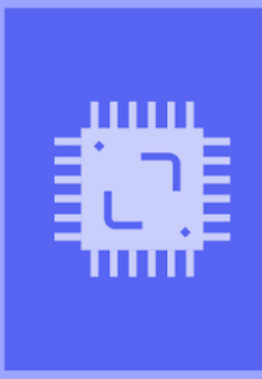
III-I



COMPUTER ORGANIZATION & ARCHITECTURE

Organization of Computer

Module 2 QB Solutions Handbook

Ruthvik Yadav

COA MODULE 2

PART A

1. What is assembly language? Why do we need it? What is the function of Assembler? What is an Address symbol table? Describe in brief.

- Assembly language is a low-level language that allows users to write a program using alphanumeric mnemonic codes. It mainly depends on the architecture of the system.
- Assembly language helps programmers to write human-readable code that is almost similar to machine language. Assembly language is used primarily for direct hardware manipulation, access to specialised processor instructions or to address critical performance issues.
- An assembler is a program that takes basic commands and operations from assembly code and converts them into binary code that can be recognized by a specific type of processor.
- The address symbol table contains information to locate and relocate symbol definitions and references. The assembler creates the symbolic table section for the object file. It makes an entry in the symbol table for each symbol that is defined or referenced in the input file and it is needed during linking.

2. What is an addressing mode? List and explain various addressing modes of a computer with examples.

The term addressing modes refers to the way in which the operand of an instruction is specified. The addressing mode specifies a role for interacting or modifying the address field of the instruction before the operand is actually executed.

Types of addressing modes:

- **Implied addressing mode:** In implied addressing the operand is specified in the instruction itself.
  Example: In stack organised computers, zero address instructions are implied mode instructions.

- **Immediate addressing mode (symbol #):**In this mode data is present in address field of instruction
  Example: `MOV AL, 35H (move the data 35H into AL register)`

- **Register mode:** In register addressing the operand is placed in one of 8 bit or 16 bit general purpose registers. The data is in the register that is specified by the instruction.
  Example: `MOV AX,CX (move the contents of CX register to AX register)`

- **Register Indirect mode:** In this addressing mode, the operand's offset is placed in any one of the registers BX,BP,SI,DI as specified in the instruction. The effective

address of the data is in the base register or an index register that is specified by the instruction.

Example: `MOV AX, [BX](move the contents of memory location s addressed by the register BX to the register AX)`

- **Auto Indexed (increment mode):** Effective address of the operand is the contents of a register specified in the instruction. After accessing the operand, the contents of this register are automatically incremented to point to the next consecutive memory location.

  Example:

  ```
  Add R1, (R2)+  // OR
  R1 = R1 +M[R2]
  R2 = R2 + d
  ```

- **Auto indexed (decrement mode):** Effective address of the operand is the contents of a register specified in the instruction. Before accessing the operand, the contents of this register are automatically decremented to point to the previous consecutive memory location.

  Example:

- **Stack addressing mode:** the operand is contained at the top of the stack

  Example: this instruction simply pops out two symbols containing the top of the stack.

3. Explain the operational concepts between the processor and memory

Basic Operational Concepts

Instructions take a vital role for the proper working of the computer. An appropriate program consisting of a list of instructions is stored in the memory so that the tasks can be started. The memory brings the Individual instructions into the processor, which executes the specified operations. Data which is to be used as operands are moreover also stored in the memory.

Example: Add LOCA, R0

This instruction adds the operand at memory location LOCA to the operand which will be present in the Register R0.

The above mentioned example can be written as follows:

Load LOCA, R1

Add R1, R0

First instruction sends the contents of the memory location LOCA into processor Register R0, and meanwhile the second instruction adds the contents of Register R1 and R0 and places the output in the Register R1.

The memory and the processor are swapped and are started by sending the address of the memory location to be accessed to the memory unit and issuing the appropriate control signals.

The data is then transferred to or from the memory. Analysing how processor and memory are connected :–

Processors have various registers to perform various functions :-

Program Counter :- It contains the memory address of the next instruction to be fetched.

Instruction Register:- It holds the instruction which is currently being executed.

MBR :- It facilities communication with memory. It contains the data to be written into or read out of the addressed location.

MAR :- It holds the address of the data that is to be accessed There are n general purpose registers that is R0 to Rn-1

4. How to measure the performance of the computer? Explain.

Computer performance is the amount of work accomplished by a computer system. The Computer performance depends on:

- **Response time** is the time from start to completion of a task. This also includes:
    - Operating system overhead
    - Waiting for I/O and other processes
    - Accessing disk and memory
    - Time spent executing on the CPU or execution time
- **Throughput** is the total amount of work done in a given time.
- **CPU execution time** is the total time a CPU spends computing on a given task. It also excludes time for I/O or running other programs.

Performance = (1 / Execution time)

5. Explain the computer levels of programming language in detail.

There are three main categories of computer languages namely low level, middle level and high level languages.

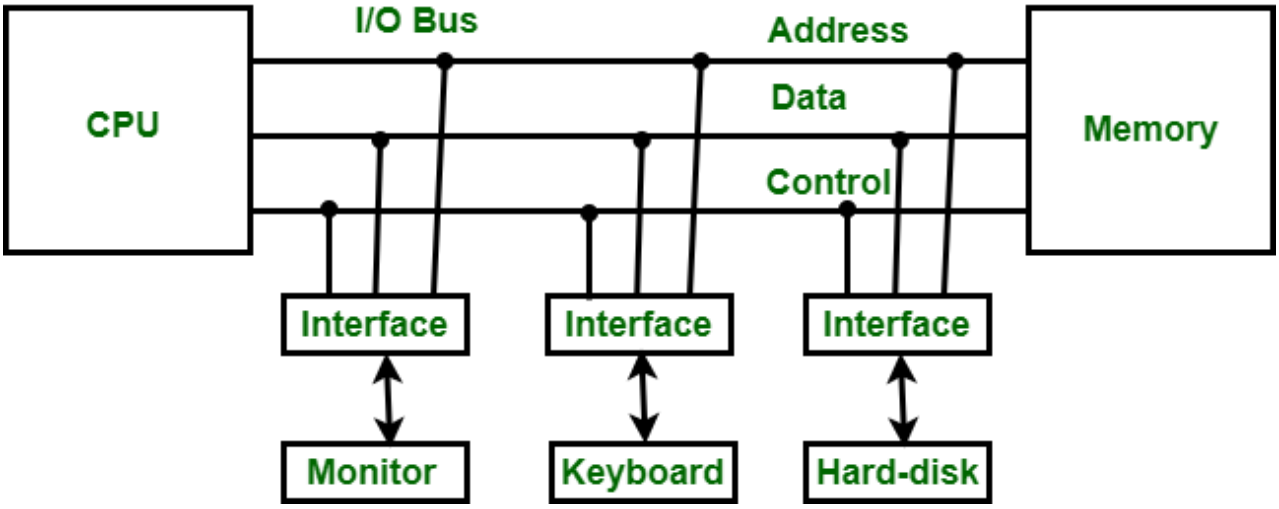
Low-level language:
They are basic computer instructions or better known as machine codes. a computer cannot understand any instructions given to it by the users in English or any other high-level language. Therefore low-level language is easily understandable by the machine. The main function of low-level language is to interact with the hardware of the computer.
They help in operating, syncing and managing all the hardware and system components of the computer.

