Data Transfer & Manipulation

There are a set of basic operations that most of computers include in their instruction repertoire which can be classified into three categories viz.

1. Data transfer instructions
2. Data manipulation instructions
3. Program control instructions

Data transfer instructions cause transfer of data from one location to another without changing the binary information content. Data manipulation instructions are those that perform arithmetic, logic, and shift operations. Program control instructions provide decision-making capabilities and change the path taken by the program when executed in the computer. The instruction set of a particular computer determines the register transfer operations and control decisions that are available to the user. Let us study them one by one

1. **Data Transfer Instructions:** Data transfer instructions move data from one place in the computer to another without changing the data content. The most common transfers are between memory and processor registers, between processor registers and input or output, and between the processor registers themselves.

Load	LD
Store	ST
Move	MOV
Exchange	XCH
Input	IN
Output	OUT
Push	PUSH
Pop	POP

Figure 1: Typical Data Transfer Instructions

2. **Data Manipulation Instructions:** Data manipulation instructions perform operations on data and provide the computational capabilities for the computer. The data manipulation instructions in a typical computer are usually divided into three basic types:
    a. Arithmetic instructions (Increment, Decrement, Add, Subtract etc)
    b. Logical and bit manipulation instructions (AND, OR, XOR, Complement etc)
    c. Shift instructions (Shift Left, Shift Right, Rotate Right etc)
3. **Program Control (Instructions):** Instructions are always stored in successive memory locations. When processed in the CPU, the instructions are fetched from consecutive memory locations and executed. Each time an instruction is fetched from memory, the program counter is incremented so that it contains the address of the next instruction in sequence. After the execution of a data transfer or data manipulation instruction, control returns to the fetch cycle with the program counter containing the address of the instruction next in sequence. On the other hand, a program control type of instruction, when executed, may change the address value in the program counter and cause the flow of control to be altered. In other words, program control instructions specify conditions for altering the content of the program counter, while data transfer and manipulation instructions specify conditions for data-processing operations. The change in value of the program counter as a result of the execution of a program control instruction causes a break in the sequence of instruction execution. This is an important feature in digital computers, as it provides control over the flow of

For Academic use only

program execution and a capability for branching to different program segments.

Name	Mnemonic
Branch	BR
Jump	JMP
Skip	SKP
Call	CALL
Return	RET
Compare (by subtraction)	CMP
Test (by ANDing)	TST

Figure 2: Typical Program Control Instructions

(For Academic Purpose Only)