GENERATIONS AND TYPES OF COMPUTERS

3.1. Computer Generations

As you go through the **history and evolution of computers**, you will find that the earliest computers were big in size, consumed a lot of power and heated up quickly, due to which it had to be shut down, frequently to be cooled. They were very expensive in terms of development and maintenance. As **technology** improved, computers became compact, faster and more powerful. From a user's perspective, they become **user friendly** and more affordable. This has largely contributed towards the popularity that computers have gained these days.

The term **'generation'** was earlier used only to distinguish between varying hardware technologies but was later extended to include both **hardware** and **software**. A comparison of generations is made below.

3.2. First Generation Computers (1940 - 1956)

The first generation of computers was characterized by **vacuum tubes** in the circuitry and magnetic drums for memory. These computers were enormous in size, used great deal of electricity and were expensive to operate. They also had limited storage capacity.

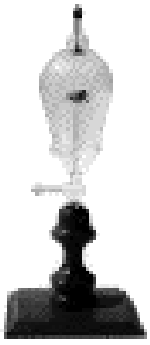

Figure 1: Vacuum Tube

First generation computers relied on machine language (binary-coded program) to perform operations and could solve only one problem at a time. Punched cards and paper tapes were used to input data and instructions, and output was displayed on printouts.

Early computers like ENIAC, EDVAC and UNIVAC can all be classified as first generation computers.

3.3. Second Generation Computers (1956 - 1963)

In the early 1950s, the discoveries of **Transistor** and **Magnetic core memory** changed the image of computers – from unreliable to highly reliable machines with increased capability, and higher storage capacity.

The **transistor** was far superior to the **vacuum tube**, allowing computers to become smaller in size, cheaper, reliable and more energy efficient. Though transistor still generated a great deal of heat, it was a substantial improvement over the vacuum tube. Second generation of computers was also characterized by allowing programmers to specify instructions in symbolic (or assembly) language rather than cryptic binary machine language. High level programming languages like **COmmon Business Oriented Language (COBOL)** and **FORmula TRANslation (FORTRAN)** were also being developed at this time.

Due to the increase in the cost of expanding programming, these machines were expensive to purchase and operate. Such computers were, therefore, mostly found in large computer centers or government/private laboratories with many programmers and support professionals.

3.4. Third Generation Computers (1964 - 1971)

The development of **Integrated Circuit (IC)** by ***Jack Kilby***, an engineer with Texas Instruments, in 1958, was the hallmark of the third generation of computers. Punched cards and printouts gave way to devices like keyboards and monitors making it easier for the user to interact with the computer. Computer manufacturers could provide a range of accessories like the cathode ray tube display devices, page printers, consoles etc. Existence of an **operating system** allowed the device to run various applications at one time with the central program monitoring the memory. An **operating system**

(**OS**) is a collection of software that manages computer hardware resources and provides common services for computer programs.

So computers were being widely used in business for areas like:

- Accounting
- Payroll
- Billing
- Tracking Inventory, etc.

Third generation computers were substantially smaller and cheaper than their predecessors.

3.5. Fourth Generation Computers (1971 to present)

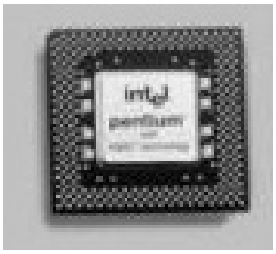

Figure 2: IC Chip

The trend in 1970s was to move from single-purpose but powerful computers towards cheaper computer systems that could support a large range of applications. A new revolution in computer hardware came about which could shrink the computer logic circuitry and its components using the Large Scale Integration (LSI) technology. Hundreds of components could now fit onto a single chip!

In the 1980s, **Very Large Scale Integration (VLSI)** squeezed hundreds of thousands of components onto a single chip. This shrinking trend continued and led to the introduction of personal computers (PCs) programmable machines that are small enough and inexpensive so that these can be purchased and used by individuals. Companies like Apple Computers and IBM introduced very successful PCs.

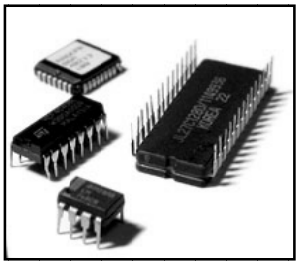

Figure 2: Intel Pentium Microprocessor Chip

The IC technology was not only used to construct the processor, but also for the construction of memory. The first memory chip was constructed in 1970 and could hold 256 bits.

3.6. Fifth Generation Computers (the Road Ahead)

The fifth generation of computers characterized by **artificial intelligence** is in the process of development. The goal here is to develop devices that are capable of learning and responding to natural language input. This generation of computers is using new technologies in very large scale integration, along with new programming languages and will be capable of amazing feats, in the area of artificial intelligence, such as voice recognition.

