Instruction Types

Computer System Architecture

By

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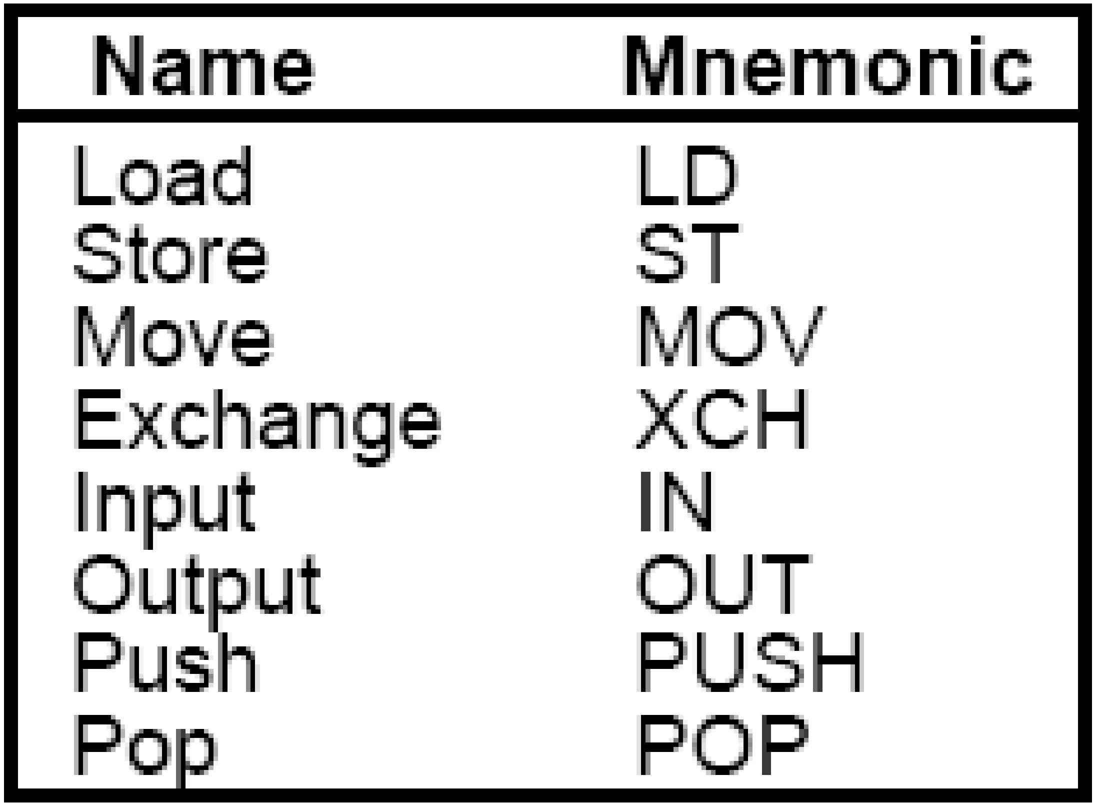
Classification of computer instructions

- Most computer instructions can be classified into three categories:
  - 1) Data transfer,
  - 2) Data manipulation,
  - 3) Program control instructions

