work, brand or model.

On the basis of size:

On the basis of size, computers can be classified into three groups. They are:

1. Mainframe computer
2. Mini Computer
3. Micro computer

1 Mainframe Computer:

These are the largest computers. A centrally located server or CPU is connected with more than 100 terminals. Examples of these computers are: IBM 1401, ICL 2950/10 etc.

Characteristics:

1. Very large in size with approximately 1000 sq. Feet area.
2. Central processor, central administration.
3. More than 100 terminals, large capacity storage devices used.
4. Fastest and most expensive systems.
5. General purpose computers.
6. Used by large agencies and governments for large scale data processing.

2 Mini computers

These are the medium sized computers on the basis of size. A centrally located server or CPU is connected with more than 50 terminals. Examples are: Prime 9755, Vax36 etc.

Characteristics:

1. Medium sized computer occupying approximately 10 sq.feet of area.

2. More than 50 terminals and large capacity storage devices than micro computers but smaller than mainframes.
3. Used for general purpose.
4. Used in medium sized organizations and corporations for their database administration.

3 Microcomputers

These are the smallest computer systems. These computers are called micro because microprocessor is used as memory device and they are very small. These computers are also called PC or home computers. Examples: IBM Pentium PC, Apple/Macintosh etc.

Characteristics:

1. Smallest in terms of size. Can be kept on top of a desk, on the top of our lap(laptop), on top of our palm (palmtop) and like a notebook.
2. Speed and cost is also smaller.
3. Since a single user system is used, storage devices and memory are smaller sized.

On the basis of work

Computers can be classified as follows:

1. Analog computer
2. Digital computer
3. Hybrid computer

1. Analog computer

The computers, which work with the natural phenomena and physical values like frequency, earthquake, volcano, water flow, current floe etc. are known as analog computers. They are based on continuous changing values or voltage levels. These types of computers are used in scientific work and not for commercial or personal purpose. Example of analog computer is 'Plesley' and some other analog devices are odometer, speedometer, thermometer, seismograph etc.

Characteristics

1. Based on continuous varying data.
2. Measure only natural or physical values.
3. Used for special purpose.
4. Generally no storage facility is available because they work on real time basis. If provided, then only a little amount of storage is available in it.
5. Accuracy of these types of computers is very less because of noise and filtering facility.
6. Output of those signals is also not well known by general public because they are in form of wave lines, curved lines or graphs.

2. Digital computer

These computers are based on binary digits. Binary system is such system of numbering in which only 2 digits are used- 0 and 1. meaning of 0 is off and 1 is on. Examples: IBM PC, Apple/Macintosh etc.

Characteristics:

1. Based on discrete data which are not continuous with time.
2. Based on principle of logic 1 and 0 or high and low voltage.
3. Used for general purpose.
4. They are more reliable because of less noise and filtering facility.
5. It has large memory capacity because the calculations are to be stored internally for future use and re-programming.
6. It is multipurpose and programmable. So high cost and faster processing.

3. Hybrid Computers:

Hybrid means combination or cross-link of two or more types. So, as the name suggests, it is combination of analog and digital computers. It can perform the works done by analog computers as well as by digital computers. Examples of these types of computers are: computers used in hospitals, computers used in jet planes etc.

Characteristics:

1. Combination of good qualities of analog as well as digital computer.
2. Can process both continuous and discrete data. It has capability to convert one type of data into another.
3. These are special purpose machines.
4. Mostly used in aero planes, hospitals etc.
5. High cost.

Differences between analog and digital computers:

Basis for difference	***Analog***	***Digital***
Working principle	These computers work with natural or physical value.	These computers work with digits.
Type of data	These computers work with continuous data	These computers work with discrete data
Accuracy	Low	High
Storage/memory	Low	High
Purpose of use	Special	General
Cost	Low	High
Programming	No possibility of re-programming. for that total circuitry system and hardware parts are to be replaced with new ones.	Totally flexible and can be re-programmed.

On the basis of brand

Computers can be classified into following categories:

1. IBM computers
   i. IBM PC
   ii. IBM Compatible
2. Apple/Macintosh computers

1. IBM computers

IBM, which was established by Dr. Herman Hollerith in 1923 AD, is the largest computer manufacturing company in the world till today. It is leading the market of mainframe and PCs. It uses the processors, multimedia devices and some other hardware parts developed by some other companies like Intel but use the principle of its own. So, all the computers developed by IBM company are called IBM computers. It has two categories:

(a) IBM PC and (b) IBM Compatible

The computers developed by IBM company itself are called branded or IBM PC. Computers which are developed or assembled by other companies using the parts and principle of IBM PCs are called IBM compatibles. So, IBM compatibles are also called duplicate of IBM PCs.

Difference between IBM PC and IBM Compatible

Basis For Difference	**IBM PC**	**IBM Compatible**
Developed by	These computers are developed by IBM Company itself.	These computers are developed by the companies other than IBM company.
Generally called	These computers are also called Branded or Original PCs.	These computers are generally called assembled or duplicate of PCs.
Cost	Generally expensive	Comparatively cheaper

2. Apple/Macintosh Computers

Apple Corporation was established in 1970 AD in USA. Within these 3 decades, it has gone much forward and produced PCs with good qualities and user friendly. So, all the computers that are developed by Apple Corporation are called Apple/Macintosh (Mac) computers. These computers are architecturally totally different than that of IBM's. Not only hardware part, but their software architecture is also totally different. Software made for IBM PC can't be run in Macintosh or vice versa. Floppy disks or hard disks formatted in one can't be recognized by other.

On the basis of Model

Computers can be classified into following categories:

1. XT computers
2. AT computers
3. PS/2 computers

1. XT computers

XT (eXtra Technology) computers are the old technology computers with much slower processing speed (not more than 4.77 MHz). Advanced GUI based software like (Windows) can't be run in these computers. Everything was based on text based system. Serial number of processors was like 8080, 8086, 8088 which were developed by Intel and were 4 bit word length. Complex calculation and large processing couldn't be done. I/O devices were not flexible and faster.

2. AT computers

AT (Advanced Technology) computers are the new technology computers. They are faster in processing (more than 2 GHZ) and can run any type of software whether that is text based or GUI based. Serial number of processors are 80286, 80386, 80486, Pentium I, Pentium 2 etc. any type

of complex and long processing can be done depending on the capacity of the computers. I/O devices are interactive, flexible and faster. Word length exceeds 64 bits. Co-processors are used to help the main processors for complex mathematics.

3. PS/2 computers

Actually these are not totally different models of computers but are refinement of AT computers. These models were built after 1990s and mostly used in laptop computers. Rechargeable and battery operated systems with faster and flexible I/O devices are some important characteristics of these computers. OS/2 operating system was used at the beginning but now-a-days, windows operating system is leading.