3.7. CLASSIFICATION OF COMPUTERS

Computers can be classified based on their principles of operation as per the electronic signal or on their configuration. By configuration, we mean the size, speed of doing computation and storage capacity of a computer.

Computers, in general are of three types as per the electronic signal they transmit.

A. Analog Computers

B. Digital Computers

C. Hybrid Computers

A. Analog Computers

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.

Ex: abacus, **old-fashioned cash register** (with gears and handle), gear-driven clocks/watches, **Educational Analog Computer**

B. Digital Computers

On the other hand a 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**. The digital computer is 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.

Based on the purpose, Digital computers can be further classified as,

- General Purpose Computers
- Special Purpose Computers

Special purpose computer is one that is built for a specific application.

Ex: video games, cameras, digital watches, washing machines, robots elevators, aircraft and satellite controllers, MRT and LRT etc.

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.

Ex: personal computer, All computers from micro to mainframe are general purpose.

C. Hybrid Computers

A 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.

For example, in hospital's ICU, analog devices might measure the patient's 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.

3.8. Types of Computers based on Configuration

There are four different types of computers when we classify them based on their performance and capacity. The four types are –

1. Super Computers
2. Mainframe Computers
3. Mini Computers
4. Micro Computers

3.8.1. Super Computers

Super computers are the ***best*** in terms of processing capacity and also the ***most expensive*** ones. These computers can process Billions of Instructions Per Second (BIPS). Normally, they will be used for applications which require intensive numerical computations such as stock analysis, weather forecasting etc. Other uses of supercomputers are scientific simulations, (animated) graphics, fluid dynamic calculations, nuclear energy research, electronic design, and analysis of geological data (e.g. in petrochemical

prospecting). Perhaps the best known super computer manufacturer is **Cray Research.** Some of the traditional companies which produce super computers are **Cray**, **IBM** and **Hewlett-Packard**.

3.8.2. Mainframe Computers

Mainframe computers can also process data at very high speeds i.e., hundreds of million instructions per second and they are also quite expensive. Normally, they are used in banking, airlines and railways etc for their applications.

3.8.3. Mini Computers

Mini computers are lower to mainframe computers in terms of speed and storage capacity. They are also less expensive than mainframe computers. Some of the features of mainframes will not be available in mini computers. Hence, their performance also will be less than that of mainframes.

3.8.4. Micro Computers

The invention of microprocessor (single chip CPU) gave birth to the much cheaper micro computers. They are further classified into

- **Desktop Computers**
- **Laptop Computers**
- **Handheld Computers (PDAs)**

3.8.5. Desktop Computers

Today the Desktop computers are the most popular computer systems. These desktop

computers are also known as personal computers or simply PCs. They are usually easier to use and more affordable. They are normally intended for individual users for their word processing and other small application requirements.

3.8.6. Laptop Computers

Laptop computers are portable computers. They are lightweight computers with a thin screen. They are also called as notebook computers because of their small size. They can operate on batteries and hence are very popular with travelers. The screen folds down onto the keyboard when not in use.

3.8.7. Handheld Computers

Handheld computers or Personal Digital Assistants (PDAs) are pen-based and also battery-powered. They are small and can be carried anywhere. They use a pen like stylus and accept handwritten input directly on the screen. They are not as powerful as desktops or laptops but they are used for scheduling appointments, storing addresses and playing games. They have touch screens which we use with a finger or a stylus.

MODEL QUESTIONS

1. The term 'generation' was earlier used only to distinguish between varying _____ technologies (**Hardware**)
2. The first generation of computers was characterized by _____ (**vacuum tubes**)
3. First generation computers works based on machine language means **binary-coded program**
4. **ENIAC**, **EDVAC** and **UNIVAC** can all be classified as _____computers. (**first generation**)
5. **Transistor** and **Magnetic core memory** are use for building of **Second generation computers**
6. **COBOL** and **FORTRAN** were developed during _____(**Second generation**)
7. Integrated Circuits introduced by_____ **(Jack Kilby)**

8. LSI technology supports Hundreds of components could fit onto a ____ (**single chip**)
9. **V**ery **L**arge **S**cale **I**ntegration (VLSI) technology supports squeezed _____ of components onto a single chip (**hundreds of thousands**)
10. Introduction of personal computers (PCs) happened in **Fourth Generation**
11. The IC technology also used for the construction of **memory**
12. The first memory chip was constructed in 1970 and could hold **256 bits**
13. The fifth generation of computers characterized by **artificial intelligence**
14. Analog Computer works on _____range of values. (**continuous**)
15. Digital computers have binary number system in which there are only 2 digits **0 and 1**
16. Super computers are the ***best*** in terms of _____ (**processing capacity)**

SK. Faiz Ahmed, Nellore.