Middle-level language:
It bridges the gap between machine understandable machine level language and more conventional high-level language. This programming helps in writing system programming as well as application programming.

High-level language: the important feature about high-level languages is that they allow the programmers to write the program for all types of computers and Systems. Every instruction in

high-level language is converted to machine learning for the computer to comprehend Example: Pascal , FORTRAN, C++

6. Illustrate the input and output operations with a neat diagram.



7. What are the four basic types of operations that need to be supported by an Instruction set?

The four basic types of operations that need to be supported by an Instruction set are:

- **Arithmetic/Logic Instructions:**
  These Instructions perform various Arithmetic & Logical operations on one or more operands.

- **Data Transfer Instructions:**
  These instructions are responsible for the transfer of instructions from memory to the processor registers and

vice versa.

- **Branch and Jump Instructions:**
  These instructions are responsible for breaking the sequential flow of instructions and jumping to instructions at various other locations. This is necessary for the implementation of *functions* and *conditional statements*.

- **System Operations:**
  These include OS instructions, virtual memory management instructions.

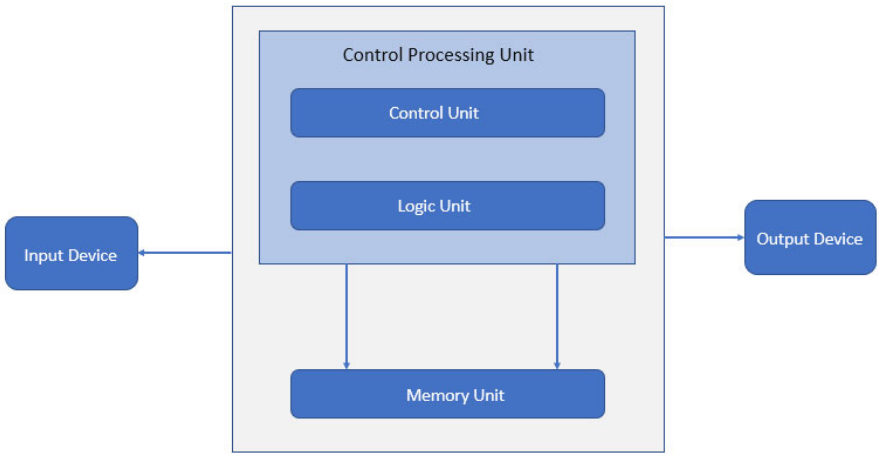
8. Demonstrate the architecture of a basic computer and explain what the input is and output operations in this architecture

Most of today's computers are based on Von Neumann architecture. In this, programs and data are stored in a separate storage unit called memory and are treated the same.
The three basic units of a Von Neumann computer are:

1. Central Processing Unit (CPU)

2. Main memory

3. Input/Output device



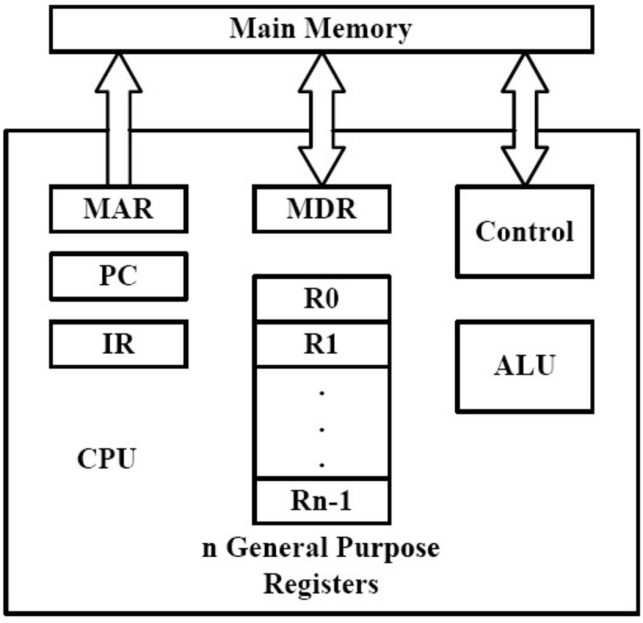
Input:

It is the data that is given by the user and read into the main memory from the input device meant for processing by the CPU

Output:

It is the data that is shown to the user through the output device.

9. Draw and explain the connection between memory and processor with the respective registers.



Communication between memory and processing unit consists of two *registers*:

- Memory Address Register (MAR).
- Memory Data Register (MDR).

To read,

1. The address of the location is put in MAR.
2. The memory is *enabled* for a read.
3. The value is put in MDR by the memory.

To write,

1. The address of the location is put in MAR.
2. The data is put in MDR.
3. The **Write Enable** signal is *asserted*.
4. The value in MDR is written to the location specified.

