

Chapter -1

The Discipline of Computing

Counting and evolution of positional number system

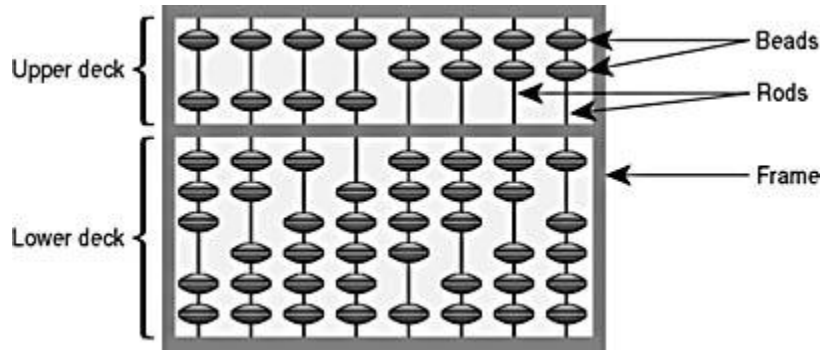
The Number System is a method to represent numbers. Egyptian number system emerged around 3000 BC. It used 10 as radix (base). It used the symbols 1 to 9, 10 to 90, 100 to 900 and 1000 to 9000. Later Sumerian/Babylonian number system began. It used 60 as its base. It was also known as sexagesimal system. Numbers were written from left to right. They did not use any symbol for zero, but they used the idea of zero. They used a blank space instead of zero. The Chinese number system emerged in 2500 BC. It used numbers from 1 to 9. In 500 BC Greek number system called Ionian number system evolved. It was a decimal number system. It also did not have any symbol for zero. The Romans started using numbers for practical purposes such as construction of roads and bridges etc. They used 7 letters (I, V, X, L, C, D and M). The Mayan number system was base 20. It could make accurate astronomical measurements. The Hindu-Arab number system originated in India around 1500 years ago. It was a positional number system and had a symbol for zero. It was India's greatest contribution to the world. Later many countries adopted this number system.

Evolution of Computers

During early periods humans communicated with each other using symbols and later letters. Introduction of numbers led to the invention of Abacus, the first computing machine. Today computers are used in every aspect of our life. The evolution of computers started with the invention of Abacus. Some important milestones in its evolution are examined below,

Abacus

The word Abacus means *calculating board*. It is also known as counting frame. It works on the basis of place value system. Arithmetic operations are carried out by manipulating the beads on the wires. The frame has two parts upper and lower. The upper part is called Heaven and the lower part is called Earth. It works on place value system.



Napier's Bones

Napier's bones is a manually operated calculating device created by John Napier. It is also called Napier's rods. A set of rods were used for calculation. These rods were carved from bones, hence it was called Napier's bones.

Pascaline

Pascaline also called Arithmetic machine was the first adding machine to give accurate results. It was designed by a French mathematician Blaise Pascal. It could only do addition and subtraction. It operated by using a series of wheels and cylinders.

Leibniz's calculator

Leibniz's calculating machine was also called step Reckoner. It performed multiplication by repeated addition and shifting. It used rotating gears to represent numbers.

Jacquard's loom

In 1801 Joseph Marie Jacquard invented a power loom that could base its weave upon a pattern automatically read from punched wooden cards. This invention reduced human labour and allowed to store pattern on punched cards.

Difference engine

The difference engine was the first step towards the development of computer. It was designed by Charles Babbage. It was an automatic mechanical calculator designed to calculate polynomial functions. The name derives from the method of divided difference used for calculation.

Analytical Engine

Analytical Engine was a proposed mechanical general purpose computer designed by Charles Babbage. It was the successor to difference engine. It was more versatile than difference engine and could perform any mathematical calculations.

Hollerith's machine

Hollerith designed first electromechanical punched card. These cards can be used for input and output. This marked the beginning of automatic data processing systems. Hollerith is regarded as the father of modern data processing. Mark-1 Mark-1 is regarded as the earliest stored program computer. It was an electro-mechanical computer. It could perform the four basic operations (addition, subtraction, multiplication and division). It was controlled by punched paper tape.

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Generation of Computers

Based on hardware technology computers are classified into different generations. Each generation represents different stages of development in technology used.

