

Addressing Modes

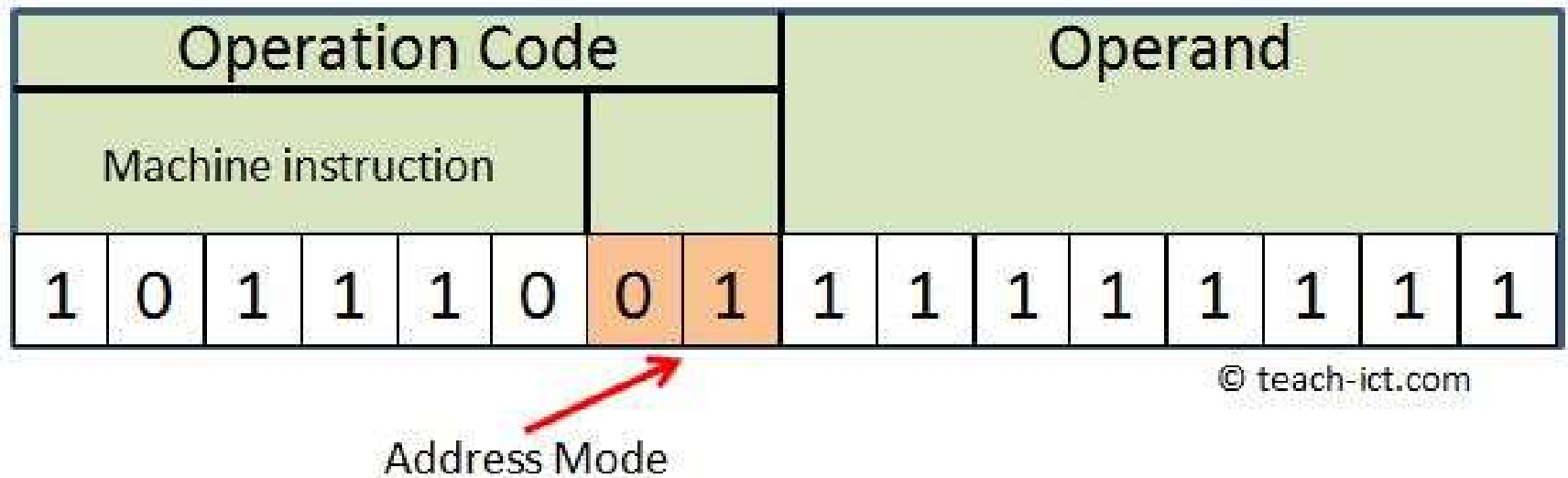
- What is addressing modes?
 - The addressing modes help us specify the way in which an **operand's effective address** is represented in any given instruction.
 - The addressing modes describe an efficient and flexible way to define complex effective addresses.

Types of AM in 8051

- Immediate
- Register
- Direct
- Register Indirect
- Indexed

Opcode and Operand

- The opcode is the instruction that is executed by the CPU and
- The operand is the data or memory location used to execute that instruction.



Immediate Addressing Mode

- Here, the source operand is a constant.
- The immediate data must be preceded by the hash sign, “#”
- This addressing mode can load information into any registers, including 16-bit DPTR register.
- We can also use immediate addressing mode to send data to ports.
 - Ex. MOV R4, #45h
 - MOV DPTR, #4521h
 - MOV PI, #55h

Register Addressing Mode

- Use registers to hold the data to be manipulated.
- The source and destination registers must match in size.
- The movement of data between Rn registers is not allowed.
 - MOV A,R0 - Valid instruction
 - MOV DPTR,A – Invalid instruction
 - MOV R4, R7 - Invalid instruction

Direct Addressing Mode

- Direct addressing mode is capable of addressing whole 128 byte RAM.
- But it is most often used the direct addressing mode to access RAM locations 30-7FH.
 - `MOV 56h,A` ;save the content of A in RAM location 56H.

Cont.

- With direct addressing, operands can be accessed from:
 - Lower 128 bytes of internal RAM
 - SFRs
 - 128 bits in the data RAM address space
 - 128 bits in the SFR address space
- Another major use of this addressing mode is stack. Here, we cannot write “PUSH A”. Instead of this, we need to write PUSH 0E0H. Similarly pushing R3 of bank 0 is coded as “PUSH 03”.

Register Indirect Addressing Mode

- In this addressing mode, a **register is used as a pointer to the data.**
- If the data is a part of the internal data RAM, either register **R0 or R1** can be used for this purpose and in the instruction format they must be preceded with “@” sign.
- Apart from this, the data can also be accessed from externally located RAM using register indirect with the help of the DPTR register.

Cont.

- One of the advantage of the Register-indirect mode is that it makes accessing data dynamic rather than static.
- Register indirect addressing is used to access:
 - Internal data RAM using @R0, @RI and @SP (in the case of PUSH and POP only)
 - External data memory using @R0, @RI and @DPTR.
 - Ex. MOV A, @R0 – It means, move contents of RAM location whose address is held by R0 to A.
 - MOVX @DPTR, A – Move the contents of A, to external RAM location whose address is held by DPTR.

Indexed Addressing Mode

- This addressing mode is widely used in accessing data elements of look-up table entries located in the program ROM space.
- The instruction used for this purpose is
 - `MOVC A, @A+DPTR`
 - `MOVC A, @A+PC.`
- “C” stands for “code”.

Cont.

- In the first case, the contents of register A is added to the contents of the 16 bit register DPTR to generate the address of the data element stored in on-chip ROM.
- That data element is transferred to A.
- This is also refereed as “base register plus index register addressing mode”.
- The DPTR act as base register and the A register act as index register.

Cont.

- In the second case, the PC is incremented to the address of the following instruction before it is added to the A register to generate the address of the data element stored in on-chip ROM.
- Then, that data element is transferred to A.