10. Demonstrate the various generations of Computer

First generation (1946-1959):

- The first generation of computers was based upon vacuum tubes or thermionic valve machines.
- Input was given using punched cards and paper tapes and output was displayed on printouts.
- Ex - ENIAC, EDVAC

Second generation (1959 - 1965):

- This generation was developed by using transistor technology
- A noticeable decrease in computing time compared to the first generation

Third generation (1963 - 1971):

- This generation was based on the Integrated Circuit (IC) technology
- There was a drastic decrease in size, computing time and maintenance cost compared to the previous generation.

Fourth generation (1972 - 2010):

- This generation was developed using microprocessor technology.
- Computers of this generation were cheaper and more powerful compared to the previous generations
- These computers generated comparatively low heat.
- This generation marked the rise of the Personal Computer (PC) and widespread adoption among common people.

Fifth generation (2010 -):

- While previous generations were defined on the basis of hardware only, the fifth generation was categorised on the basis of software too.
- Computers of this generation have high processing power and large memory.
- Some of the popular advanced technologies of the fifth generation include AI, Quantum computation, parallel processing, etc

PART B

1. Demonstrate the basic instruction types in assembly language programming.

Assembly language instructions are grouped together based on the operation they performed.

(1) Data transfer instructions:

Load the data from memory into the microprocessor: These instructions copy data from memory into a microprocessor register

Store the data from the microprocessor into the memory: This is similar to the load data except data is copied in the opposite direction from a microprocessor register to memory.

Move data within the microprocessor: These operations copy data from one microprocessor register to another.

Input the data to the microprocessor: The microprocessor inputs the data from the input devices ex: keyboard into one of its registers.

Output the data from the microprocessor: The microprocessor copies the data from one of the registers to an input device such as a digital display of a microwave oven.

(2) Data operational instructions:

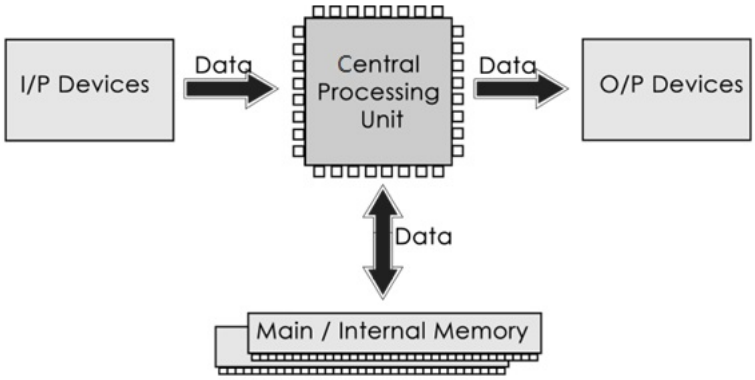
- Data operational instructions do modify their data values. They typically perform some operations using one or two data values (operands) and store results.
- Arithmetic instructions make up a large part of data operations instructions. Instructions that add, subtract, multiply, or divide values fall into this category. An instruction that increments or decrements also falls into this category.
- Logical instructions perform basic logical operations on data. They AND, OR, or XOR two data values or complement a single value.
- Shift operations as their name implies shift the bits of data values also come under this category.

(3) Program control instructions:

- Program control instructions are used to control the flow of a program. Assembly language instructions may include subroutines like in high level language programs may have subroutines, procedures, and functions.
- A jump or branch instructions are generally used to go to another part of the program or subroutine.
- A microprocessor can be designed to accept interrupts. An interrupt causes the processor to stop what is doing and start other instructions. Interrupts may be software or hardware.
- One final type of control instructions is halt instruction. This instruction causes a processor to stop executing instructions such as the end of a program.

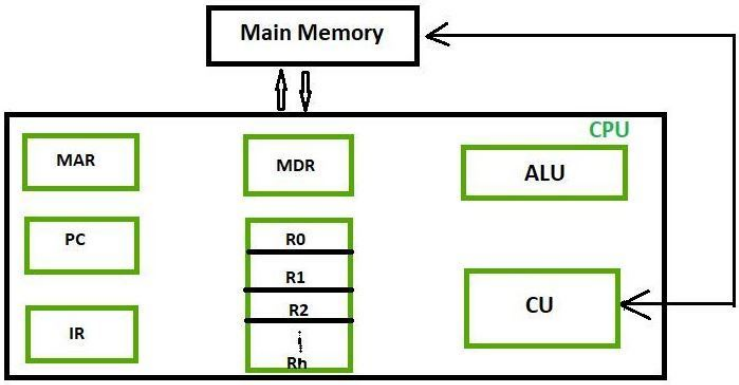
2. List the various components of computer system and show with neat diagram

- Input Unit
- Output unit
- Memory Unit
- Control unit
- Arithmetic and Logic Unit



3. Explain the functions of the processor registers and sketch the block diagram

- Instruction Register: This register is used for storing the instructions that are sent to the ALU.
- The Program Counter (PC) holds the address of the next instruction to be read from memory after the current instruction is executed.
- Memory Address Register: This register is used for maintaining the address of all requested items (the address of a data or command) which is going to be written to or read from memory.
- Memory Buffer Register: This register is used to store data temporarily when sending or receiving memory.
- The Memory Data Register: When the data is received in the memory buffer register, then it is stored in this register until it is changed.



4. List the various instruction formats and illustrate with an example.

Refer Question 12 Part C

5. Illustrate the basic computer organisation.

The main component of basic organisation of a computer system is microprocessor(C.P.U), memory unit(MU), and input-output devices.

1. Central processing unit: CPU is the brain of a computer. It controls the computer system. It converts data to information.
2. Arithmetic and logic unit: This is a part of the CPU. It consists of two units. One is an arithmetic unit and another one is a logic unit.
3. Input unit and output unit: This unit controls input and output devices. Input devices are keyboard, mouse etc and output devices are printer, monitor, plotter, etc.

6. Explain in detail about the instruction cycle.

A program residing in the memory unit of a computer consists of a sequence of instructions. These instructions are executed by the processor by going through a cycle for each instruction.
In a basic computer, each instruction cycle consists of the following phases:

- Fetch instruction from memory
- Decode the instruction
- Read effective address from memory
- Execute the instruction

7. Summarise the input-output subsystem organisation and its interfacing.

Input-Output Interface is used as a method which helps in transferring of information between the internal storage devices i.e. memory and the external peripheral device . A peripheral device is that which provides input and output for the computer, it is also called Input-Output devices. For Example: A keyboard and mouse provide Input to the computer are called input devices while a monitor and printer that provide output to the computer are called output devices. Just like the external hard-drives, there is also availability of some peripheral devices which are able to provide both input and output.

