Q 1: Describe the basic differences between computer architecture and computer organization. Explain it with suitable examples.

Ans: Computer architecture refers to those parameters of a computer system that are visible to a programmer or those parameters that have a direct impact on the logical execution of a program. Examples of architectural attributes include the instruction set, the number of bits used to represent different data types, I/O mechanisms, and techniques for addressing memory.

Computer organization refers to the operational units and their interconnections that realize the architectural specifications. Examples of organizational attributes include those hardware details transparent to the programmer, such as control signals, interfaces between the computer and peripherals, and the memory technology used.

In more general language, Architecture of computer system can be considered as a catalog of tools available for any operator using the system, while Organization will be the way the system is structured so that all those cataloged tools can be used, and that in an efficient fashion.

Examples are:

1. It is an architectural design issue whether a computer will have a multiply instruction. It is an organizational issue whether that instruction will be implemented by a special multiply unit or by a mechanism that makes repeated use of the add unit of the system. The organizational decision may be based on anticipated frequency of use of the multiply instruction, the relative speed of the two approaches, and the cost and physical size of a special multiply unit.
2. In a multimedia decoder, the designers might need to arrange for most data to be processed in the fastest data path and the various components are assumed to be in place and task is to investigate the organizational structure to verify the computer parts operates. Computer organization also helps plan the selection of a processor for a particular project. Multimedia projects may need very rapid data access, while supervisory software may need fast interrupts. Sometimes certain tasks need additional components as well.
3. A computer capable of virtualization needs virtual memory hardware so that the memory of different simulated computers can be kept separated. Computer organization and features also affect power consumption and processor cost.

Q 2:Brifely write about evaluation of computer by giving emphasis on first generation ,second generation computer, etc.

Ans: The computer has evolved through the following stages:

1. **The mechanical era (1623-1945):** Trying to use machines to solve mathematical problems. Charles Babbage (The father of computer) designed ambitious machines “Difference Engine ”and ”Analytical Engine” including several important programming techniques including conditional branches, iterative loops and index variables .The US Census Bureau was one of the first organizations to use the mechanical computers which used punch-card equipment designed by Herman Hollerith to tabulate data for the 1890 census. In 1911 Hollerith's company merged with a competitor to found the corporation which in 1924 became International Business Machines (IBM).
2. **First Generation Electronic Computers (1937-1953)(**Vacuum Tube**):**These devices used electronic switches, in the form of vacuum tubes, instead of electromechanical relays. The first general purpose programmable electronic computer was the Electronic Numerical Integrator and Computer (ENIAC).ENIAC was controlled by a set of external switches and dials; to change the program required physically altering the settings on these controls designed by Mauchly & Echert, built by US army to calculate trajectories for ballistic shells during WorldWar II. Around 18000 vacuum tubes and 1500 relays were used to build ENIAC, and it was programmed by manually setting switches

EDVAC was the notion of a stored program.EDVAC was able to run orders of magnitude faster than ENIAC and by storing instructions in the same medium as data.UNIVAC was arguably the first commercially successful computer designed in 1952.Software technology during this period was very primitive.

Features:

* Electron emitting devices
* Data and programs are stored in a single read-write memory
* Memory contents are addressable by location, regardless of the content itself
* Machine language/Assemble language
* Sequential execution

1. **Second Generation (1954-1962)(tansistior):**The second generation witnessed several important developments at all levels of computer system design, ranging from the technology used to build the basic circuits to the programming languages used to write scientific applications. Electronic switches in this era were based on discrete diode and transistor technology with a switching time of approximately 0.3 microseconds. Index registers were designed for controlling loops and floating point units for calculations based on real numbers. A number of high level programming languages were introduced and these include FORTRAN (1956), ALGOL (1958), and COBOL (1959). Important commercial machines of this era include the IBM 704 and its successors, the 709 and 7094. In the 1950s the first two supercomputers were designed specifically for numeric processing in scientific applications.

