

## **Instruction Set:**

The instruction set is the structure of the controller or processor that provides commands to the controller to guide the controller for processing data. The instruction set consists of instructions, native data types, addressing modes, interrupt registers, exceptional handling and memory architecture. The 8051 microcontroller can follow CISC instructions with Harvard architecture. In case of the 8051 programming different types of CISC instructions include:

- Data Transfer Instruction set
- Sequential Instruction Set
- Arithmetic Instruction set
- Branching Instruction set
- Loop Instruction Set
- Conditional Instruction set
- Unconditional Instruction set
- Logical Instruction set
- Boolean Instruction set

## **Arithmetic Instruction Set:**

The arithmetic instructions perform the basic operations such as:

- Addition
- Multiplication
- Subtraction
- Division

### **Addition:**

```
ORG 0000h
MOV R0, #03H // move the value 3 to the register R0//
MOV A, #05H // move the value 5 to accumulator A//
Add A, 00H // add A value with R0 value and stores the result in A//
END
```

### **Multiplication:**

```
ORG 0000h
MOV R0, #03H // move the value 3 to the register R0//
MOV A, #05H // move the value 5 to accumulator A//
```

```
MUL A, 03H    // Multiplied result is stored in the Accumulator A //  
END
```

### **Subtraction:**

```
ORG 0000h  
MOV R0, #03H // move the value 3 to register R0//  
MOV A, #05H  // move the value 5 to accumulator A//  
SUBB A, 03H  // Result value is stored in the Accumulator A //  
END
```

### **Division:**

```
ORG 0000h  
MOV R0, #03H // move the value 3 to register R0//  
MOV A, #15H  // move the value 5 to accumulator A//  
DIV A, 03H   // final value is stored in the Accumulator A //  
END
```

### **Conditional Instructions**

The CPU executes the instructions based on the condition by checking the single bit status or byte status. The 8051 microcontroller consists of various conditional instructions such as:

- JB —> Jump below
- JNB —> Jump if not below
- JC —> Jump if Carry
- JNC —> Jump if not Carry
- JZ —> Jump if Zero
- JNZ —> Jump if not Zero

### **Call and Jump Instructions:**

The call and jump instructions are used to avoid the code replication of the program. When some specific code is used more than once in different places in the program, if we mention a specific name to the code then we could use that name anywhere in the program without entering a code for every time. This reduces the complexity of the program. The 8051 programming consists of call and jump instructions such as LCALL, SJMP.

- LCALL
- ACALL

- SJMP
- LJMP

### **Loop Instructions:**

The loop instructions are used to repeat the block each time while performing the increment and decrement operations. The 8051 microcontroller consist two types of loop instructions:

- CJNE —> compare and jump if not equal
- DJNZ —> decrement and jump if not zero

### **Logical Instruction Set:**

The 8051 microcontroller instruction set provides the AND, OR, XOR, TEST, NOT and Boolean logic instructions for set and clears the bits based on the need in the program

### **Shifting Operators**

The shift operators are used for sending and receiving the data efficiently. The 8051 microcontroller consist four shift operators:

- RR —> Rotate Right
- RRC —> Rotate Right through carry
- RL —> Rotate Left
- RLC —> Rotate Left through carry