Functions of Input-Output Interface:

- It is used to synchronize the operating speed of CPU with respect to input-output devices.
- It selects the input-output device which is appropriate for the interpretation of the input-output device.
- It is capable of providing signals like control and timing signals.
- In this data buffering can be possible through a data bus.
- It converts serial data into parallel data and vice-versa.
- It also converts digital data into analog signals and vice-versa.

8.Explain important steps for computer design.

9. Show the different types of fields that are part of an instruction

An instruction can be considered to be a command that has been issued to a computer to perform a particular operation. The instruction format contains various field in them such as:

- Operation Code Field: Also known as the op code feld, this field is used to specify the operation to be performed for the instruction.
- Address Field: This field as its name specifier is used to designate the various addresses such as register address and memory address.
- Mode field: This field specifies as to how effective address is derived or how an operand is to perform. For example, ADD R0, R1. In this case the ADD is the operand whereas the R1, and R0 are the address fields.

10.Find the basic components of a microprocessor

Some of the common components of a microprocessor are:

- Control Unit
- I/O Units
- Arithmetic Logic Unit (ALU)
- Registers
- Cache
- Control Unit

Control Unit

The control unit, as described above, reads the instructions, and generates the necessary digital signals to operate the other components. An instruction to add two numbers together would cause the Control Unit to activate the addition module, for instance.

I/O Units

The processor needs to be able to communicate with the rest of the computer system. This communication occurs through the I/O ports. The I/O ports will interface with the system memory (RAM), and also the other peripherals of a computer.

Arithmetic Logic Unit

The Arithmetic Logic Unit, or ALU is the part of the microprocessor that performs arithmetic operations. ALUs can typically add, subtract, divide, multiply, and perform logical operations of two numbers (and, or, nor, not, etc).

Registers

Registers are a type of computer memory used to quickly accept, store, and transfer data and instructions that are being used immediately by the CPU. The registers used by the CPU are often termed as Processor registers.
A processor register may hold an instruction, a storage address, or any data (such as bit sequence or individual characters).
The computer needs processor registers for manipulating data and a register for holding a memory address. The register holding the memory location is used to calculate the address of the next instruction after the execution of the current instruction is completed.

Cache

Cache is memory that is located on the chip, but that is not considered registers. The cache is used because reading external memory is very slow (compared to the speed of the processor), and reading a local cache is much faster. In modern processors, the cache can take up as much as 50% or more of the total area of the chip.

11. Classify the different types of interrupts in a microprocessor system.

In the normal execution of a program there are three types of interrupts that can cause a break:

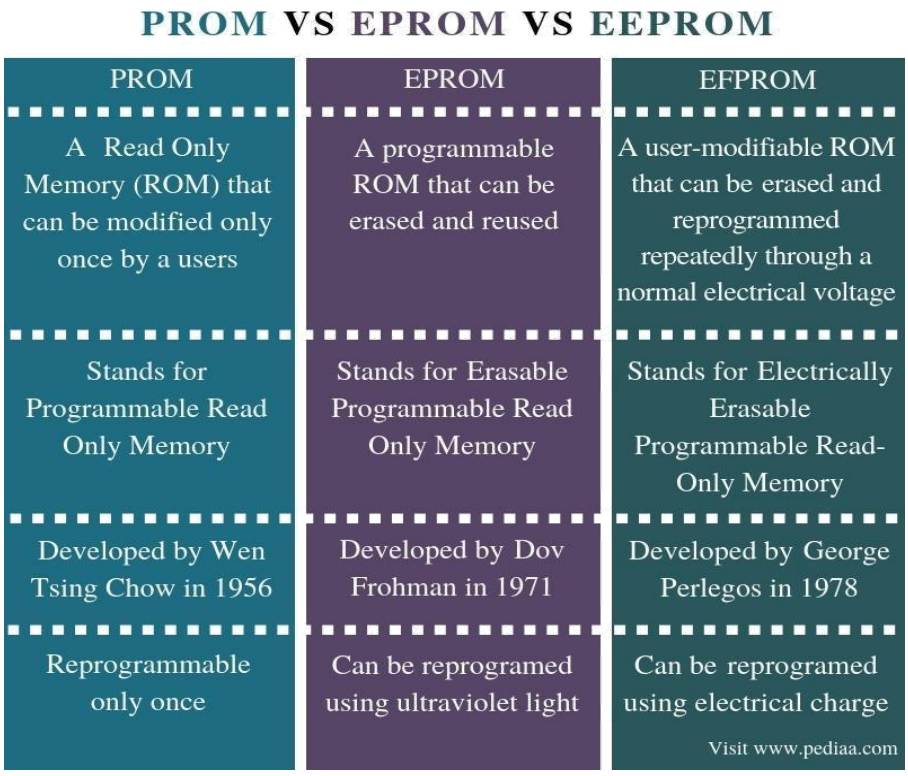
- External Interrupts: These types of interrupts generally come from external input / output devices which are connected externally to

the processor. They are generally independent and oblivious of any programming that is currently running on the processor.

- Internal Interrupts: They are also known as traps and their causes could be due to some illegal operation or the erroneous use of data. Instead of being triggered by an external event they are usually triggered due to any exception that has been caused by the program itself. Some of the causes of these types of interrupts can be due to attempting a division by zero or an invalid opcode etc.

- Software interrupts: These types of interrupts can occur only during the execution of an instruction. They can be used by a programmer to cause interrupts if need be. The primary purpose of such interrupts is to switch from user mode to supervisor mode.

12.Compare the different kinds of ROMs.



13. How are they useful in implementation of architecture of a processor?

14. Explain computer architecture with diagram

A computer system is basically a machine that simplifies complicated tasks. It should maximize performance and reduce costs as well as power consumption.The different components in the Computer System Architecture are Input Unit, Output Unit, Storage Unit, Arithmetic Logic Unit, Control Unit etc.