Features:

* William Shockley, John Bardeen, and Walter Brattain invent the **transistor** that reduce size of computers and improve reliability. Vacuum tubes have been replaced by transistors.
* **First operating Systems:** handled one program at a time
* **On-off switches** controlled by electronically.
* **High level languages**
* **Floating point arithmetic**

1. **Third Generation (1963-1972)(Integrated circuits):**Technology changes in this generation include the use of integrated circuits, or ICs (semiconductor devices with several transistors built into one physical component), semiconductor memories, microprogramming as a technique for efficiently designing complex processors and the introduction of operating systems and time-sharing. The first ICs were based on small-scale integration (SSI) circuits, which had around 10 devices per circuit (or ‘chip’), and evolved to the use of medium-scale integrated (MSI) circuits, which had up to 100 devices per chip. Multilayered printed circuits were developed and core memory was replaced by faster, solid state memories.

Features:

* **Microprocessor chips** combines thousands of transistors, entire circuit on one computer chip.
* **Semiconductor memory**
* **Multiple computer models** with different performance characteristics
* The size of computers has been reduced drastically

1. **Fourth Generation (1972-1984) :** Large scale integration (LSI - 1000 devices per chip) and very large scale integration (VLSI - 100,000 devices per chip) were used in the construction of the fourth generation computers. Whole processors could now fit onto a single chip, and for simple systems the entire computer (processor, main memory, and I/O controllers) could fit on one chip. Gate delays dropped to about 1ns per gate. Core memories were replaced by semiconductor memories.In 1972, Dennis Ritchie developed the C language from the design of the CPL (Common Programming Language) and Thompson's B. Thompson and Ritchie then used C to write a version of UNIX.Other developments in software include very high level languages such as FP (functional programming) and Prolog (programming in logic). IBM worked with Microsoft during the 1980s to start what we can really call PC (Personal Computer) life today. IBM PC was introduced in October 1981 and it worked with the operating system (software) called ‘Microsoft Disk Operating System (MS DOS) 1.0.

**Features:**

* **Combines** millions of transistors
* **Single-chip processor** and the single-board computer emerged
* Creation of the **Personal Computer (PC)**
* Use of **data communications**
* Massively **parallel machine**

1. **Fifth Generation (1984-1990) :**

This generation brought about the introduction of machines with hundreds of processors that could all be working on different parts of a single program. The scale of integration in semiconductors continued at a great pace and by 1990 it was possible to build chips with a million components - and semiconductor memories became standard on all computers. Computer networks and single-user workstations also became popular. Parallel processing started in this generation.Both wide area network (WAN) and local area network (LAN) technology developed rapidly.

1. **Sixth Generation (1990 - present) :**

Most of the developments in computer systems since 1990 have not been fundamental changes but have been gradual improvements over established systems. This generation brought about gains in parallel computing in both the hardware and in improved understanding of how to develop algorithms to exploit parallel architectures.Wide area networks, network bandwidth and speed of operation and networking capabilities have kept developing tremendously. Personal computers (PCs) now operate with Gigabit per second processors, multi-Gigabyte disks, hundreds of Mbytes of RAM, color printers, high-resolution graphic monitors, stereo sound cards and graphical user interfaces. Thousands of software (operating systems and application software) are existing today.Finally, this generation has brought about micro controller technology. Micro controllers are ’embedded’ inside some other devices (often consumer products) so that they can control the features or actions of the product. They work as small computers inside devices and now serve as essential components in most machines.

Q 3:Show the basic components of computer and explain the Von Neumann Stored Programmed Principle.

Ans:The basic components of computer according to Von Neumann stored program Architecture is as following:



These basic units are:

* + - Central  Processor  Unit
    - Input  Unit
    - Output  Unit
    - Memory  Unit

A. Central Processor Unit (CPU):

Central processor unit consists of two basic blocks:

* + The program control unit has a set of registers and control circuit to generate control signals.
  + The execution unit or data processing unit contains a set of registers for storing data and an Arithmetic and Logic Unit (ALU) for execution of arithmetic and logical operations.

