

REGISTERS Computer registers are high speed memory storing units. It is an element of the computer processor.

It can carry any type of information including a bit sequence or single data.

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 also termed as Processor registers.

A processor register may hold an instruction, a storage address or any data (bit sequence / individual characters).

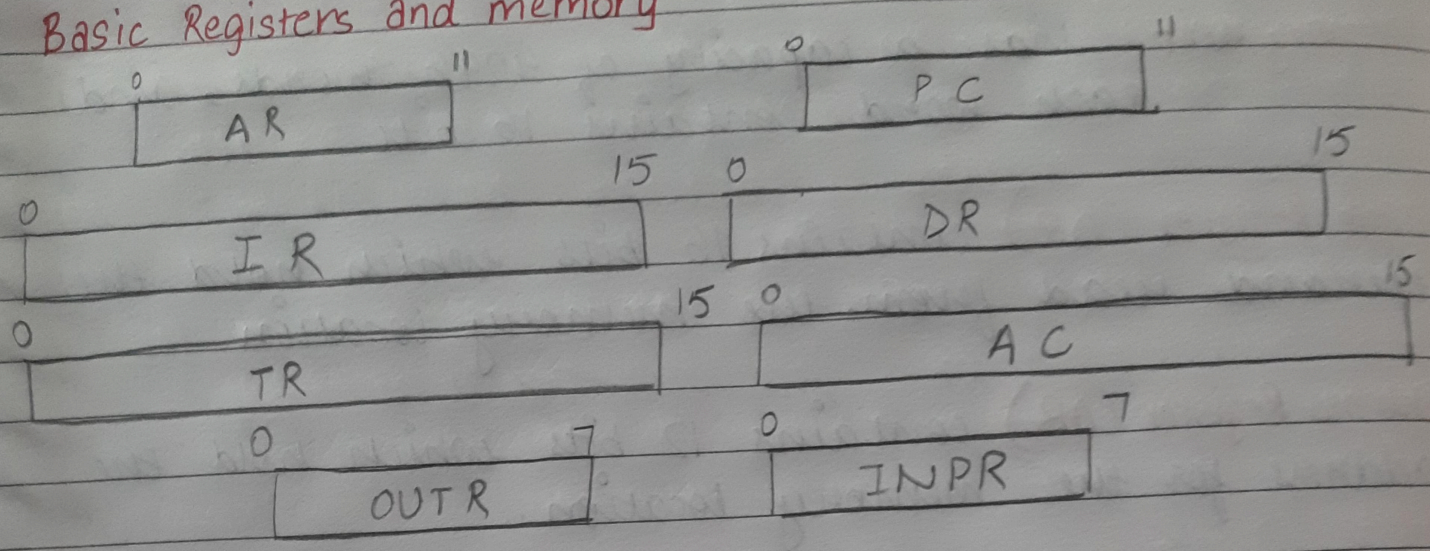
Computer needs processor registers for manipulating data and a register for holding a memory address.

The instructions in a computer are saved in memory locations and implemented one after another at a time.

The function of a control unit is to fetch the instrⁿ from the memory and implement it.

A counter is needed to maintain path of the next instrⁿ to be implemented and evaluate its address.

Basic Registers and memory



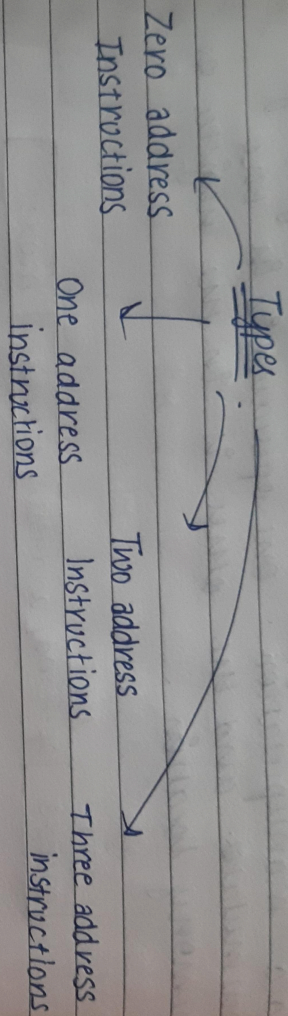
Memory
4096 words
16 bits per word

Register	Symbol	Bits	Function
Data Register	DR	16	Holds Memory operand
Address Reg	AR	12	Holds address for the memory
Accumulator	AC	16	Processor Register
Instr ⁿ Reg.	IR	16	Holds instruction code
Program Counter	PC	12	Holds address of the instruction
Temporary Reg.	TR	16	Holds temporary data
Input reg	INPR	8	carries input character
output reg	OUTR	8	carries output character

- Memory unit has a capacity of 4096 words, and each word contains 16 bits
- Data Register (DR) contains 16 bits which hold the operand read from the memory location
- Address Register (AR) contains 12 bits which hold the address for the memory location.
- Program Counter (PC) contains 12 bits which holds the address of the next instruction to be read from memory after the current execution is executed
- Accumulator (AC) register is a general purpose processing register.
- The instruction read from memory is placed in the Instruction Register (IR)
- Temporary Register (TR) is used to hold the temporary data during the processing
- Input Register (IR) holds the input character given by the user.
- Output Register (OR) holds the output after processing the input data.