Data Transfer Instruction



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

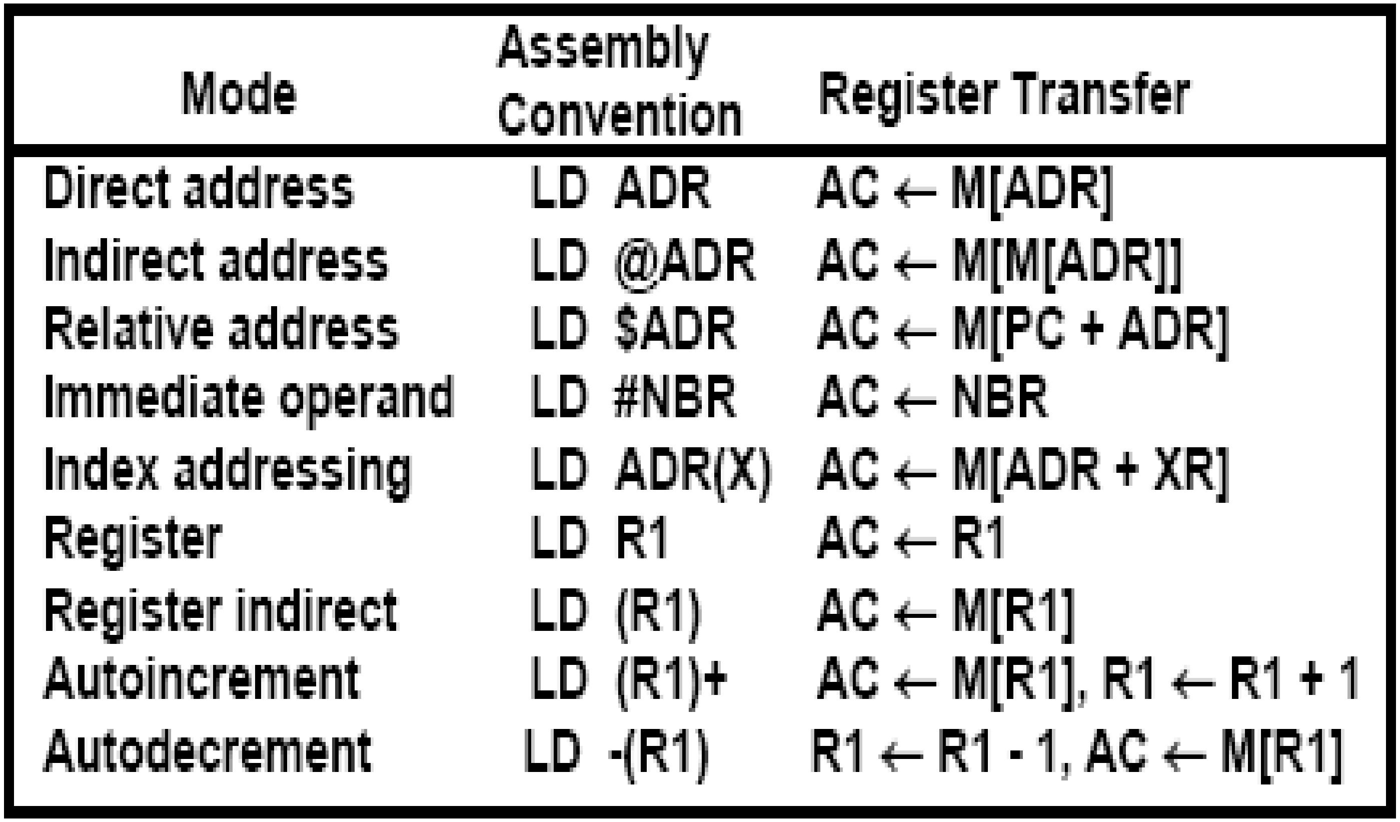
Data Transfer Instruction cont..

- **Load** : transfer from memory to a processor register, usually an AC (*memory read*)
- **Store** : transfer from a processor register into memory (*memory write*)
- **Move** : transfer from one register to another register
- **Exchange** : swap information between two registers or a register and a memory word
- **Input/Output** : transfer data among processor registers and input/output device
- **Push/Pop** : transfer data between processor registers and a memory stack

Addressing Mode for the LOAD Instruction

- **@** : Indirect Address
- **$** : Address relative to PC
- **#** : Immediate Mode
- **( )** : Index Mode, Register Indirect, Autoincrement