In addition, CPU may have some additional registers for temporary storage of data.

B. Input Unit:

With the help of input unit data from outside can be supplied to the computer. Program or data is read into main storage from input device or secondary storage under the control of CPU input instruction.

Example of input devices: Keyboard, Mouse, Hard disk, Floppy disk, CD-ROM drive etc.

C. Output Unit:

With the help of output unit computer results can be provided to the user or it can be stored in storage device permanently for future use. Output data from main storage go to output device under the control of CPU output instructions.

Example of output devices: Printer, Monitor, Plotter, Hard Disk, Floppy Disk etc.

D. Memory Unit:

Memory unit is used to store the data and program. CPU can work with the information stored in memory unit. This memory unit is termed as primary memory or main memory module. These are basically semiconductor memories.

There are two types of semiconductor memories -

* Volatile Memory          : RAM (Random Access Memory).
* Non-Volatile Memory: ROM (Read only Memory), PROM (Programmable ROM), EPROM (Erasable PROM), EEPROM (Electrically Erasable PROM).

Secondary Memory:

* There is another kind of storage device, apart from primary or main memory, which is known as secondary memory. Secondary memories are nonvolatile memory and it is used for permanent storage of data and program.
* Example of secondary memories:

|  |  |  |
| --- | --- | --- |
| Hard Disk,  Floppy Disk,  Magnetic Tape | ------ | These are magnetic devices, |
| CD-ROM | ------ | Is optical device |
| Thumb drive (or pen drive) | ------ | Issemiconductor memory. |

Q 4:Give the structural and functional view of computer.

Ans: Structure is the way in which components relate to each other while

Function is the operation of individual components as part of the structure.

STRUCURE:

Simplest possible view of a computer:

Storage

Processing

Peripherals

communication Lines

Four main internal structural components:



\*Central Processing Unit (CPU): Controls the operation of the computer and performs its

data processing functions. Often simply referred to as processor.

\*Main Memory : Stores Data.

\*I/O Devices: Moves data between the computer and its external environment.

\*System Interconnection : Some mechanism that provides for communication among

CPU, main memory, and I/O.

FUNCTION:

the basic functions performed by computer is execution of a program, which consists of a set of instructions stored in memory.

Basic computer functions:

\*Data processing: A wide variety of forms, but only a few fundamental methods or types

\*Data storage: long term or short, temporary storage

\*Data movement:

1) Input/Output - when data are received from or delivered to a peripheral, a device connected directly to the computer.

2) Data Communication- when data is moved over longer distances, to or from a remote device.

\*Control: control of the above functions, by instructions provided by the user of the computer (i.e their programs)

Main Structural components of the CPU:

Control Unit: Controls the operation of the CPU and hence the computer.

Arithmetic and Logic Unit (ALU): Performs the computer's data processing functions.

Registers: Provides storage internal to the CPU.

CPU Interconnection: Some mechanism that provides for communication among the control unit, ALU, and registers .



Q 5.what is the concept of family of computers and what are the basic characteristics of a family of computers?

Ans:A computer family is a category of computers with the same designs and microprocessors that are compatible with each other.

A good example of different computer families are the IBM or PC family versus the Apple or Mac family of computers.

In general, a family is a group of products that have similarities, are compatible, or made by the same manufacturer. For example, the Intel Pentium II computer processors are in the same family of processors as they have similar instruction and are compatible with each other.

\*\*\*The key characteristics of a computer family:-

Similar or identical instruction set: In many cases, the same set of machine instructions is supported on all members of the family. Thus, a program that executes on one machine will also execute on any other. Similar or identical operating system: The same basic operating system is available for all family members.

Increasing speed: The rate of instruction execution increases in going from lower to higher family members.

Increasing Number of I/O ports: In going from lower to higher family members.

Increasing memory size: In going from lower to higher family members.

Increasing cost: In going from lower to higher family members.

**Scribe submitted by:-**

* 1. **Sridhar Gajjela (120101024)**
  2. **Abhinav Ravi (120101003)**