ST. LAWRENCE HIGH SCHOOL

A Jesuit Christian Minority Institution

FOR GOD AND COUNTRY

STUDY MATERIAL - 2

Subject: COMPUTER SCIENCE **Class - 11** **F.M:15**

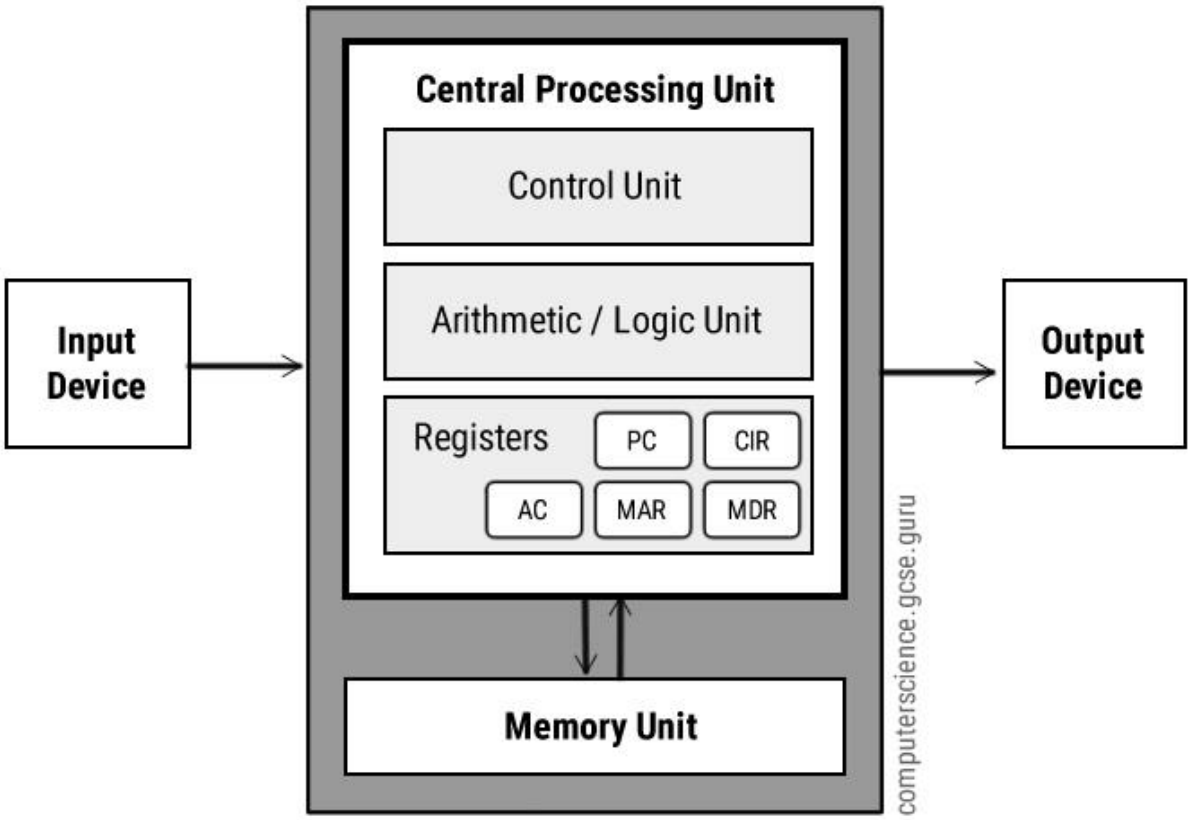
Chapter: Evolution of Computers **Date: 22/06/2020**

SOME EARLY COMPUTING DEVICES

Srl. No	Inventor's Name	Device and its brief description
1.	The Chinese people	**ABACUS**: It was a wooden rack which has metal rods with beads mounted on them. The beads were moved by the abacus operator according to some rules to perform arithmetic calculations.
2.	John Napier	**Napier's Bones**: In this calculating tool, 9 different ivory strips or bones were used to mark with numbers to multiply and divide.
3.	Blaise Pascal	**Pascaline**: It could only perform addition and subtraction. It was a wooden box with a series of gears and wheels. When a wheel is rotated one revolution, it rotates the neighbouring wheel.
4.	Gottfried Wilhelm Leibnitz	**Stepped Reckoner or Leibnitz wheel**: It was a digital mechanical calculator which was called the stepped reckoner as instead of gears it was made of fluted drums.
5.	Joseph Marie Jacquard	**Punch Cards**: It was to take inputs from user.
6.	Charles Babbage	**Difference Engine**: It was a mechanical computer which could perform simple calculations. It was a steam driven calculating machine designed to solve tables of numbers like logarithm tables. **Analytical Engine**: It was a mechanical computer that used punch-cards as input. It was capable of solving any mathematical problem and storing information as a permanent memory.
7.	Herman Hollerith	**Tabulating Machine**: It was a mechanical tabulator based on punch cards. It could tabulate statistics and record or sort data or information.

