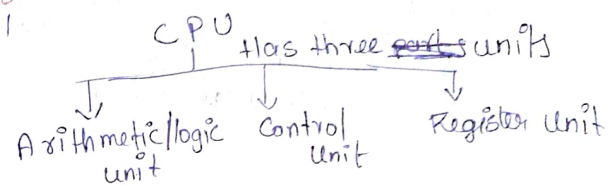
~~Excess 4: Notation~~

Mother board :

- The CPU's whose connecting pins plug into a socket mounted on the machine's main circuit board called mother board
- In smartphones, mini-notebooks, and other Mobile Internet Devices (MID), CPU's are around half of the size of a postage stamp. Due to their small size, these processors are called microprocessors.

Chapter - 2

CPU Basic



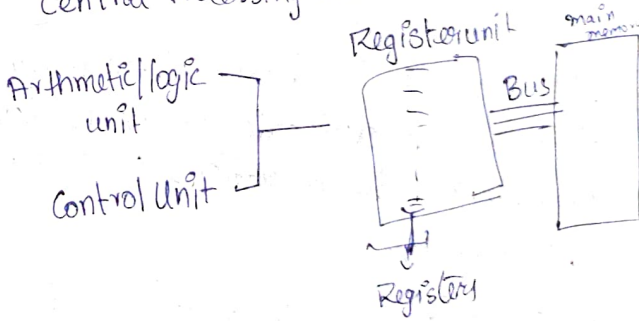
① Arithmetic : It performs some addition and ~~diff~~ subtraction and all.
logic : And, OR and some logical expressio

② Control Unit : Contains the circuitry for co-ordinating the machines activities.

③ Register unit : to store temporay ~~data~~ date of information within the CPU

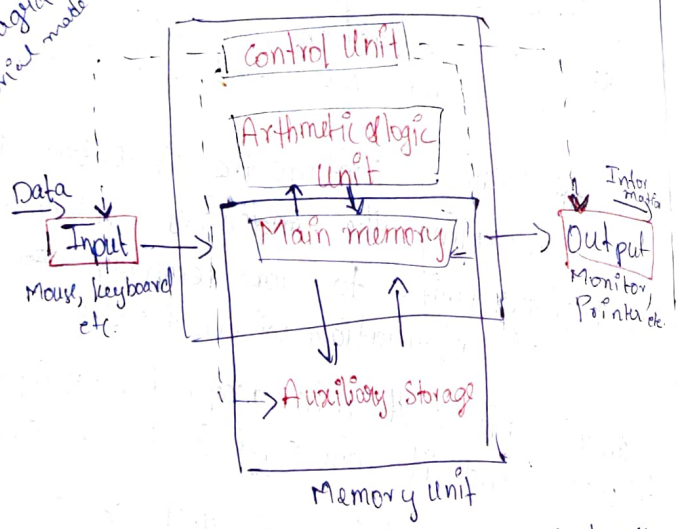
Input unit : It will accept the ~~th~~ input from the user and it will send it to the Computer

Central Processing Unit [CPU]



Registers :- Classified into types
1. general-purpose register (register with the register unit)
2. special-purpose register (whereas others are)

Block Diagram
Tutorial mate.com



CPU : ① It is the brain of the computer system.
② It is an electronic hardware device that processes all the operations (eg; arithmetic/logical operations) of computer

Memory unit: It is an essential part of the computer system which is used to store data and instructions before and after processing.

The memory unit transmits the information to other units of the computer system when required

* Primary memory: [or] Temporary memory

The primary memory cannot 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. It store input data.
Ex: RAM

* Secondary Memory:

The use of primary memory is not possible to store data permanently for future access. Therefore, there are some other options to store the data permantly for further use, which is known as secondary or auxiliary or permanent storage. The data stored in the secondary memory is safe even when there is a power failure or no power supply.
Hard Disk is usually considered memory.

* Output Unit

The output unit consists of devices that are used to display the results or output of processing. The output data is first stored in the memory and then displayed in human-readable form through output devices.
Ex; Monitor, Printer, Projector etc.

* Bus:

For the purpose of transferring bit patterns, a machine's CPU and main memory are connected by a collection of wires called a bus

* Stored-Program concept

The idea of storing a computer's program in its main memory is called the stored-program concept

* Cache Memory: is a portion of high-speed memory located within the CPU itself. In this special memory area, the machine attempts to keep a copy of that portion of main memory that is of current interest.

* Machine language:

To apply the stored-program concept, CPU's are designed to recognize instructions encoded as bit patterns. This collection of instructions along with the encoding system is calle

The stored-Program concept:

The idea of storing a computer's program in its main memory is called the stored-program concept and has become the standard approach used today — so standard, in fact, it seems obvious

* Machine language

[To apply the stored-program concept, CPU's are designed to recognize instructions encoded as bit patterns]

- The collection of instructions along with the encoding system is called machine language
- An instruction expressed in this language is called a machine-level language or machine instruction

* The instruction Repertoire

This lead to two philosophies of CPU architecture: ① Reduced instruction set computer [RISC]

② complex [CISC]

- Reduced instruction set computer (RISC)

One is that a CPU should be designed to execute a minimal set of machine instructions
- efficient, fast, less expensive

- Complex [CISC]

→ The ability to execute a large number of complex instructions, even though many of them are technically redundant

→ Programs can exploit a powerful rich set of instructions, many of which would require a multi-instruction sequence in a RISC design

→ It has an insatiable thirst for electrical power.