The input data travels from the input unit to ALU. Similarly, the computed data travels from ALU to the output unit. The data constantly moves from the storage unit to ALU and back again. This

is because stored data is computed on before being stored again. The control unit controls all the other units as well as their data.

Details about all the computer units are –

Input Unit

The input unit provides data to the computer system from the outside. So, basically it links the external environment with the computer. It takes data from the input devices, converts it into machine language and then loads it into the computer system. Keyboard, mouse etc. are the most commonly used input devices.

Output Unit

The output unit provides the results of the computer process to the users i.e it links the computer with the external environment. Most of the output data is the form of audio or video. The different output devices are monitors, printers, speakers, headphones etc.

Storage Unit

Storage unit contains many computer components that are used to store data. It is traditionally divided into primary storage and secondary storage.Primary storage is also known as the main memory and is the memory directly accessible by the CPU. Secondary or external storage is not directly accessible by the CPU. The data from secondary storage needs to be brought into the

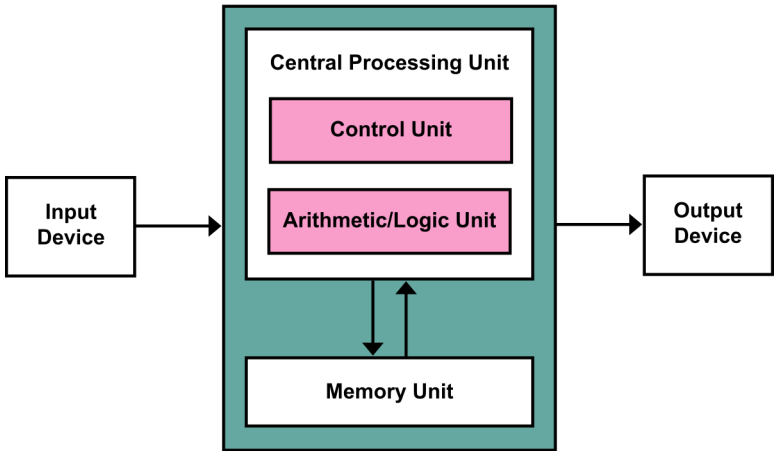
primary storage before the CPU can use it. Secondary storage contains a large amount of data permanently.

Arithmetic Logic Unit

All the calculations related to the computer system are performed by the arithmetic logic unit. It can perform operations like addition, subtraction, multiplication, division etc. The control unit transfers data from storage unit to arithmetic logic unit when calculations need to be performed. The arithmetic logic unit and the control unit together form the central processing unit.

Control Unit

This unit controls all the other units of the computer system and so is known as its central nervous system. It transfers data throughout the computer as required including from storage unit to central processing unit and vice versa. The control unit also dictates how the memory, input output devices, arithmetic logic unit etc. should behave.



15. Compare the computer architecture and computer Organization

Computer Architecture:
Computer Architecture is a functional description of requirements and design implementation for the various parts of a computer.It deals with functional behavior of computer systems. It comes before the computer organization while designing a computer.

Computer Organization:
Computer Organization comes after the device of Computer Architecture first. Computer Organization is how operational attributes are linked together and contribute to realize the architectural specification. The Computer Organization deals with structural relationships.

16. Summarize briefly about computer fundamental systems?
Ans.

17. Illustrate memory unit function.
Ans. Memory unit is a component of a computer system. It is used to store data, instructions and information. It is actually a work area of a computer, where the CPU stores the data and instruction. It is also known as a main/primary/internal memory.

There are two types of memory: -

1. Read only memory (ROM):- ROM is a part of the memory unit. This is read only memory. It can not be used to write. ROM is used in situations where the data must be held permanently.

2. Random access memory (RAM):- RAM is also part of the memory unit. It is used for temporary storage of program data. Its data is lost when power is turned off.

18. Explain in detail about different instruction types and instruction sequencing

INSTRUCTIONS & INSTRUCTION SEQUENCING

The tasks carried out by a computer program consist of a sequence of small steps, such as adding two numbers, testing for a particular condition, reading a character from the keyboard, or sending a character to be displayed on a display screen.

A computer must have instructions capable of performing 4 types of operations:

- Data transfers between the memory and the registers (MOV, PUSH, POP, XCHG).
- Arithmetic and logic operations on data (ADD, SUB, MUL, DIV, AND, OR, NOT).
- Program sequencing and control(CALL.RET, LOOP, INT).
- I/0 transfers (IN, OUT).
- REGISTER TRANSFER NOTATION (RTN)

Here we describe the transfer of information from one location in a computer to another.Possible locations that may be involved in such transfers are memory locations, processor registers, or registers in the I/O subsystem. Most of the time, we identify such locations symbolically with convenient names.

The possible locations in which transfer of information occurs are:
1) Memory-location
2) Processor register &
3) Registers in I/O devices.

ASSEMBLY LANGUAGE NOTATION

• To represent machine instructions and programs, assembly language format is used.

INSTRUCTION EXECUTION & STRAIGHT LINE SEQUENCING • The program is executed as follows:
Initially, the address of the first instruction is loaded into PC
Then, the processor control circuits use the information in the PC to fetch and execute instructions, one at a time, in the order of increasing addresses. This is called Straight-Line sequencing.
During the execution of each instruction, the PC is incremented by 4 to point to the next instruction.

• There are 2 phases for Instruction Execution:

Fetch Phase: The instruction is fetched from the memory-location and placed in the IR.

Execute Phase: The contents of IR is examined to determine which operation is to be performed. The specified-operation is then performed by the processor.

19.Explain instruction set architecture? Give examples

Ans.ISA describes the design of a Computer in terms of the basic operations it must support. The ISA is not concerned with the implementation specific details of a computer. It is only concerned with the set or collection of basic operations the computer must support. For example the AMD Athlon and the Core 2 Duo processors have entirely different implementations but they support more or less the same set of basic operations as defined in the x86 Instruction Set.

The ISA defines the types of instructions to be supported by the processor.
Based on the type of operations they perform MIPS Instructions are classified into 3 types:

Arithmetic/Logic Instructions:
These Instructions perform various Arithmetic & Logical operations on one or more operands.

Data Transfer Instructions:
These instructions are responsible for the transfer of instructions from memory to the processor registers and vice versa.

