# Classification of computer architecture

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# Organization and Architecture

- **Computer architecture** refers to those attributes of a system visible to a programmer or, put another way, those attributes that have a direct impact on the logical execution of a program.
- **Computer organization** refers to the operational units and their interconnections that realize the architectural specifications.

# Structure and Function

- **Function**: The operation of each individual component as part of the structure.
  - Data Processing
  - Data Storage
  - Data Movement
  - Control
- **Structure**: The way in which the components are interrelated.

**Central Processing Unit (CPU)**: Controls the operation of the computer and performs its data processing functions; often simply referred to as *processor.*

**Main Memory**: Stores data.

**I/O**: Moves data between the computer and its external environment.

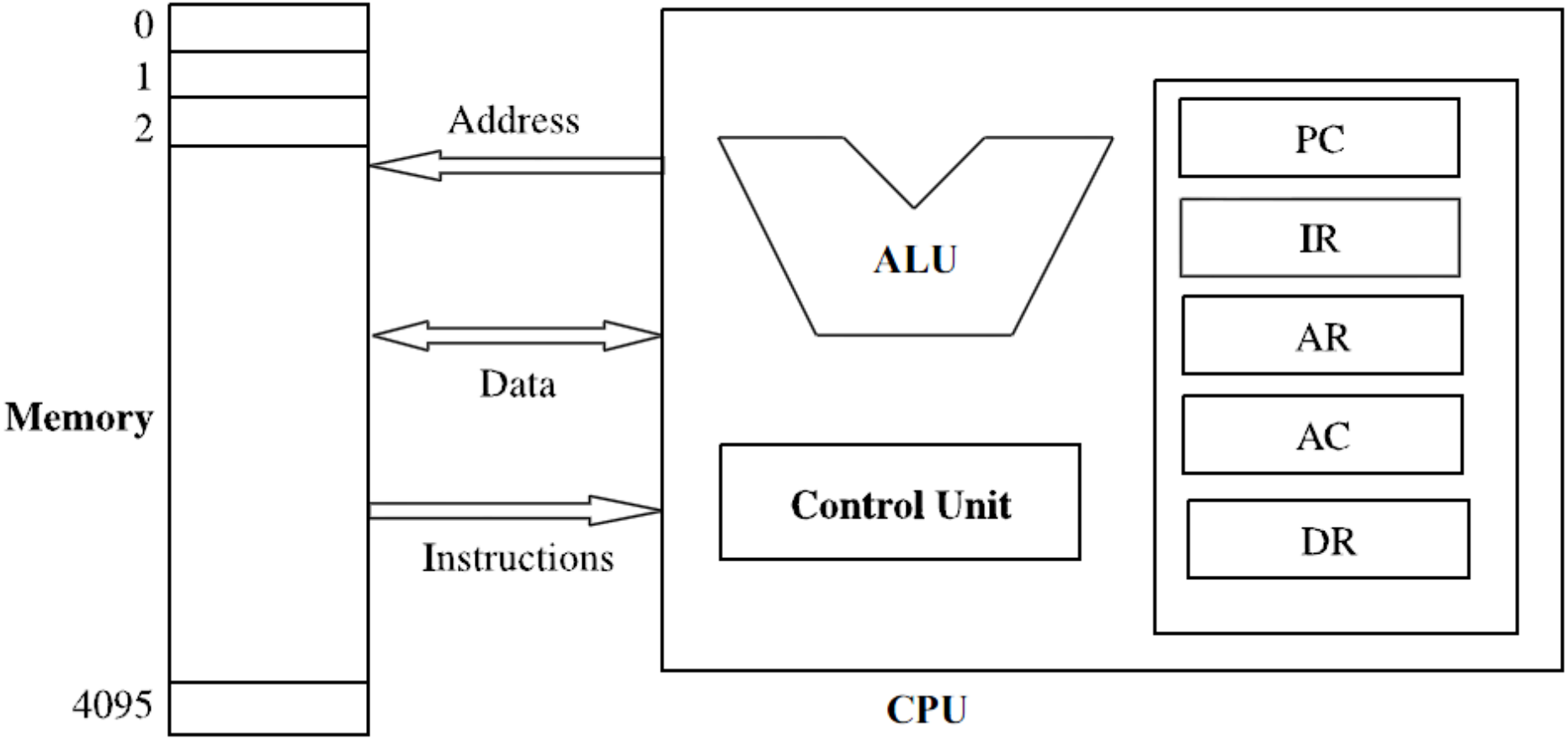
**System interconnection**: Some mechanism that provides for communication among CPU, main memory, and I/O.