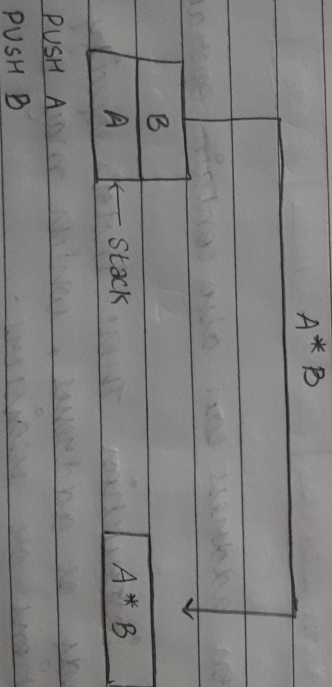
INSTRUCTION FORMAT

Instruction format refers to the way instructions are encoded and represented in machine language.



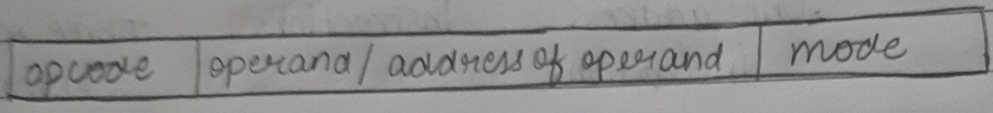
The structure of instrⁿ is called instrⁿ format. It means into how many parts has the instrⁿ been divided.

① Two address instruction. These instrⁿs do not specify any operand or address.



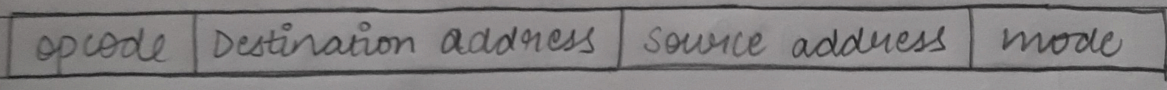
② One address instruction These instrⁿs specify one operand or address, which typically refers to memory location or registers.

This uses an implied ACCUMULATOR register for data manipulation. One operand is in the accumulator and the other is in the register or memory location.



③ Two address instruction These instrⁿs specify two operands or addresses, which may be memory locations or registers.

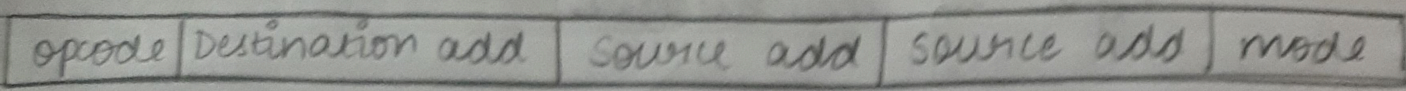
This is common in commercial computers. Here 2 addresses can be specified in the instruction



Here, destination address can also contain operand.

④ Three address instruction These instrⁿs specify three operands or addresses, which may be memory locations or registers.

Programs created are much shorter in size but the number of bits per instruction increase

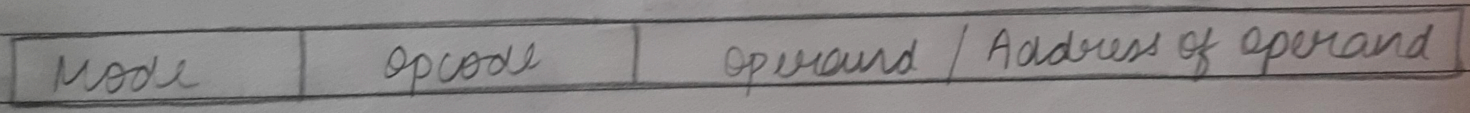


COMPUTER INSTRUCTIONS

Computer instructions are a set of machine lang. instructions that a particular processor understands and executes.

A computer performs tasks on the basis of the ~~an~~ instruction provided.

Instruction comprises of groups called fields



Opcode - Operational code field which specifies the operation to be performed.

Address field which contains the location of the operand, i.e., register or memory location

Mode field which specifies how the operand will be located

* The operational code of an instruction refers to a group of bits that define arithmetic & logic operations such as add, subtract, multiply, shift and complement.