→ In contrast, the company Advanced RISC Machine (ARM) has designed a RISC architecture specifically for low power consumption

- Machine instructions can be categorized into three groupings:

(1) the data transfer group
(2) the arithmetic / logic group
(3) the control group

Data transfer: The data transfer grp consists of instructions that request the movement of data from one location to another.

Step 1, 2, 3 in Fig 2.2 fall into this category

* A request to fill a general-purpose register with the contents to memory call is commonly referred to as a LOAD instruction

- Conversely, a request to transfer the contents of a register to a memory call is called a STORE instruction.

In Fig 2.2 Step 1, 2 are LOAD
Step 4 – store

Fig 2.2 : Adding values stored in memory

Step 1 : Get one of the values to be added from memory and put it in a register

Step 2 : Get the other value to be added from memory and place it in another register

Step 3 : Activate the addition circuitry with the registers used in Steps 1 and 2 as inputs and another designated to hold the result

Step 4 : store the result in memory

Step 5 : Stop

- The instructions handle the input/output (I/O) activities of the machine, they are called I/O instructions

Eg : printers, keyboards, display, screens, disk drivers etc.

- ~~Arithmetic logic~~ :
- An Illustrative Machine language

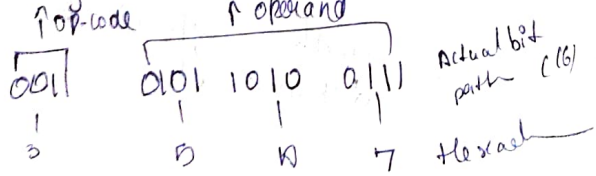
→ The registers are labled 0 through F
the memory cells are addressed 00 through FF

* The encoded version of a machine ~~language~~ instruction consists of two parts: (1) OP-code (2) Operand

OP-code: is the instruction that is executed by the CPU

operand: is the data or memory location used to execute that instruction

- the bit pattern appearing in the op code field indicates which of the ~~following~~ elementary operations, such as STORE, SHIFT, XOR, JUMP is requested by the instruction.
- Machine language have only 12 basic instru
- Each instruction is encoded using of total 16 bit 4 hexade — dia
- OP code are represented by the hexadecimal 1 ~~to~~ through C
- ~~X~~ Instruction beginning with the hexadecimal digit 3 refers to store instruc
- beginning with A refers to rotate instn



Program Executions:

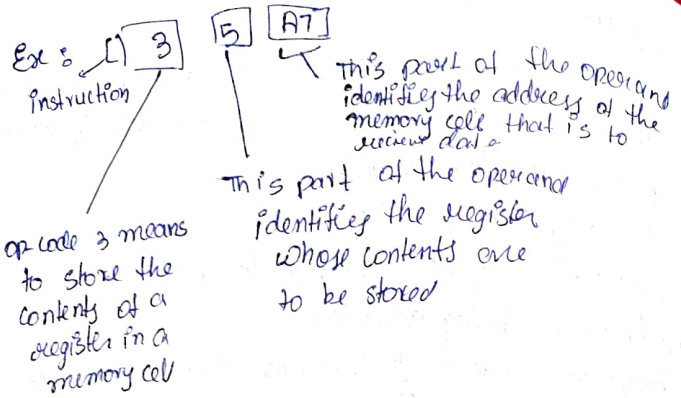
To know how the overall execution process takes place, we two registers within CPU:

1. Instruction register
2. Program counter

1. Instruction register is used to hold the instruction being executed.
2. Program counter: It contains the address of the next instruction to be executed, thereby ~~set~~ serving as the machine's way of keeping track of when it is in the program.

* The CPU performs its job by continually repeating an algorithm that guides it through a three-step process known as machine cycle

~~St~~ Three steps: fetch, decode, execute



* Arithmetic / logic instructions

logical operators

```
  10011010
AND 11001001
  ----------
  10001000
```

```
  10011010
OR 11001001
  ----------
  11011011
```

```
  10011010
XOR 11001001
  ----------
  01010011
```

* The use of AND operation is an example of process called masking
* Here one operand called a mask, determines which part of the other operand will affect the result
* Such an operation is useful when manipulating a bit map, a string of bits in which each bit represents the presence or absence of a particular object.
* Op-codes 7, 8, 9 are used for the logical operations OR, AND, XOR

Rotation and Shift Operations

* If we shift its contents 1 bit to the right, we imagine the rightmost bit falling off the edge and a hole appearing at the leftmost end.
* One technique is to place the bit that fell off the right end in the hole at the left end. This result is a circular shift, also called a rotation
* Another technique is to discard the bit that falls off the edge and always fill the hole with a 0.
* The term logical shift is used to refer to these operations.
* logical shift: is a bitwise operation that shifts all the bits of its operand. The two base variants are the logical left shift and the logical right shift.
* shifting right by n bits on an unsigned binary number has the effect of dividing it by 2.
* shifts that leave the sign bit unchanged are sometimes called arithmetic shifts.

The Role of Controllers

* Communication btw a computer and other devices is normally handle through an intermediary apparatus known as a Controller
* the controller connects via cables to peripheral devices within the computer case or ~~pth~~ perhaps to a connector, called a Port, on the back of the computer where external devices can be attached
* A controller translates messages and data back and forth btw forms compatible with the internal characteristics of the computer and those of the peripheral device to which it is attached
* Steps have been taken within the personal computer arena to develop standards, such as Universal serial bus (USB) and FireWire by which a single controller is able to handle a variety of devices
* Likewise, if the CPU tries to read data from such a memory location, as in a LOAD instruction, it will receive a bit pattern from the controller rather than from memory.

Such a communication system is called memory-mapped I/O