Computer Organization & Architecture (Instruction Set Architecture)

Dr. Sonu Lamba

Department of Computer Science and Engineering
The LNM Institute of Information Technology Jaipur

August 19, 2020

Instruction format

Computer perform task on the basis of instruction provided

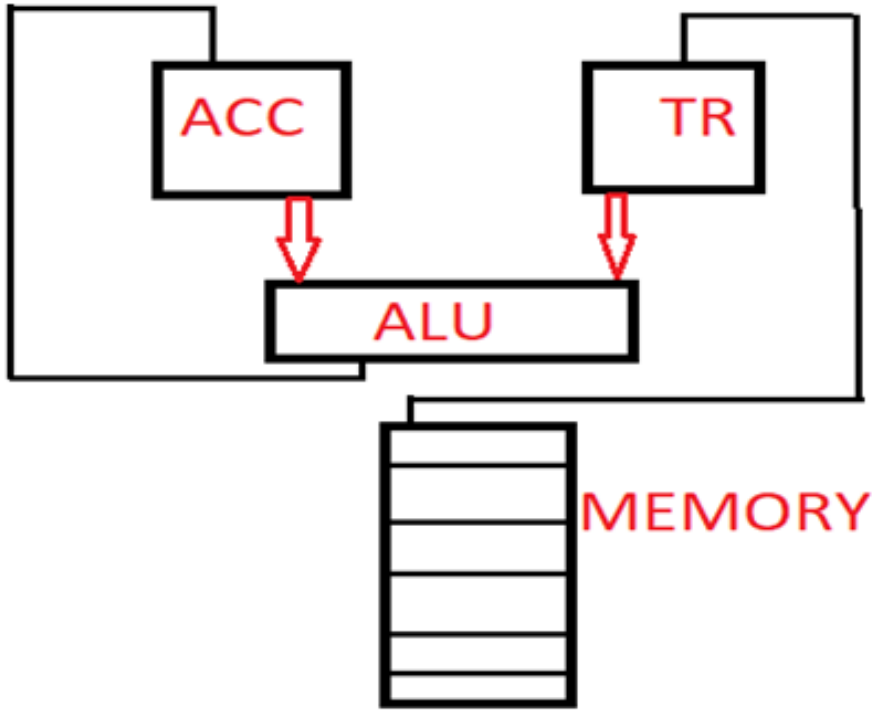
- **Instruction Format:** describes the internal structures (layout design) of the bits of an instruction, in terms of its constituent parts.
- The most common parts are:
  - Operation field (Opcode)
  - Address field (Operand)
  - Mode field (Addressing Mode)

Classification of Instruction Format

- Classification of Instruction Formats: (based on the type of the CPU organization)
  1. Zero Address Instruction
  2. One Address Instruction
  3. Two Address Instruction
  4. Three Address Instruction
- Classification of CPU Organization:(based on the availability of the ALU operands)
  1. Single Accumulator Organization
  2. General Register Organization
  3. Stack Organization

Single Accumulator Organization

- Use an implied ACCUMULATOR register
- One of the ALU operands is in the accumulator.
- Another ALU operand is either in the register or in memory.
- Supports One Address Instruction Format.



Example:One Address Instruction Format

General Register CPU Organization

- Multiple registers are available
  1. Two Address Instruction Format
  2. Three Address Instruction Format

Two Address Instruction Format

- Two address can be specified in the instruction
- First ALU operand is always required in the register.
- The same register can also be used as the destination.
- Second ALU operand is present either in a register or in memory.

Example:Two Address Instruction Format

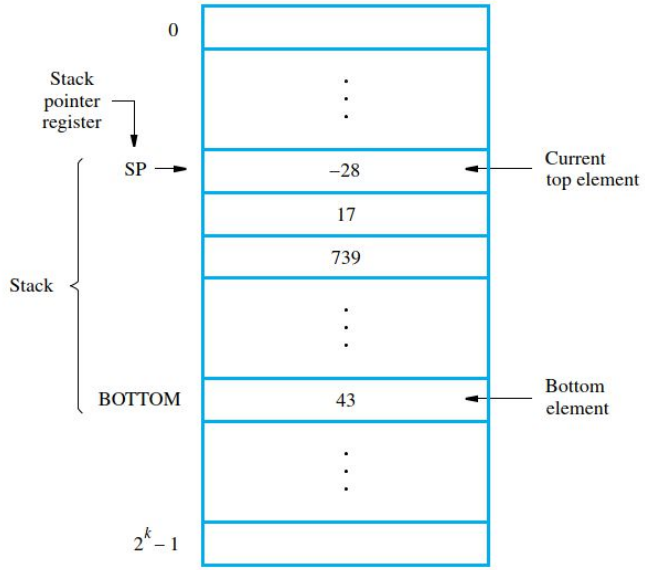
Three Address Instruction Format

- Three address fields to specify a register or a memory location.
- Number of instruction decreases but size increases

Example:Three Address Instruction Format

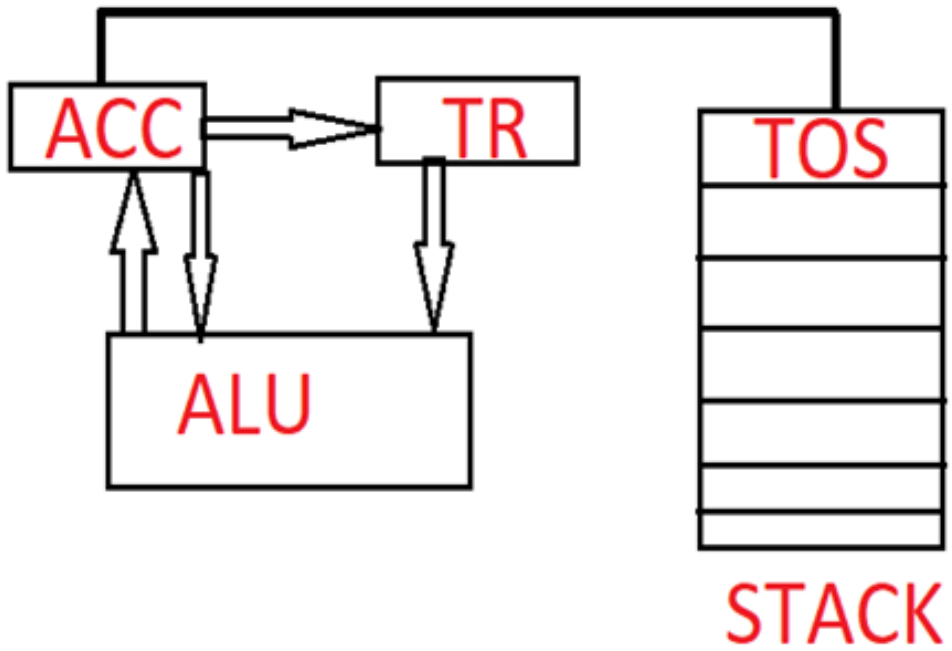
Stack Organization

- Last-in–first-out (LIFO) data structure



Stack Organization

- ALU operations are performed only on a stack data.
- We can perform insert and deletion operation at only one end (TOS)
- No address required because the TOS becomes the default location.
- The computable instruction format of STACK organization is Zero Address Instruction Format.



Example: Zero Address Instruction

Example

- A machine has 24-bit instruction Format. It has 32 registers each of which is 32-bit long.It needs to support 49 instructions. Each instruction has two register operands and one immediate operand. If the immediate operand is signed number, then what will be the minimum value of immediate operand?