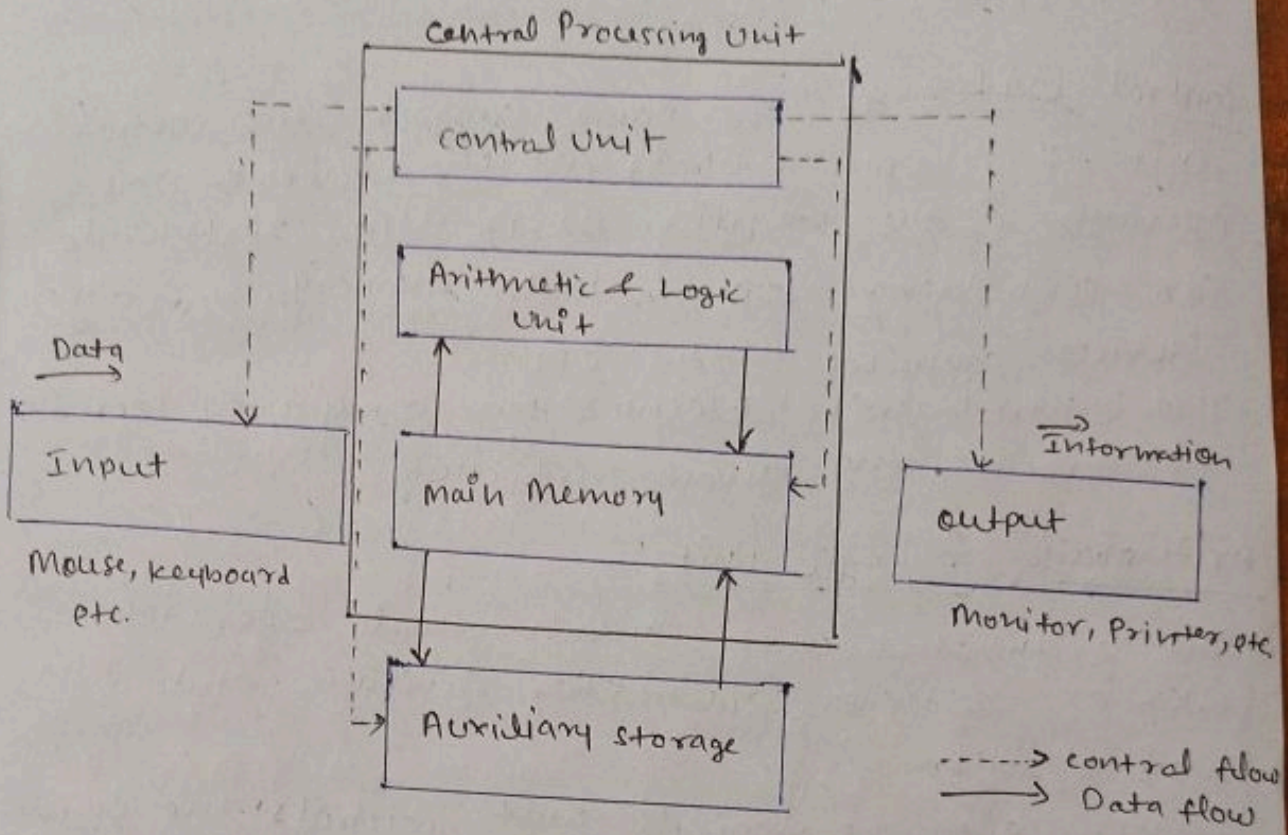
Tutorial - UNIT-III

1- Draw Explain the basic diagram of a digital computer system.



A computer system is a combination of three components:

- Input unit
- CPU
- output unit.

Input unit :-

The Input unit consist of input devices such as a Mouse, keyboard, scanner etc. These devices are used to input Information or Instruction into the computer system. A computer takes input as raw data (binary data) and performs necessary processing giving out processed data.

- The input unit convert the inputted data or instruction into binary form for further processing
- Input unit transmit the data to the main memory of the computer

Central Processing Unit:- CPU is known as the brain of the computer system. It is an electronic hardware device that processes all the operation (arithmetic and logical operations) of the computer.

Control unit:- As the name suggest, the control unit of a CPU controls all the activities and operation of the computer. It is also responsible for controlling input/output, memory, and other devices connected to the CPU
The control unit determins the sequence of operations to execute the given instructions.

Arithmatic & Logic Unit:-

The arithmatic unit controls simple operations such as addition, substraction, division and multiplication.
On other side the logical unit controls the logical operation such as AND, OR, Equal, greater than, and less than Apart from it the logic unit also responsible for performing several other operations such as comparing, selecting, matching and merging data.