VON NEUMANN ARCHITECTURE

- Historically there have been 2 types of Computers:
  - **Fixed Program Computers –** Their function is very specific and they couldn't be programmed, e.g. Calculators.
  - **Stored Program Computers –** These can be programmed to carry out many different tasks, applications are stored on them, hence the name.
- The modern computers are based on a stored-program concept introduced by John Von Neumann.
- His computer architecture design consists of a Control Unit, Arithmetic and Logic Unit (ALU), Memory Unit, Registers and Inputs/Outputs.
- Von Neumann architecture is based on the stored-program computer concept, where instruction data and program data are stored in the same memory. This design is still used in most computers produced today.



Let's consider its parts in details:

a) **CU**: A control unit (CU) handles all processor control signals. It directs all input and output flow, fetches code for instructions and controlling how data moves around the system.

b) **ALU**: The arithmetic logic unit is that part of the CPU that handles all the calculations the CPU may need, e.g. Addition, Subtraction, Comparisons. It performs Logical Operations, Bit Shifting Operations, and Arithmetic Operation.

c) **Registers**: Registers are high speed storage areas in the CPU. All data must be stored in a register before it can be processed.

MAR	Memory Address Register	Holds the memory location of data that needs to be accessed
MDR	Memory Data Register	Holds data that is being transferred to or from memory
AC	Accumulator	Where intermediate arithmetic and logic results are stored
PC	Program Counter	Contains the address of the next instruction to be executed
CIR	Current Instruction Register	Contains the current instruction during processing

d) **I/O devices**: Program or data is read into main memory from the *input device* or secondary storage under the control of CPU input instruction. *Output devices* are used to output the information from a computer. If some results are evaluated by computer and it is stored in the computer, then with the help of output devices, we can present it to the user.

e) **Buses:** Buses are the means by which data is transmitted from one part of a computer to another, connecting all major internal components to the CPU and memory. A standard CPU system bus is comprised of a control bus, data bus and address bus.

Address Bus	Carries the addresses of data (but not the data) between the processor and memory
Data Bus	Carries data between the processor, the memory unit and the input/output devices
Control Bus	Carries control signals/commands from the CPU (and status signals from other devices) in order to control and coordinate all the activities within the computer

f) Main memory unit:

- The memory unit consists of RAM, sometimes referred to as primary or main memory. Unlike a hard drive (secondary memory), this memory is fast and also directly accessible by the CPU.
- RAM is split into partitions. Each partition consists of an address and its contents (both in binary form).

- The address will uniquely identify every location in the memory.
- Loading data from permanent memory (hard drive), into the faster and directly accessible temporary memory (RAM), allows the CPU to operate much quicker.

GENERATIONS OF COMPUTERS

Generations	Technology Used	Examples
First Generation (1942-1955)	Vacuum tubes	• **ENIAC** (Electronic Numerical Integrator and Computer) • **EDVAC** (Electronic Discrete Variable Automatic Computer) • **UNIVAC**(Universal Automatic Computer) • **IBM-701** • **IBM-650**
Second Generation (1955-1964)	Transistor	• **IBM 1620** • **IBM 7094** • **CDC 1604** • **CDC 3600** • **UNIVAC 1108**
Third Generation (1964-1975)	integrated circuits (ICs)	• **IBM-360 series** • **Honeywell-6000 series** • **PDP(Personal Data Processor)** • **IBM-370/168** • **TDC-316**
Fourth Generation (1975-1989)	large scale integrated (LSI) circuits and very large scale integrated (VLSI) circuits	• **DEC 10** • **STAR 1000** • **PDP 11** • **CRAY-1(Super Computer)**
Fifth Generation (1989-till present)	ULSI (Ultra Large Scale Integration)	• **Desktop** • **Laptop** • **NoteBook** • **UltraBook**

Salient Features of Computer generations:

First Generation Computers

1. It made use of vacuum tubes which are the only electronic component available during those days.
2. These computers could calculate in milliseconds.
3. These were very big in size, weight was about 30 tones.
4. These computers were very costly.
5. It could store only a small amount of information due to the presence of magnetic drums.
6. As the invention of first generation computers involves vacuum tubes, so another disadvantage of these computers was, vacuum tubes require a large cooling system.
7. Very less work efficiency.
8. Limited programming capabilities and punch cards were used to take inputs.
9. Large amount of energy consumption.
10. Not reliable and constant maintenance is required.

