

Addressing Modes

April 26, 2020

1 Implied Mode

In this mode, the operands are specified implicitly in the definition of the instruction.

2 Immediate Mode

In this mode, the operand is specified in the instruction itself.

$$AC \leftarrow \#NBR$$

3 Register Mode

In this mode, the operand are in registers that reside within the CPU.

$$AC \leftarrow R1$$

4 Register Indirect Mode

In this mode, the instruction specifies a register in the CPU whose contents give the address of the operand in memory.

$$AC \leftarrow M[R1]$$

5 Autoincrement or Autodecrement Mode

This is similar to the register indirect mode except that the register is incremented or decremented after(or before) its value is used to access memory.

$$\begin{aligned} AC &\leftarrow M[R1] \\ R1 &\leftarrow R1 + 1 \end{aligned}$$

$$\begin{aligned} AC &\leftarrow M[R1] \\ R1 &\leftarrow R1 - 1 \end{aligned}$$

6 effective address

The effective address is defined to be the memory address obtained from the computation dictated by the given addressing mode.

7 Direct Address Mode

In this mode, the effective address is equal to the address part of the instruction.

$$AC \leftarrow M[ADR]$$

8 Indirect Address Mode

In this mode, the address field of the instruction gives the address where the effective address is stored in memory .

$$AC \leftarrow M[M[ADR]]$$

9 Relative Address Mode

In this mode, the content of the program counter is added to the address part of the instruction in order to obtain the effective address.

$$AC \leftarrow M[PC + ADR]$$

10 Indexed Addressing Mode

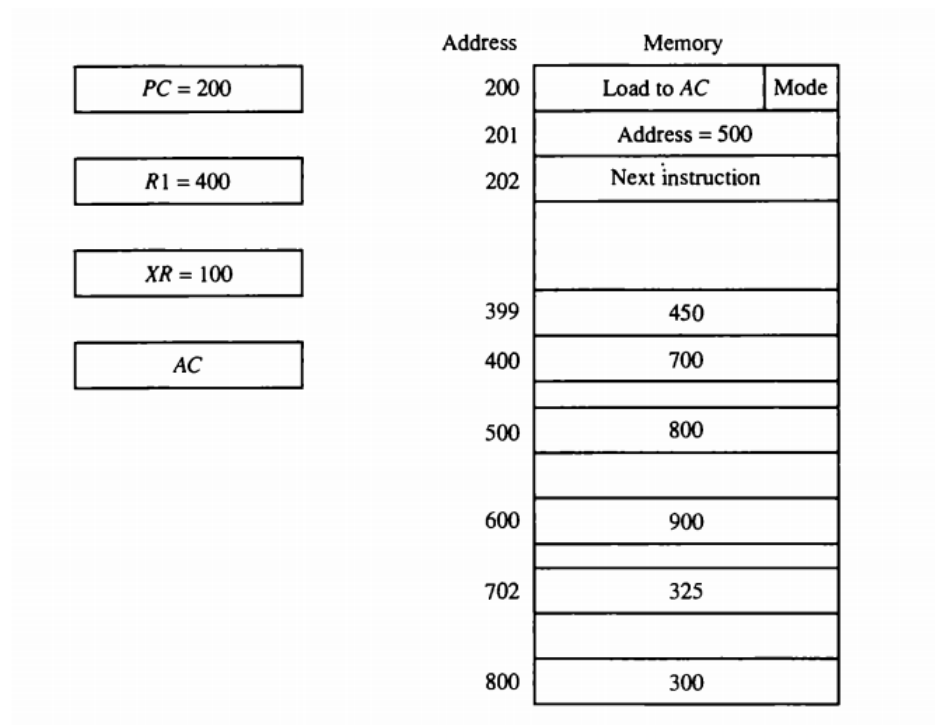
In this mode, the content of an index register is added to the address part of the instruction to obtain the effective address

$$AC \leftarrow M[XR + ADR]$$

11 Base Register Addressing Mode

In this mode, the content of a base register is added to the address part of the instruction to obtain the effective address.

12 Example



12.1 Direct Address Mode

the effective address is the address part of the instruction 500 and the operand to be loaded into AC is 800.

12.2 Immediate Mode

the second part of the instruction is taken as the operand rather than an address, so 500 is loaded into AC. (The effective address in this case is 201)

12.3 Indirect Mode

the effective address is stored in memory at address 500. Therefore, the effective address is 800 and the operand is 300.

12.4 Relative Mode

the effective address is $500 + 202 = 702$ and the operand is 325

** Note that the value in PC after the fetch phase and during the execute phase is 202

12.5 Index Mode

the effective address is $XR + 500 = 100 + 500 = 600$ and the operand is 900

12.6 Register Mode

the operand is in R1 and 400 is loaded into AC

** There is no effective address in this case

12.7 Register Indirect Mode

the effective address 400, equal to the content of R1 and the operand loaded into AC is 700 .

12.8 Autoincremented Mode

is the same as register indirect mode except that R1 is incremented to 401 after the execution of the instruction.

12.9 Autodecremented mode

decrements R1 to 399 before of the execution of the instruction, and the operand loaded into AC is now 450