Memory Unit:-

Memory unit is an essential part of the computer system which is used to store data and instruction before and after processing.
The memory unit transmit the information to other Units of the computer system when it required.

Primary Memory:-

The primary memory can not store a vast amount of data. The data stored in the primary memory is temporary. The data will be lost if they are disconnected from the power supply. Store the input data and immediate calculation result.
Example - RAM.

Secondary Memory:- Secondary memory used to store data permanently for future use. the data is safe even when their power failure.
Example → Hard disk.

Output UNIT:-

The output data is first stored in the memory and then displayed in human readable ~~for~~ form through output devices. Ex - Monitor, Printer, Projector.

- The output unit accept the data or information in binary form from the main memory of the computer system.
- The output unit convert the binary data into a human readable form for better understanding.

2- Compare RISC and CISC processors.

RISC	CISC
- Stand for Reduced Instruction set computers.	- Stand for complex Instruction set computer.
- RISC is consumes low Power.	- CISC consumes high power
- The no. of instruction is less as compared to CISC	- The no. of instruction is more as compared to RISC
- The addressing modes are less	- The addressing modes are more
- it works in a fixed instruction format.	- it works in a variable instruction format.
- The RISC processors are highly pipelined	- The CISC processors are less pipelined.
- it optimizes the performance by focusing on software	- it optimized the formance by focusing on hardware
- Requires more RAM	- Require less RAM.

3- Explain the use of following registors of processors.

a- Program counter-

A program counter (PC) is a CPU register in the computer processor which has the address of the next instruction to be executed from memory. It is a digital counter needed for faster execution of tasks as well as for tracking the current execution point.

b-Accumulator:-

An accumulator is primarily used as a register in a CPU to store intermediate logical or arithmetic data in multistep calculation. for such calculation it functions as a temporary storage location.

c- Instruction Register:- An instruction register holds a machine instruction that is currently being executed.
The function of the instruction register is to hold that currently queued instruction for use.

d- Stack Pointer:-
A stack pointer is a small register that stores the memory address of the last data element added to stack or, in some cases, the first available address in the stack.

e:- Scratch register:-
scratch register / temporary register A register used to hold an intermediate value during a calculation. if you call a function, the values in the scratch registers may have been changed after the function call.

f:- Status information register:-
The status register lets an instruction take action contingent on the outcome of a previous instruction. Typically flags in the status register are modified as effects of arithmetic and bit manipulation operations

g- The Buffer Register:- The Buffer Register prevents the high speed processor from being locked to a slow I/p devices during a sequence of data transfer or reduces speed mismatch between faster and slower devices.

4- Explain about Arithmatic and Logic Unit.

The data inputted through input devices is stored in the primary storage Unit. The Arithmatic Logic Unit (ALU) performs arithmatic and Logical operations.

The arithmetic unit controls simple operations such as addition, subtraction, devision and multiplication.

On the other side the logical unit controls the logical operations such as AND, OR, Equal greater than, and less than. Apart from it the logic unit also responsible for performing several other operations such as comparing, selecting, matching and merging data.

5- Describe the Input-output subsystem organizaticon and interfacing.

Input/output Subsystem:-

The I/O subsystem of a computer provides an efficient mode of communication between the central system and the outside environment it handles all the input-output operations of the computer system

Peripheral Devices:-

Input/output devices that are connected to computer are called peripheral devices. These devices are designed to read information into or out of the memory unit upon command from the CPU and are considered to be the part of computer system

Input peripherals :- Allows user input from the outside world to the computer Example - keyboard Mouse.

output peripherals :- Allows information output from the computer to the outside world
Example : Printer, Monitor.

Input-output pheripherals :- Allows both input as well as output .
EX - Touch screen.

Interfaces :- Interface is a shared boundary between two separate components of the computer system which can be used to attach two or more components to the system for communication purposes

Input - output Interface :-

Peripherals connected to a computer need special communication link for interfacing with CPU . In computer system there are special hardware components between the CPU and peripherals to control or manage the input output transfers. These components are called input-output interface units. because they provide communication link between processor and pheripherals. They provide a method for transfering information between internal system and input-output devices.

6- What do you mean addressing mode? List and Explain different types of addressing modes of with one Example. each.

Addressing mode:- The addressing mode is the method to specify the operand of an instruction The job of a microprocessor is to execute a set of instruction stored in memory to perform specific task.

1- The operator or opcode which is determines what will be done.
2- The operands which defined the data to be used in the operation.