Second Generation Computers

1. Due to the presence of transistors instead of vacuum tubes, the size of electron component decreased. This resulted in reducing the size of a computer as compared to first generation computers.
2. Less energy and not produce as much heat as the first generation.
3. Assembly language and punch cards were used for input.
4. Low cost than first generation computers.
5. High level programming languages were being developed (early versions of COBOL and FORTRAN).
6. Better speed, calculate data in microseconds.
7. Better portability as compared to first generation
8. A cooling system was required.
9. Constant maintenance was required.
10. Only used for specific purposes.
11. Magnetic core technology was used as their memory devices.

Third Generation Computers

1. These computers were based on Integrated circuits (ICs).
2. IC was a single component containing number of transistors.
3. These computers were cheaper as compared to second-generation computers.
4. They were fast and reliable.

5. Use of IC in the computer provides the small size of the computer.
6. IC not only reduces the size of the computer but it also improves the performance of the computer as compared to previous computers.
7. This generation of computers has big storage capacity.
8. Instead of punch cards, mouse and keyboard are used for input.
9. They used an operating system for better resource management and used the concept of time-sharing and multiple programming.
10. These computers reduce the computational time from microseconds to nanoseconds.
11. IC chips are difficult to maintain.
12. The highly sophisticated technology required for the manufacturing of IC chips.
13. Air conditioning is required.

Fourth Generation Computers

1. This technology is based on Microprocessor.
2. A microprocessor is used in a computer for any logical and arithmetic function to be performed in any program.
3. Graphics User Interface (GUI) technology was exploited to offer more comfort to users.
4. Fastest in computation and size get reduced as compared to the previous generation of computer.
5. Heat generated is negligible.
6. Small in size as compared to previous generation computers.
7. Less maintenance is required.
8. All types of high-level language can be used in this type of computers.
9. The Microprocessor design and fabrication are very complex.
10. Air conditioning is required in many cases due to the presence of ICs.
11. Advance technology is required to make the ICs.

Fifth Generation Computers

1. This generation is based on artificial intelligence.
2. The aim of the fifth generation is to make a device which could respond to natural language input and are capable of learning and self-organization.
3. This generation is based on ULSI (Ultra Large Scale Integration) technology resulting in the production of microprocessor chips having ten million electronic components.
4. It is more reliable and works faster.
5. It is available in different sizes and unique features.
6. It provides computers with more user-friendly interfaces with multimedia features.
7. They need very low-level languages.
8. They may make the human brains dull and doomed.

Answer the following questions:

1. **Name at least four early calculating devices.**

   Ans: Napier's Bone, Pascaline, Stepped Reckoner and Punched Cards.

2. **Name the first operational general purpose computers.**

   Ans: Electronic Numerical Integrator and Computer (ENIAC) was the first operational general purpose computers**.**

3. **Who first proposed the concept of 'Stored Program Computer'.**

   Ans: John von Neumann was the first person who proposed the concept of 'Stored Program Computer'.

4. **Who is known as father of Computers? Why?**

   Ans: Charles Babbage is known as father of Computers because his concepts and inventions laid the foundation of modern day computers.

5. **Define the term IC.**

   Ans: An integrated circuit (IC) is a small semiconductor-based electronic device consisting of fabricated transistors, resistors and capacitors. Integrated circuits are the building blocks of most electronic devices and equipment.

6. **Who introduced the concept of punched cards?**

   Ans: Joseph Marie Jacquard introduced the concept of punched cards.

7. **Which generation of computers used LSI and VLSI technology?**

   Ans: Fourth generation of computers used LSI and VLSI technology as their chief component.

8. **Which generation of computers used Vacuum tubes as their chief technology?**

   Ans: First generation of computers used Vacuum tubes as their chief technology.

9. **Name some examples of first generation of computers.**

   Ans: UNIVAC, ENIAC and EDVAC are some of the examples of first generation of computers.

10. Write any three disadvantages of first generation of computers.

Ans: Those computers were computers were slow, huge and expensive.

11. Write any three advantages of fourth generation of computers.

Ans: Such computers are faster, powerful and affordable.

12. Compare the salient features of first and second generation computers.

Ans:

1) Transistors were used in place of vacuum tubes.
2) Second generation computers were smaller in comparison with the first generation computers.
3) They were faster in comparison with the first generation computers.
4) They generated less heat and were less prone to failure.
5) They took comparatively less computational time.
6) Assembly language was used for programming.
7) Second generation computers has faster input/output devices.

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