**Fundamentals of Computer**

**What is a Computer ?**

**By definition, Computer is an electronic device designed to accept and manipulate data to produce meaningful information.**

**Data vs Information**

**Data is a term used when referring to those values which are yet to be processed while information is a term used when referring to those values that were already processed.**

**Examples of data: rate per hour, student no., score in quiz, grade in project**

**Examples of information : prelim grade, class standing, net pay, discount**

**amount, average grade**

**Characteristics of Computer:**

1. **It has a memory.**
2. **It is electronic.**
3. **It is automatic.**
4. **It has arithmetic functions.**
5. **It has logical functions.**
6. **It is an inanimate object.**
7. **It runs on electrical energy.**

**Capabilities of Computer:**

1. **Speed.**
2. **Accuracy.**
3. **Store and Recall capabilities.**
4. **It can perform arithmetic operations.**
5. **It can perform logical operations.**
6. **It can manipulate strings.**
7. **It can do repetitive tasks.**

**Limitations:**

1. **Dependence on human instructions.**
2. **It cannot produce information on its own.**
3. **It cannot make an original decision.**
4. **It cannot correct wrong instructions or wrong data on its own.**
5. **Data must be quantified.**
6. **Dependence on electrical energy.**
7. **Subject to errors due to hardware malfunctions, power fluctuations, and other related damages.**

**Fundamentals of Computer Lec**

**Parts of a Typical Computer System**

Central Processing Unit

**Arithmetic Logic Unit**

Data

Instructions

**Output**

**Input**

**Memory**

**Unit**

Data

Data

Control

**Control Unit**

**Key Components of Computer**

* **Central Processing Unit ( CPU ) - known as the brain behind every computer system. It performs storage, processing, and control functions.**

**Parts of CPU**

1. **Arithmetic Logic Unit (ALU ) - part of CPU that performs mathematical and logical operations.**
2. **Control Unit – part of CPU that serves as the supervisor of the entire computer system. Overall in-charged of coordinating the activities of all the subsystems that comprise the computer system.**
3. **Memory - part of CPU that stores the actual data and instructions. Also called primary memory. Primary memory is a type memory that is directly available to CPU.**

**Types of Primary memory :**

* **Random Access Memory ( RAM ) - a type of primary memory which is volatile in nature ( less permanent ). It automatically looses its contents when the computer is turned off.**
* **Read-only Memory ( ROM) - a type of memory that contains predefined programs being used by the computer for its operation. It is more permanent compared to RAM. Users are allowed to access the contents of ROM but are restricted from making any modifications.**
* **Input devices – devices that transform data, from human-readable form to machine-readable form.**

**Example: keyboard ( standard output ), mouse, microphone, web cam. Scanner**

* **Output devices – devices that transform data, from machine-readable form to human-readable form.**

**Example: monitor ( standard output ), printer, speaker, head phones**

**Functional Elements of Computer**

1. **Input Section - section of computer where data and instructions are taken in , from the outside world into the computer’s internal memory.**
2. **Process Section - section of computer that Is responsible in performing arithmetic and logical operations.**
3. **Output Section – section of computer where the results of processing are transferred, from the computer’s internal memory back to the outside world.**

**Different Types of Computer**

**Computers can be classified based on their size or capabilities, their principles of operation, their purpose , and their age.**

1. **Types of Computer Based on Purpose**
2. **Special purpose computers are built for specific application.**

**Example: ATM machines, Point-of-Sales Terminals, Toll-Fee Collecting Machines**

1. **General purpose computers are used for any type of applications. They can store different programs and do the jobs as per the instructions specified on those programs. Most of the computers that we see today, are general purpose computers.**
2. **Types of Computer Based on Principles of Operation**
3. **Analog Computer is a computing device that works on continuous range of values. The results given by the analog computers will only be approximate since they deal with quantities that vary continuously. It generally deals with physical variables such as voltage, pressure, temperature, speed, etc.**
4. **Digital computer operates on digital data such as numbers. It uses binary number system in which there are only two digits 0 and 1. Each one is called a bit. Digital computers are designed using digital circuits in which there are two levels for an input or output signal. These two levels are known as logic 0 and logic 1. Digital Computers can give more accurate and faster results.**

**Digital computer is well suited for solving complex problems in engineering and technology. Hence digital computers have an increasing use in the field of design, research and data processing.**

1. **Hybrid computer combines the desirable features of analog and digital computers. It is mostly used for automatic operations of complicated physical processes and machines. Now-a-days analog-to-digital and digital-to-analog converters are used for transforming the data into suitable form for either type of computation.**

**Example: In hospital’s ICU, analog devices might measure the patients temperature, blood pressure and other vital signs. These measurements which are in analog might then be converted into numbers and supplied to digital components in the system. These components are used to monitor the patient’s vital sign and send signals if any abnormal readings are detected. Hybrid computers are mainly used for specialized tasks.**

1. **Types of Computer According to Age**

**First Generation (1940-1956)**

* **Used vacuum tubes for circuitry and**[**magnetic drums**](http://www.webopedia.com/TERM/M/magnetic_drum.html)**for**[**memory**](http://www.webopedia.com/TERM/M/memory.html)
* **Enormous, taking up entire rooms.**
* **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.**
* **Relied on**[**machine language**](http://www.webopedia.com/TERM/M/machine_language.html)**, 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,**
* **Output was displayed on printouts.**
* **The UNIVAC and**[**ENIAC**](http://www.webopedia.com/TERM/E/ENIAC.html)**computers are examples of first-generation computing devices.**