Types of Addressing Modes:-

1- Immediate:-
with immediate addressing mode the actual data to be used as the operand is included in the instruction itself.
Lets say we want to store operand 1 into a register and then add operand 2. with immediate addressing mode. the data values 1 and 2 would be part of the instruction.

Add $10, $8, 2

2- Direct Addressing:- when using direct addressing mode, the address of the operand is specified in the instruction. The processor will retrieve the data directly from the address specified in the instruction.
the example shows how the instruction tells the processor where to get the data from memory. the variable addr_of_2 is a pointer to the effective address of the operand.

lw $11, addr_of_2

3- Register Addressing:-

Register addressing mode indicates the operand data is stored in the register itself, so the instruction contains the address of the register. The data would be retrieved from the register. Here is how this would work

Add $12, $11, $10

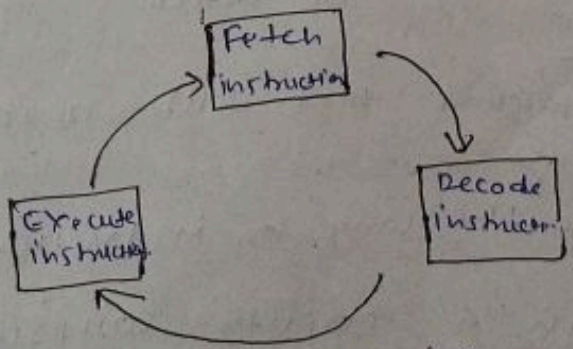
⑦ Explain in detail about fetch, decode and execute cycle in computer organization.

A standard process describe the steps needed for processing to take place. It is called the Fetch - Decode - Execute cycle or sometimes simply called the fetch execute cycle.

First of all both the data and the program that acts upon that data are loaded into main memory (RAM) by the operating system. The CPU is now ready to do some work.

- Fetch

The first step the CPU carries out is to fetch some data and instruction (program) from main memory then store them in its own internal temporary memory areas. These memory areas are called 'registers'.



This is called the 'fetch' part of the cycle

The CPU places the address of the next item to be fetched on to the address bus Data from this address then moves from main memory into the CPU by travelling along another hardware path called the 'data bus'.

Decode :-

The next step is for the CPU to make sense of the instruction it has just fetched.

This process is called 'decode'.

The CPU is designed to understand a specific set of commands.

CPU decode the instruction and prepares various areas within the chip in readiness of the next step.

Execute :-

This is the part of the cycle where data processing actually takes place. The instruction is carried out upon the data (executed). The result of this processing is stored in yet another register. Once the execute stage is complete the CPU sets itself up to begin another cycle once more.

$ Whats are the different types of instruction formats ? explain them in detail.

Instruction format :-

Instruction :- A statement that tells a computer to do something.

Instruction format :- The way an instruction is written

An instruction in a computer comprises of groups called field the most common fields are.

1- operand Field :-

- opcode
- specifies the operation to be performed by the instruction.

  Eg: ADD, SUB, MOV etc.

- It can be a value or register number on which the operation is performed.
- Mandatory part of every instruction.
- Address field
- Adress of operand / operand Refrence
- Refers to a location (address) where the operand is stored.
- The address may be memory address or a register address.

Types of Instruction FORMATS :-

1- Zero Address Instruction Format

- There is no address field
- stack is used

2- One Address Instruction Format.

- This instruction format uses only one address field
- The other operand is stored on Accumulator Register.

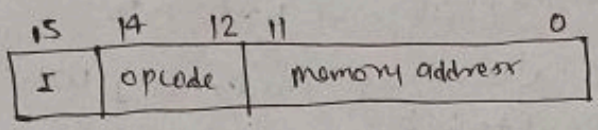
3- Two Address Instruction format.

- It used two Address fields.
- Most commonly used Instructio format.
- Example Instructio are ADD, MUL, MOV.

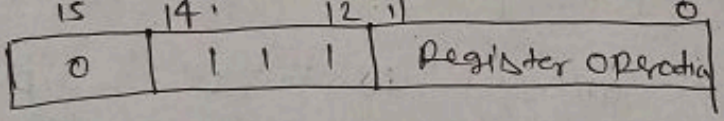
- Three Address Instruction format.
- It uses three instruction fields.

9- Differentiate memory Refrence and Register refrence Instructions.

Memory Refrence:- These instruction refers to memory address as an operand. The other operand is always accumulator. Specifies 12-bit address, 3-bit opcode (other than 111) and 1-bit addressing Mode for direct and indirect addressing.