Data Transfer Instructions with Different Addressing Modes

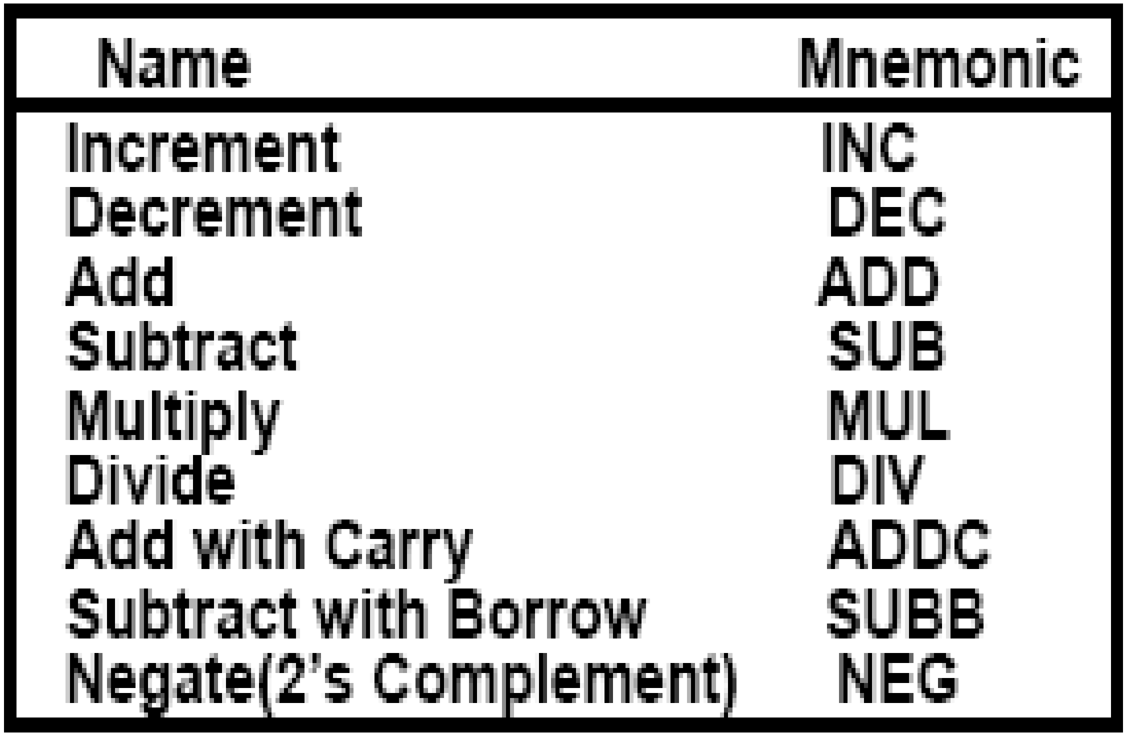


Mode	Assembly Convention	Register Transfer
Direct address	LD ADR	AC ← M[ADR]
Indirect address	LD @ADR	AC ← M[M[ADR]]
Relative address	LD $ADR	AC ← M[PC + ADR]
Immediate operand	LD #NBR	AC ← NBR
Index addressing	LD ADR(X)	AC ← M[ADR + XR]
Register	LD R1	AC ← R1
Register indirect	LD (R1)	AC ← M[R1]
Autoincrement	LD (R1)+	AC ← M[R1], R1 ← R1 + 1
Autodecrement	LD -(R1)	R1 ← R1 - 1, AC ← M[R1]

Data Manipulation Instruction

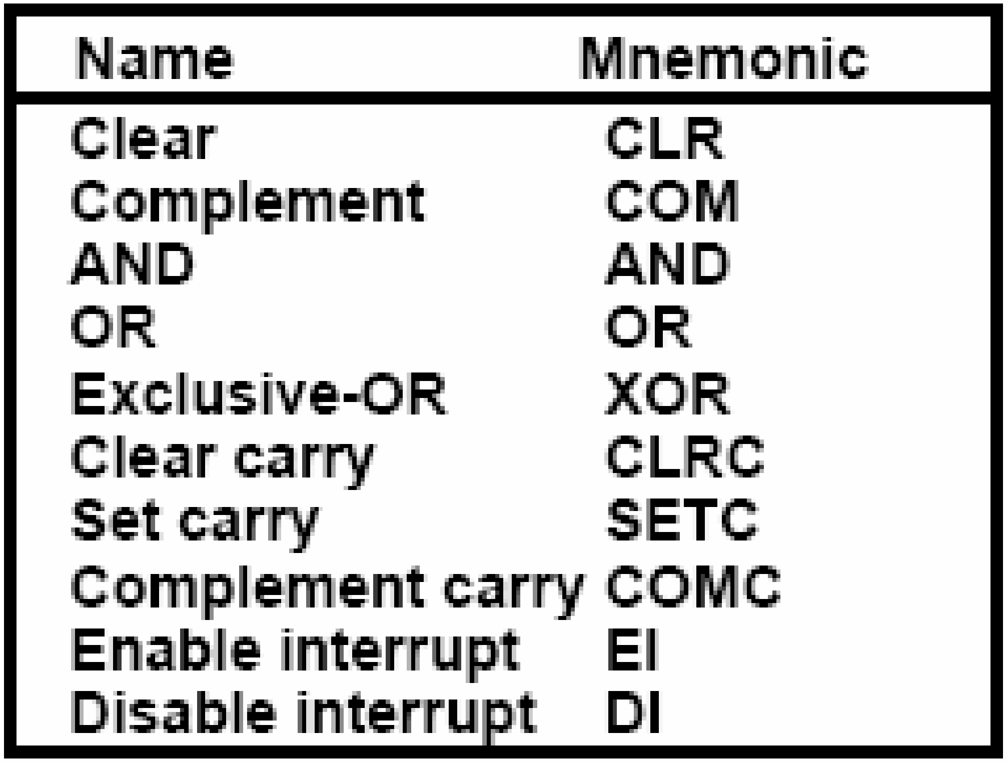
- 1) Arithmetic,
- 2) Logical and bit manipulation,
- 3) Shift Instruction

