SNS COLLEGE OF TECHNOLOGY

Coimbatore-35
An Autonomous Institution

Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A+' Grade
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

19ITT204 – MICROCONTROLLER & EMBEDDED SYSTEMS

III YEAR - V SEM

UNIT 3 – Embedded System Concepts & Processors

Topic- 8051 –Instruction Format and Addressing Modes

8051 Instruction Format

➢An **instruction** is a command to the microprocessor to perform a given task on a specified data.

➢Each instruction has two parts: one is task to be performed, called the **operation code** (opcode), and the second is the data to be operated on, called the **operand.**

➢The operand (or data) can be specified in various ways.

➢ It may include 8-bit (or 16-bit) data, an internal register, a memory location, or 8-bit (or 16-bit) address. In some instructions, the operand is implicit.

8051 Instruction Format

➤ The 8051 family of Microcontrollers are 8-bit processors, the 8051 Microcontroller Instruction Set is optimized for 8-bit control applications. As a typical 8-bit processor, the 8051 Microcontroller instructions have 8-bit Opcodes.

➤ As a result, the 8051 Microcontroller instruction set can have up to $2^8 = 256$ Instructions.

8051 Instruction sets

DATA TRANSFER	ARITHMETIC	LOGICAL	BOOLEAN	PROGRAM BRANCHING
MOV	ADD	ANL	CLR	LJMP
MOVC	ADDC	ORL	SETB	AJMP
MOVX	SUBB	XRL	MOV	SJMP
PUSH	INC	CLR	JC	JZ
POP	DEC	CPL	JNC	JNZ
XCH	MUL	RL	JB	CJNE
XCHD	DIV	RLC	JNB	DJNZ
	DA A	RR	JBC	NOP
		RRC	ANL	LCALL
		SWAP	ORL	ACALL
			CPL	RET
				RETI

Addressing modes of 8051

An Addressing Mode is a way to locate a target Data, which is also called as

Operand. The 8051 Family of Microcontrollers allows five types of

Addressing Modes for addressing the Operands.

They are:

➢Immediate Addressing

➢Register Addressing

➢Direct Addressing

➢Register – Indirect Addressing

➢Indexed Addressing

Addressing modes of 8051

Immediate Addressing

The operand, which follows the Opcode, is a constant data of either 8 or 16 bits. The constant data to be stored in the memory immediately follows the Opcode.

The constant value to be stored is specified in the instruction itself rather than taking from a register. The destination register to which the constant data must be copied should be the same size as the operand mentioned in the instruction.

Example: MOV A, #030H

Here, the Accumulator is loaded with 30 (hexadecimal). The # in the operand indicates that it is a data and not the address of a Register.

Immediate Addressing is very fast as the data to be loaded is given in the instruction itself.

Addressing modes of 8051

Register Addressing

In Register Addressing mode, one of the eight registers (R0 – R7) is specified as Operand in the Instruction.

It is important to select the appropriate Bank with the help of PSW Register.

Let us see a example of Register Addressing assuming that Bank0 is selected.

Example: MOV A, R5

Here, the 8-bit content of the Register R5 of Bank0 is moved to the Accumulator.

Addressing modes of 8051

Direct Addressing

In Direct Addressing Mode, the address of the data is specified as the Operand in the instruction. Using Direct Addressing Mode, we can access any register or on-chip variable. This includes general purpose RAM, SFRs, I/O Ports, Control registers.

Example: MOV A, 47H

Here, the data in the RAM location 47H is moved to the Accumulator.

Register Indirect Addressing

In the Indirect Addressing Mode or Register Indirect Addressing Mode, the address of the Operand is specified as the content of a Register.

Example: MOV A, @R1

The @ symbol indicates that the addressing mode is indirect. If the contents of R1 is 56H, for example, then the operand is in the internal RAM location 56H. If the contents of the RAM location 56H is 24H, then 24H is moved into accumulator.

Only R0 and R1 are allowed in Indirect Addressing Mode. These register in the indirect addressing mode are called as Pointer registers.

Indexed Addressing Mode

With Indexed Addressing Mode, the effective address of the Operand is the sum of a base register and an offset register. The Base Register can be either Data Pointer (DPTR) or Program Counter (PC) while the Offset register is the Accumulator (A).

In Indexed Addressing Mode, only MOVC and JMP instructions can be used.

Indexed Addressing Mode is useful when retrieving data from look-up tables.

Example: MOVC A, @A+DPTR

Here, the address for the operand is the sum of contents of DPTR and Accumulator.

References

https://www.electronicshub.org/8051-microcontroller-instruction-set/

https://www.brainkart.com/article/Instruction-Format---8051-Micro-Controller_7831/

https://www.win.tue.nl/~aeb/comp/8051/set8051.html

Ramesh S.Gaonkar," Microprocessor – Architecture, Programming and Applications with the 8085", Penram International Publisher,7th Ed., 2016