First Generation(1940-56)

The first generation computers used vacuum tubes. They used stored program concept. Input was based on punched cards and paper tapes. A vacuum tube is made up of glass and contains a filament. ENIAC, UNIVAC, EDVAC are some examples of first generation computers.

Second Generation(1956-63)

Second generation computers used transistors instead of vacuum tubes. They were less expensive and consumed less power than first generation computers. PDP-8, IBM1401 are examples of second generation computers. They use magnetic core memory for primary memory and magnetic tape and disk for secondary memory.

Third Generation(1964-71)

Third generation computers were smaller in size and used integrated circuits(IC) instead of transistors.The keyboard and mouse were used instead of punched cards and printouts.Highlevel languages were used instead of machine language.IBM370,PDP-11 are examples of second generation computers.

Fourth Generation(1971 onwards)

Fourth generation computers used microprocessors instead of IC,hence they are also called microcomputers.They use Very Large Scale Integration(VLSI) technology.A microprocessor consists of millions of transistors and components.Semiconductors were used as main memory.This generation saw the development of pointing devices like mouse and handheld devices.Fourth computers were more portable and reliable.

Fifth Generation(Future)

The present day computers belongs to this generation.They are based on Artificial Intelligence (AI).They are used in speech recognition,face recognition,robotics etc.This generation computers uses parallel processing and has faster execution speed.

Evolution of Computing

Computing machines are used for storing,processing and displaying information.This is done by using instructions given to it..Early computers were capable of performing a single task.They were similar to calculator.Later John Von Neumann proposed stored program concept,which enables to store data and programs in memory.The set of instructions used for performing a task is called program.

Agusta Ada Lowelace

Ada Lovelace is considered to have written instructions for the first computer program in the mid-1800s.She is often referred to as 'the **first programmer**'.

Programming Languages

A program is a group of instructions.Programs are created using programming languages.Earlier computers used machine language.It consist of 0 and 1.The main disadvantage of machine language was, it was very difficult to find error and programmer needs good knowledge of comuter architecture.Later assembly languages

were introduced.EDSAC(Electronic Delay Storage Automatic Calculator) was first to use assembly language.It was machine dependent and not portable.Later high level languages(HLL) were introduced.It used simple english like words and sentences.It was easy to learn and understand.

Algorithm and computer programs

Algorithms are tools for planning a computer program.It help to understand the logic of a program.An algorithm is a step by step instructions to solve a problem.It can be converted into machine form using programming languages.

Stored program concept

Stored program concept was proposed byJohn Von Neumann.Digital computers use stored program concept.Here programs and data are stored in memory and instructions are executed one by one by the processor.Computers based on Von neumann architecture is also called control flow computers.

Theory of computation

Theory of computation is a branch that deals with whether and how efficiently the problem can be solved on a model of computation using an algorithm.A resonable model of computation is Turing machine.

Alan Turing made made significant contributions to the development of computer science,by presenting the concepts of algorithm and computing with the help of Turing Machine.He is regarded as the father of modern computer science.

A turing machine is a theoretical computing device that manipulate symbols according to a table of rules.It can be adapted to simulate the logic of any computer algorithm.The action of a Turing machine is determined by (a) thecurrent state of the machine(b) the symbol in the cell currently being scanned by the head and (c) a table of transition rules.

Summary:-

- Number system is a method of representing numbers.
- Egyptian number system emerged around 3000BC. It used 10 as radix.
- Babylonian number system used 60 as its base. It was called sexagesimal system.
- Hindu_Arabic number system originated in India. Its greatest contribution was the use of Zero(0).
- The first microprocessor was **Intel 4004**.
- The base of Sumerian /Babylonian number system is 60 (sexagesimal system).
- Abacus is also called counting frame.
- Mark 1 was one of the world's first stored-program computers.
- Moore law states that the number of IC doubles every two years.
- The theory of computing is the study of efficient computation.
- John Von Neumann introduced the *'Stored Program Concept'*.
- The word Abacus means calculating board.
- The first Electronic computer was **ENIAC** (Electronic Numerical Integrator and Calculator).
- **EDVAC** (*Electronic Discrete Variable Automatic Computer*) was one of the earliest electronic computers. It used binary rather than decimal, and was a stored program computer.
- **UNIVAC** (Universal Automatic Computer I) was the first commercial computer.
- **Colossus** was the world's first electronic, digital, programmable computer. British codebreakers used Colossus to read secret German messages during World War II.