Branch and Jump Instructions:
These instructions are responsible for breaking the sequential flow of instructions and jumping to instructions at various other locations; this is necessary for the implementation of functions and conditional statements.

The ISA defines the maximum length of each type of instruction.

Since the MIPS is a 32 bit ISA, each instruction must be accommodated within 32 bits.

The ISA defines the Instruction Format of each type of instruction.

The Instruction Format determines how the entire instruction is encoded within 32 bits

There are 3 types of Instruction Formats in the MIPS ISA:
R-Instruction Format
I-Instruction Format
J-Instruction Format

20.i). Find the performance of the CPU. ii). Compose the factors that affect performance.

The factors Affecting CPU performance are :

- Multiple cores
- Cache memory,
- clock speed,
- word length,
- address bus width,
- data bus width.

PART C

1. Define Computer Architecture.

Computer architecture is a specification detailing how a set of software and

Ans.Computer architecture refers to how a computer system is designed and what technologies it is compatible with.

There are three categories of computer architecture:

- System Design: This includes all hardware components in the system, including data processors aside from the CPU, such as the graphics processing unit and direct memory access. It also includes memory controllers, data paths and miscellaneous things like multiprocessing and virtualization.
- Instruction Set Architecture (ISA): This is the embedded programming language of the central processing unit. It defines the CPU's functions and capabilities based on what programming it can perform or process. This includes the

word size, processor register types, memory addressing modes, data formats and the instruction set that programmers use.

- Microarchitecture: Otherwise known as computer organization, this type of architecture defines the data paths, data processing and storage elements, as well as how they should be implemented in the ISA.

2. List the components of a computer system.

Ans.

1. Input Unit
2. Output Unit
3. Memory Unit
4. Control Unit
5. Arithmetical and Logical Unit
6. RAM
7. Motherboard
8. Input Device

3. List the types of computers

Ans. A computer is a machine that can be programmed to carry out sequences of arithmetic or
logical operations automatically. There are different types of computers such as

- Mainframe Computer
- Supercomputer

- workstation computer
- personal computer
- Apple Macintosh

4. What are the functional units of a computer?

Ans. Computer is the simplest form comprising five functional units namely input unit, output unit, Memory unit, arithmetic and logical unit control unit.

Input Unit: Computer accepts encoded information through input unit. The standard input device is a keyboard. Whenever a key is pressed, the keyboard controller sends the code to CPU/Memory. Examples include Mouse, Joystick, Tracker ball, Light pen, Digitizer, Scanner etc.

Memory Unit: Memory unit stores the program instructions (Code), data and results of computations etc. Memory unit is classified as:

Primary /Main Memory

Secondary /Auxiliary Memory

Primary memory is a semiconductor memory that provides access at high speed. Run time program instructions and operands are stored in the main memory. Main memory is classified again as ROM and RAM. ROM holds system programs and firmware routines such as BIOS, POST, I/O Drivers that are essential to manage the hardware of a computer. RAM is termed as Read/Write memory or

user memory that holds run time program instruction and data. While primary storage is essential, it is volatile in nature and expensive. Additional requirements of memory could be supplied as auxiliary memory at cheaper cost. Secondary memories are non volatile in nature.

Arithmetic and logic unit: ALU consists of necessary logic circuits like adder, comparator etc., to perform operations of addition, multiplication, comparison of two numbers etc.

Output Unit: Computer after computation returns the computed results, error messages, etc. via output unit. The standard output device is a video monitor, LCD/TFT monitor. Other output devices are printers, plotters etc.

Control Unit: Control unit coordinates activities of all units by issuing control signals. Control signals issued by control unit govern the data transfers and then appropriate operations take place. Control unit interprets or decides the operation/action to be performed.

5.List the types of memory.

Ans. Random Access Memory (RAM) –

- It is also called read-write memory or the main memory or the primary memory.
- The programs and data that the CPU requires during the execution of a program are stored in this memory.
- It is a volatile memory as the data is lost when the power is turned off.

- RAM is further classified into two types- SRAM (Static Random Access Memory) and DRAM (Dynamic Random Access Memory).

Read Only Memory (ROM) –

- Stores crucial information essential to operate the system, like the program essential to boot the computer.
- It is not volatile.
- Always retains its data.
- Used in embedded systems or where the programming needs no change.
- Used in calculators and peripheral devices.

ROM is further classified into 4 types- MROM, PROM, EPROM, and EEPROM.