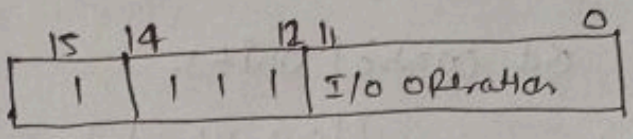
Register refrence Instruction:- These instruction perform operation on registers rather than memory addresses. The IR(14-12) is 111 (differentiate it from memory refrence). and IR(15) is 0 (differentiates it from Input/output instruction) The rest 12 bits specify register operations



(10) Differentiate Register Refrence and Input/output Instruction:-

Input/Output Instruction:-

These instruction are communication between computer and outside environment. The (14-12) is 111 (differentiate it from memory refrence and IR(15) is 1 (differentiate it from resistor refrence instructions) The rest 12-bits specify I/O operation.



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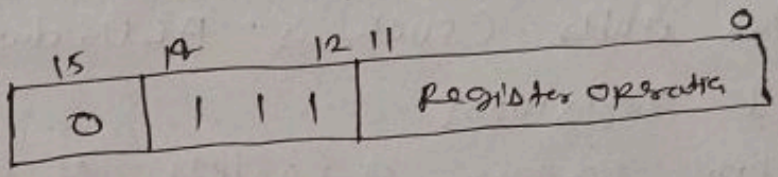
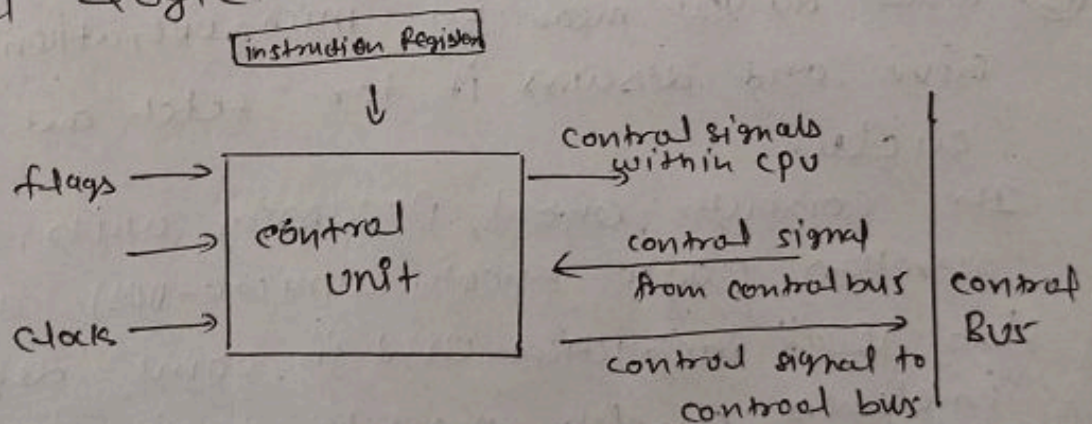


Q-11 Draw and explain the block diagram of control logic.



Block diagram of the control unit.

A control unit recieves data from the user and translates into control signals that are subsequently delivered to the control processor. The processor of the computer then instructs the associated hardware on what operation to do.

The function of control unit:-

- It coordinates the flow of data out of, into and between the various subunits and instructions.
- It understands commands and instruction
- It regulates the flow of data within the processor
- It is in charge of a CPU's multiple execution units (such as ALU, data buffers and registers)
- It also performs a variety of activities including fetching, decoding, handling execution and storing results.

(12)- What do you mean by micro operation? Give and discuss it for fetch and execute cycle.

In computer central processing units. micro-operations (also known as micro-ops) are detailed low level instruction used in some designs to implement complex machine instructions. Usually micro-operation perform basic operation on data stored in one or more registers including transferring data between registers or between registers and external buses of the CPU. and performing arithematic or logical operations on registers. In a typical fetch-decode-execute cycle., each step of a micro-instruction is decomposed during its execution so the CPU determines and its steps through a series of micro-op

(13) Explain the three categories of computer instruction such as data transfer instruction data manipulation instruction and program control instruction?

① Data transfer instruction:-
Data transfer instruction cause transfer of data from one location to another without changing the binary information. The most common transfer between the.
- memory and processor register
- processor registers and Input/output devices
- processor registers themselves

Data manipulation Instruction.-
Data manipulation instruction perform operation on data and provide the computational capabilities for the computer. These instruction perform arithmetic, logic and shift operation.

Program control instruction:-
The program control instruction provide decision making capabilities and change the path taken by the program when executed in computer. These instruction specify condition for altering the content of the program counter. The change in value of program counter as a result of execution ~~of program control as a of result. of execution of pr~~
program control instruction causes break in sequence of instruction execution.