**The UNIVAC was the first commercial computer delivered to a business client, the U.S. Census Bureau in 1951.**

**Second Generation (1956-1963)**

* **T**[**ransistors**](http://www.webopedia.com/TERM/T/transistor.html)**replaced vacuum tubes.**

**The transistor was far superior to the vacuum tube, allowing computers to become smaller, faster, cheaper, more energy-efficient and more reliable than their first-generation predecessors. Though the transistor still generated a great deal of heat that subjected the computer to damage, it was a vast improvement over the vacuum tube.**

* **Still relied on punched cards for input and printouts for output.**
* **Moved from cryptic**[**binary**](http://webopedia.com/TERM/B/binary.html)**machine language to symbolic, or**[**assembly**](http://webopedia.com/TERM/a/assembly.html)**, languages.**
* **High-level programming languages were also being developed at this time, such as early versions of**[**COBOL**](http://www.webopedia.com/TERM/C/COBOL.html)**and**[**FORTRAN**](http://www.webopedia.com/TERM/F/FORTRAN.html)**.**
* **First computers that stored their instructions in their memory, which moved from a magnetic drum to magnetic core technology.**
* **First computers of this generation were developed for the atomic energy industry.**

**Third Generation (1964-1971)**

* **The development of the**[**integrated circuit**](http://www.webopedia.com/TERM/I/integrated_circuit_IC.html)**was the hallmark of the third generation of computers.**

**Transistors were miniaturized and placed on**[**silicon**](http://www.webopedia.com/TERM/S/silicon.html)[**chips**](http://webopedia.com/TERM/C/chip.html)**, called**[**semiconductors**](http://webopedia.com/TERM/S/semiconductor.html)**, which drastically increased the speed and efficiency of computers.**

* **instead of punched cards and printouts, users interacted with third generation computers through**[**keyboards**](http://www.webopedia.com/TERM/K/keyboard.html)
* **and**[**monitors**](http://www.webopedia.com/TERM/M/monitor.html)**and**[**interfaced**](http://www.webopedia.com/TERM/I/interface.html)**with an**[**operating system**](http://www.webopedia.com/TERM/O/operating_system.html)
* **Computers for the first time became accessible to a mass audience because they were smaller and cheaper than their predecessors.**

**Fourth Generation (1971-Present)**

* **The**[**microprocessor**](http://www.webopedia.com/TERM/M/microprocessor.html)**brought the fourth generation of computers, as thousands of integrated circuits were built onto a single silicon chip. What in the first generation filled an entire room could now fit in the palm of the hand. The Intel 4004 chip, developed in 1971, located all the components of the computer—from the**[**central processing unit**](http://www.webopedia.com/TERM/C/CPU.html)**and memory to input/output controls—on a single chip.**
* **In 1981**[**IBM**](http://www.webopedia.com/TERM/I/IBM.html)**introduced its first computer for the home user**
* **In 1984**[**Apple**](http://webopedia.com/TERM/A/Apple_Computer.html)**introduced the Macintosh.**
* **Microprocessors also moved out of the realm of desktop computers and into many areas of life as more and more everyday products began to use microprocessors.**
* **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**](http://webopedia.com/TERM/G/GUI.html)**, the** [**mouse**](http://webopedia.com/TERM/M/mouse.html)**and** [**handheld**](http://webopedia.com/TERM/H/hand_held_computer.html)**devices.**

**Fifth Generation (Present and Beyond)**

* **Fifth generation computing devices, based on**[**artificial intelligence**](http://webopedia.com/TERM/A/artificial_intelligence.html)**, are still in development, though there are some applications, such as**[**voice recognition**](http://webopedia.com/TERM/V/voice_recognition.html)**, that are being used today.**
* **The use of**[**parallel processing**](http://webopedia.com/TERM/P/parallel_processing.html)**and superconductors is helping to make artificial intelligence a reality.**
* **The goal of fifth-generation computing is to develop devices that respond to**[**natural language**](http://webopedia.com/TERM/N/natural_language.html)**input and are capable of learning and self-organization.**

1. **Types of Computer According to Size**

**Supercomputers**

* **Widely used in scientific applications such as aerodynamic design simulation, processing of geological data.**
* **Supercomputers are the most powerful computers. They are used for problems requiring complex calculations.**
* **Supercomputers are relatively rare.**
* **Supercomputers are used by universities, government agencies, and large businesses.**

**Mainframe Computers:**

* **Usually slower, less powerful and less expensive than supercomputers.**
* **Mainframes are used by banks and many businesses to update inventory etc.**
* **Mainframe computers can support hundreds or thousands of users, handling massive amounts of input, output, and storage.**
* **Mainframe computers are used in large organizations where many users need access to shared data and programs.**
* **Mainframes are also used as e-commerce servers, handling transactions over the Internet.**

**Minicomputers**

* **Smaller than mainframe, a general purpose computers which give computing power without adding the prohibitive expenses associated with larger computer systems.**
* **Minicomputers usually have multiple terminals.**
* **Minicomputers may be used as network servers and Internet servers.**

**Microcomputers, or Personal Computers is the smallest, least expensive of all the computers. Micro computers have smallest memory and less power, are physically smaller and permit fewer peripherals to be attached.**

**Types of Microcomputer:**

* **Desktop computers are the most common type of PC.**
* **Notebook (laptop) computers are used by people who need the power of a desktop system, but also portability.**
* **Handheld PCs (such as PDAs) lack the power of a desktop or notebook PC, but offer features for users who need limited functions and small size.**