→ Addressing Modes

The operation field of an instruction specifies the operation to be performed. The addressing mode specifies a rule for interpreting or modifying the address field of the instruction before the operand is actualy referenced.

→ Computer use addressing mode techniques for the purpose of accomodating one or both of the following provision

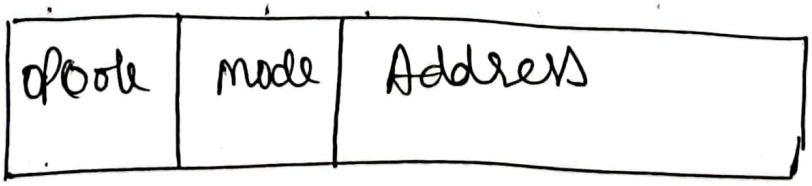
① To give programming versatility to the user by providing such facility as pointers to memory, counter for loop control, indexing of data and program relocation.

② To reduce the number of bits in the addressing field of the instruction.

→ The availabelty of the addressing mode gives the experienced assembly language programmer flexibilty language programmer for writing programs that are more efficent with respect to the number of instruction and execution time

→ Fetch, Decode, Execute the instruction

Mode field :



→ The instruction may have more than one address field, and each address field may be associated with its own particular addressing mode.

→ There are two modes that needs no address field at all. These are implied and immediate mode.

① Implied mode : In this mode, the operand are specified implicitly in the definition of the instruction. For example, the instruction, "Complement Accumulator," is an implied mode because the operand in the accumulator register is implied in the definition of instruction.

→ All register reference that uses accumulator and zero address instruction in a stack organized computer are implied mode instructions.

② Immediate mode : The operand is specified in the instruction itself. In other words, an immediate mode instruction has an operand field rather than an address field. The operand field contains actual operand to be used in conjunction with the operation specified in the instruction.

It was

) Register mode : operands are in register that resides within CPU. The particular register is selected from register field in the instruction. A k bit can specify any of 2^k registers.

s of Register Indirect Mode : Instruction specifies
es a register in the CPU whose contents give the address
te of the operand in memory. ~~In other word~~
→ Instructions uses few bits to select a register than
would have been required to specify a memory
address directly.

3) Autoincrement or Autodecrement mode :
Similar to the register indirect mode except
that the register is incremented or decremented
after its value is used to access memory.
When the address stored in the register refers
to a table of data in memory, it is necessary to
increment or decrement the register after every
access to the table.

4) Direct Address mode : In this mode effective
address is equal to the part of the instruction.
The operand resides in memory and its address is
given directly by the address field of the instruction
In branch types instruction the address field specifies
the actual branch address.

5) Indirect addressing modes : This mode of address
field of the instruction gives the address where
the effective address is stored in memory.
The control fetches the instruction from memory and
uses its address part to access memory again to read
effective address.
Effective address = address part of instruction + content
of CPU register.

Types of Interrupts

3 Types of Interrupts

(8) Relative address mode : The content of the is added to the address part of the instruction in to obtain the effective address. It is usually a signed number which can either +ve or negative.

→ When the no. is added to content of Program Counter the result produces an effective address whose position in the memory is relative to address of the next instruction. 825 read from memory

PC ← PC+1 = 826

Effective address 826+24 = 850

→ often used with branch-type instructions when the branch address is in instruction word.

(9) Indexed Addressing Mode : In this mode the content of an index register is added to the address part of the instruction to obtain the effective address. Index register is a special CPU register that contains an index value. which is array form.

(10) Base register addressing modes :

In this mode the content of base register is added to the address part of the instruction to obtain the effective address. Similar to Indexed register, but register is changes to base register. A base register is hold the base address and the address field of instruction gives a displacement relative to this base address. used to relocation of program in memory.

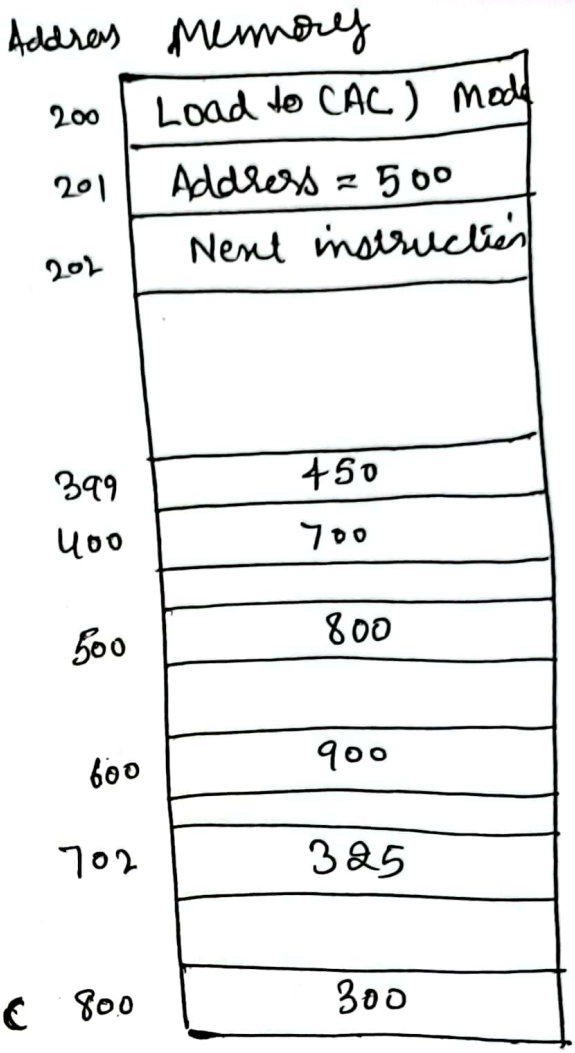
3 Numerical example

PC = 200

R_1 = 400

XR = 100

AC



1) Direct address mode:
Effective address - 500
operand is loaded into AC is 800

2) Immediate mode the second word of instruction is taken as the operand rather than an address, 500 is loaded in AC
Effective address = 201

3) Indirect mode → Effective addresses at memory 500
Effective address 800, operand is 300.

4) Relative mode, Effective address is 500 + 202 = 702. operand is 325. (PC value is PC+1) (701 → 702)

5) In the index mode the effective address is XR + 500 = 100 + 500 = 600 2) Operand is 900

6) In register mode the operand is in R_1 and 400 is loaded in AC. CNO effect address in this CM

7) In register Indirect mode the ~~effective~~ address is 400, equal to the content of R_1 and operand loaded into AC is 700