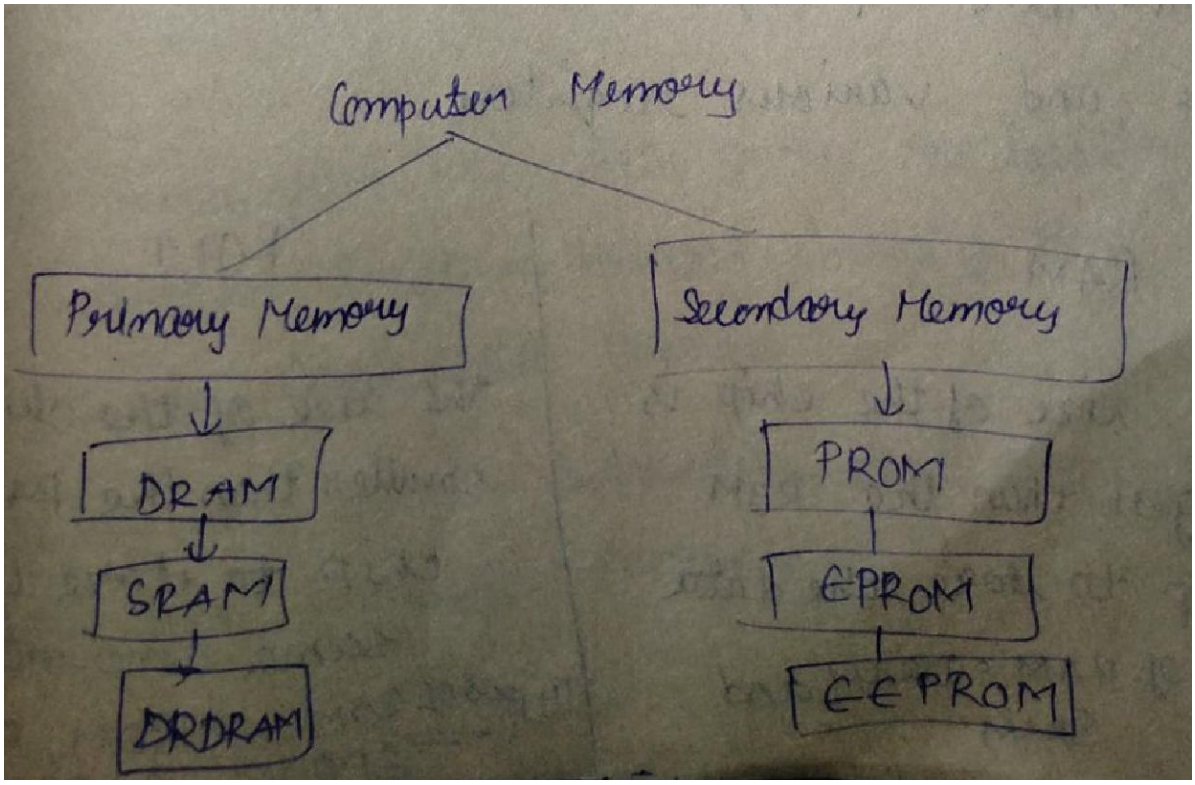
Types of Read Only Memory (ROM) –

PROM (Programmable read-only memory) – It can be programmed by the user. Once programmed, the data and instructions in it cannot be changed.

EPROM (Erasable Programmable read only memory) – It can be reprogrammed. To erase data from it, expose it to ultraviolet light. To reprogram it, erase all the previous data.

EEPROM (Electrically erasable programmable read only memory) – The data can be erased by applying an electric field, with no need for ultraviolet light. We can erase only portions of the chip.

MROM(Marked ROM) – The very first ROMs were hard-wired devices that contained a pre-programmed set of data or instructions. These kinds of ROMs are known as masked ROMs, which are inexpensive.



6.Define the arithmetic and Logical operations

An ALU performs basic arithmetic and logic operations. Arithmetic operations are used to perform mathematical calculations such as addition subtraction multiplication division. logical operators are used to perform logical operations such as AND, OR or NOT

7. What is a Computer Instruction?

Computer instructions are a set of steps and documentation that includes information on how to operate, perform or otherwise make, in particular computer software or hardware.

8. What do you mean by central processing unit?

Ans. The Computer Central Processing Unit is the portion of a computer that retrieves and executes instructions. The CPU is the brain of a CAD system . It consists of an arithmetic and logic unit (ALU), a control unit, and various registers.

The CPU's main function is to take input from a peripheral (keyboard, mouse, printer, etc) or computer program, and interpret what it needs. The CPU then either outputs information to your monitor or performs the peripheral's requested task.

9. Classify different memory chips.

Ans. Random Access Memory (RAM) – RAM contains a various number of memory locations wherein each location typically 8-bits are stored. It can be possible to read from a RAM location, as well as write to a RAM location. The drawback of RAM is that it is volatile. That means, when the power supply to the RAM is switched off, the information in the RAM will be lost.

Read Only Memory (ROM) – ROM consists of a number of memory locations wherein each location typically 8-bits are stored like RAM. A ROM also uses a random access method just like RAM. The advantage of ROM is that it is non-volatile in nature. That means, though the power supply to the ROM is switched off, the information in the ROM will not be lost. However, only reading operation is possible from a ROM location. Thus, in a computer, ROM is used for storing information which is not lost when power is switched off.

10. What are the static and dynamic RAMs?

Ans. SRAM (static RAM) is random access memory (RAM) that retains data bits in its memory as long as power is being supplied .Data is stored in transistors and requires a constant power flow. Because of the continuous power, SRAM doesn’t need to be refreshed to remember the data being stored. SRAM is called static as no change or action i.e. refreshing is not needed to keep the data intact. It is used to cache memories.

Dynamic ram which stores bits in cells consisting of a capacitor and a transistor , SRAM does not have to be periodically registered. Data is stored in capacitors. Capacitors that store data in DRAM gradually discharge energy, no energy means the data has been lost. So, a periodic refresh of power is required in order to function. DRAM is called dynamic as constant change or action i.e. refreshing is needed to keep the data intact. It is used to implement main memory.

11. List out the levels of programming languages.

Ans. Refer Question 5 Part A

12.Define the instruction format.

Ans. When the assembler processes an Instruction it converts the instruction from its mnemonic form to standard machine language format called the "Instruction format". In the process of conversion the assembler must determine the type of instruction, convert symbolic labels and explicit notation to a base/displacement format, determine the lengths of certain operands and parse any literal and constants.

An instruction format defines layout of bits of an instruction, in terms of its constituent parts.An instruction format must include an opcode and implicitly or explicitly, zero or more operand.

- Op-field: specifies the operation to be performed;

- Address-field: provides operands or the CPU register/MM addresses of the operands.

13. Write a short description about Instruction set architecture (ISA) design.

Ans.Refer to Question 19 Part B

14. Show the data transfer instructions

Ans.It transfers the data from one location to another location without changing the binary information content.

Following are some instructions that are used for data transfer purpose

1. MOV
2. PUSH
3. POP
4. XCHG
5. LAHG
6. SAHF
7. IN
8. OUT
9. LDS
10. LES

15.Explain number systems in computer organization.

Ans. Number systems are the technique to represent numbers in the computer system architecture, every one you are saving for

getting into Computer memory as a defined number system. Computer Architecture supports number systems, binary number systems, octal number systems, decimal number systems.

Binary Number System

A Binary number system has only two digits that are 0 and 1. Every number (value) represents 0 and 1 in this number system. The base of the binary number system is 2, because it has only two digits.

Octal number system

Octal number system has only eight (8) digits from 0 to 7. Every number (value) represents 0,1,2,3,4,5,6 and 7 in this number system. The base of the octal number system is 8, because it has only 8 digits.

Decimal number system

Decimal number system has only ten (10) digits from 0 to 9. Every number (value) represents 0,1,2,3,4,5,6, 7,8 and 9 in this number system. The base of the decimal number system is 10, because it has only 10 digits.