Arithmetic Instructions



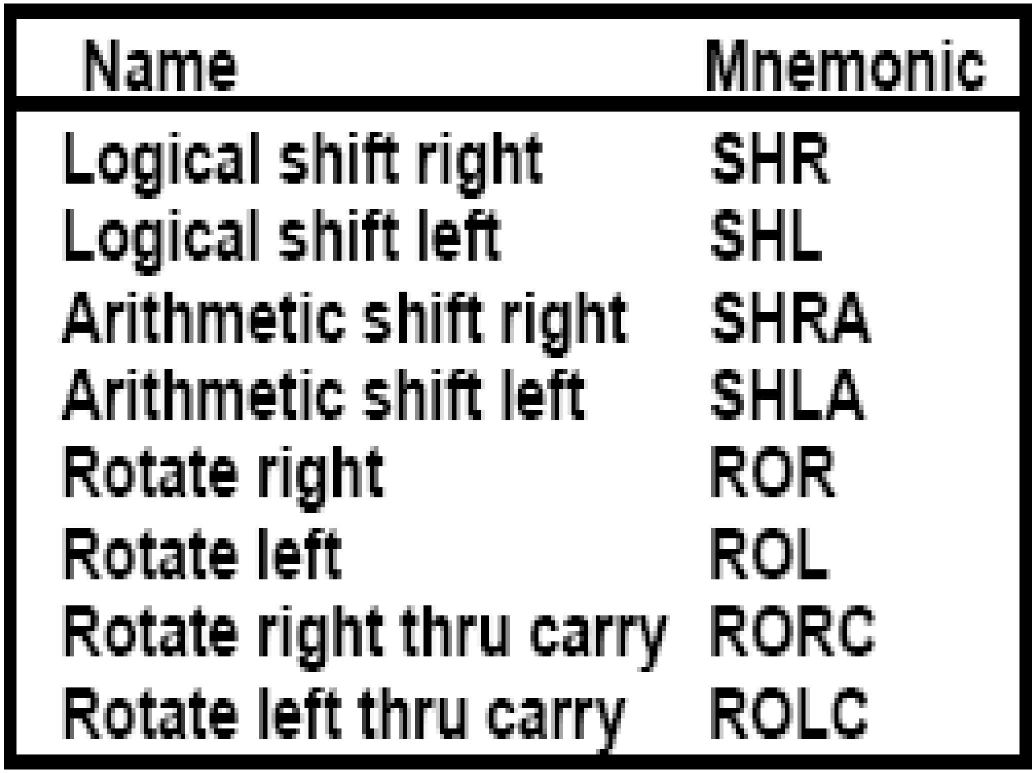
Name	Mnemonic
Increment	INC
Decrement	DEC
Add	ADD
Subtract	SUB
Multiply	MUL
Divide	DIV
Add with Carry	ADDC
Subtract with Borrow	SUBB
Negate(2's Complement)	NEG

Logical and Bit Manipulation Instructions



Name	Mnemonic
Clear	CLR
Complement	COM
AND	AND
OR	OR
Exclusive-OR	XOR
Clear carry	CLRC
Set carry	SETC
Complement carry	COMC
Enable interrupt	EI
Disable interrupt	DI

Shift Instructions



Name	Mnemonic
Logical shift right	SHR
Logical shift left	SHL
Arithmetic shift right	SHRA
Arithmetic shift left	SHLA
Rotate right	ROR
Rotate left	ROL
Rotate right thru carry	RORC
Rotate left thru carry	ROLC