Hexadecimal number system

A Hexadecimal number system has sixteen (16) alphanumeric values from 0 to 9 and A to F. Every number (value) represents with

0,1,2,3,4,5,6, 7,8,9,A,B,C,D,E and F in this number system. The base of the hexadecimal number system is 16, because it has 16 alphanumeric values. Here A is 10, B is 11, C is 12, D is 13, E is 14 and F is 15.

16.State operation of control unit

Ans. Control Unit is the part of the computer's central processing unit (CPU), which directs the operation of the processor. It is the responsibility of the Control Unit to tell the computer's memory, arithmetic/logic unit and input and output devices how to respond to the instructions that have been sent to the processor. It fetches internal instructions of the programs from the main memory to the processor instruction register, and based on this register contents, the control unit generates a control signal that supervises the execution of these instructions.

A control unit works by receiving input information to which it converts into control signals, which are then sent to the central processor. The computer's processor then tells the attached hardware what operations to perform.

17. What is the need of system software?

Ans. System software is a collection of programs that supports computer operations. It is closely tied to Computer Architecture. By taking care of basic tasks such as input, output and data storage,

system software allows application developers to focus on specific tasks that software needs to accomplish .

18. What is meant by primary storage and secondary storage?

Ans. Primary storage (also known as main memory or internal memory), often referred to simply as memory, is the only one directly accessible to the CPU. The CPU continuously reads instructions stored there and executes them as required. Any data actively operated on is also stored there in uniform manner.

Types of primary storage devices:

There are several types of primary storage devices; random access memory (RAM), Read-only Memory (ROM) and cache memory are common examples of primary storage devices.

Random Access Memory(RAM)

RAM is considered the fastest storage and can achieve very high transfer rates of data. When programs or files are accessed, the data is temporarily loaded from your hard drive into your RAM where it can be smoothly accessed. However, if your RAM becomes filled, your operating system will adjust and send some of the open programs and files to your hard drive's paging file. This file is slower than your RAM because it resides on your hard drive and is one of the causes of your computer being unresponsive.

Read-only Memory (ROM)

Read-only memory (ROM) is a type of non-volatile memory used in computers and other electronic devices. Data stored in ROM can only be modified slowly, with difficulty, or not at all, so it is mainly used to store firmware (software that is closely tied to specific hardware, and unlikely to need frequent updates) or application software in plug-in cartridges.

Cache Memory

Cache memory is generally joined onto the motherboard and installed on the core processor or main RAM. It provides quicker access by storing an instance of the programs or data regularly accessed by the processor. With the information in cache memory, the processor does not need to go to RAM or the hard drive to get the data, it already has an instance of it in its memory.

Other types of primary storage

In addition to the above three types, there are some others, programmable read-only memory(PROM), Erasable programmable read-only memory(EPROM), registers, etc.

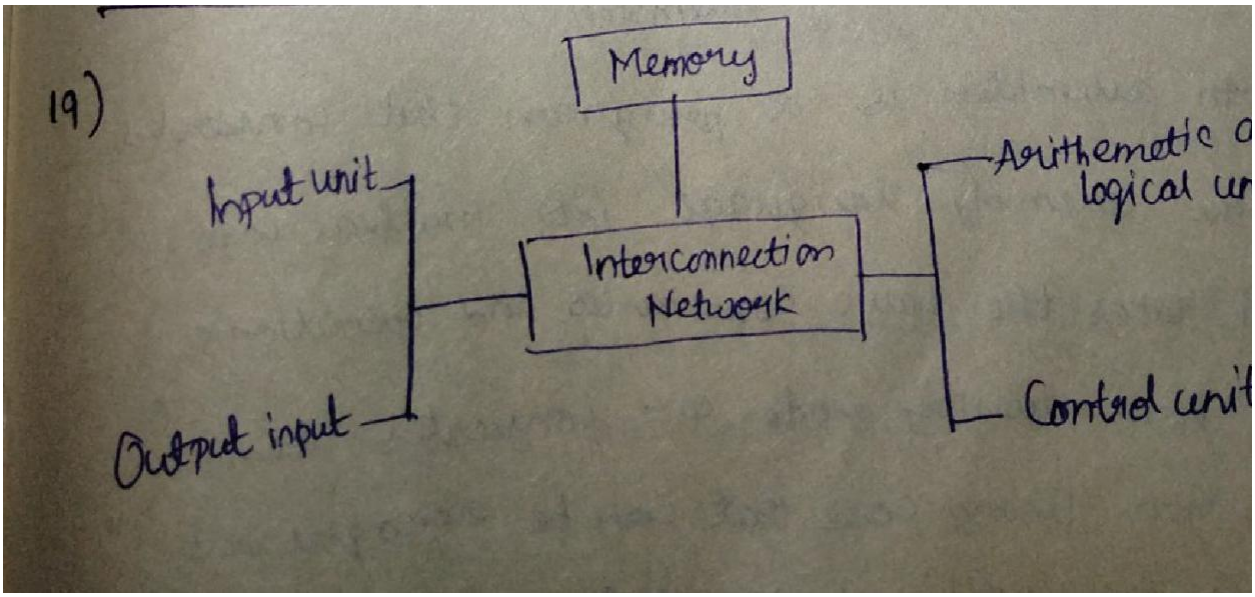
What is secondary storage?

Secondary storage (also known as external memory or auxiliary storage), differs from primary storage in that it is not directly accessible by the CPU. The computer usually uses its input/output

channels to access secondary storage and transfers the desired data using the intermediate area in primary storage. Secondary storage does not lose the data when the device is powered down—it is non-volatile.

Types of secondary storage devices
The common hard drive and optical drive are both secondary storage devices. In addition, magnetic tapes, floppy disks, USB drives, paper tape, punched cards and so on.

19.Show the basic functional units of a computer.



Refer to Question 4 Part C

20. Interpret the instruction set architecture.

Ans. Refer to Part B Question 19

Most of the Answers are taken from Lecture Notes and Google. Due to very limited time, all the relevant content has been dumped into this file, without any editing whatsoever. Only REFER this document for understanding, and not write it as is in the examination.