# CPU Component

- **Control Unit**: Controls the operation of the CPU and hence the computer.
- **Arithmetic and Logic Unit (ALU)**: Performs the computer's data processing functions.
- **Registers**: Provides storage internal to the CPU.
- **CPU interconnection**: Some mechanism that provides for communication among the control unit, ALU, and registers.

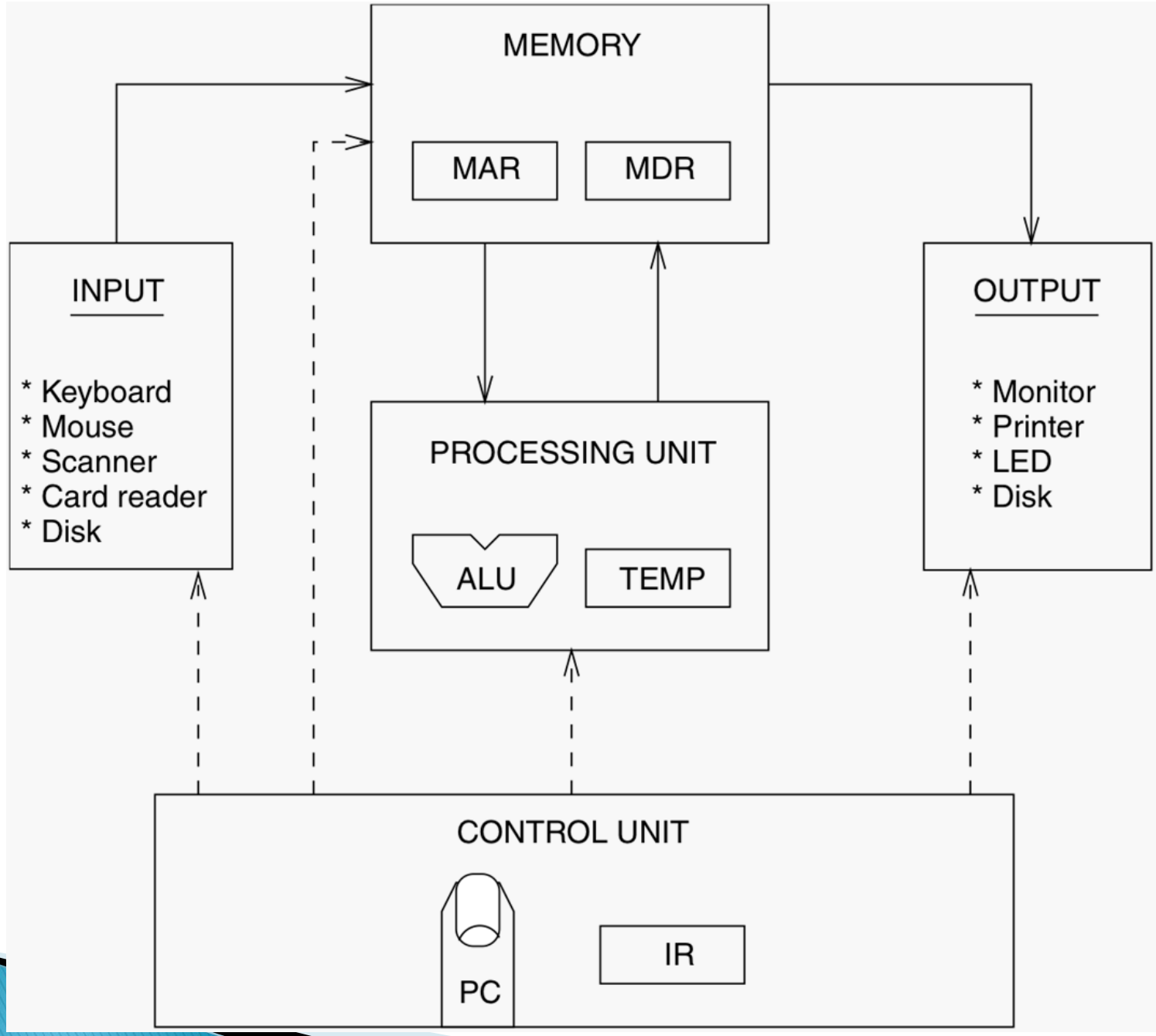
# A simple machine

- Our simple machine is an accumulator-based processor, which has five 16-bit registers: Program Counter (PC), Instruction Register (IR), Address Register (AR), Accumulator (AC), and Data Register (DR).
- The memory unit is made up of 4096 words of storage. The word size is 16 bits.


0
1
2
4095
Memory
Address
Data
Instructions
ALU
Control Unit
PC
IR
AR
AC
DR
CPU

# The von Neumann Machine

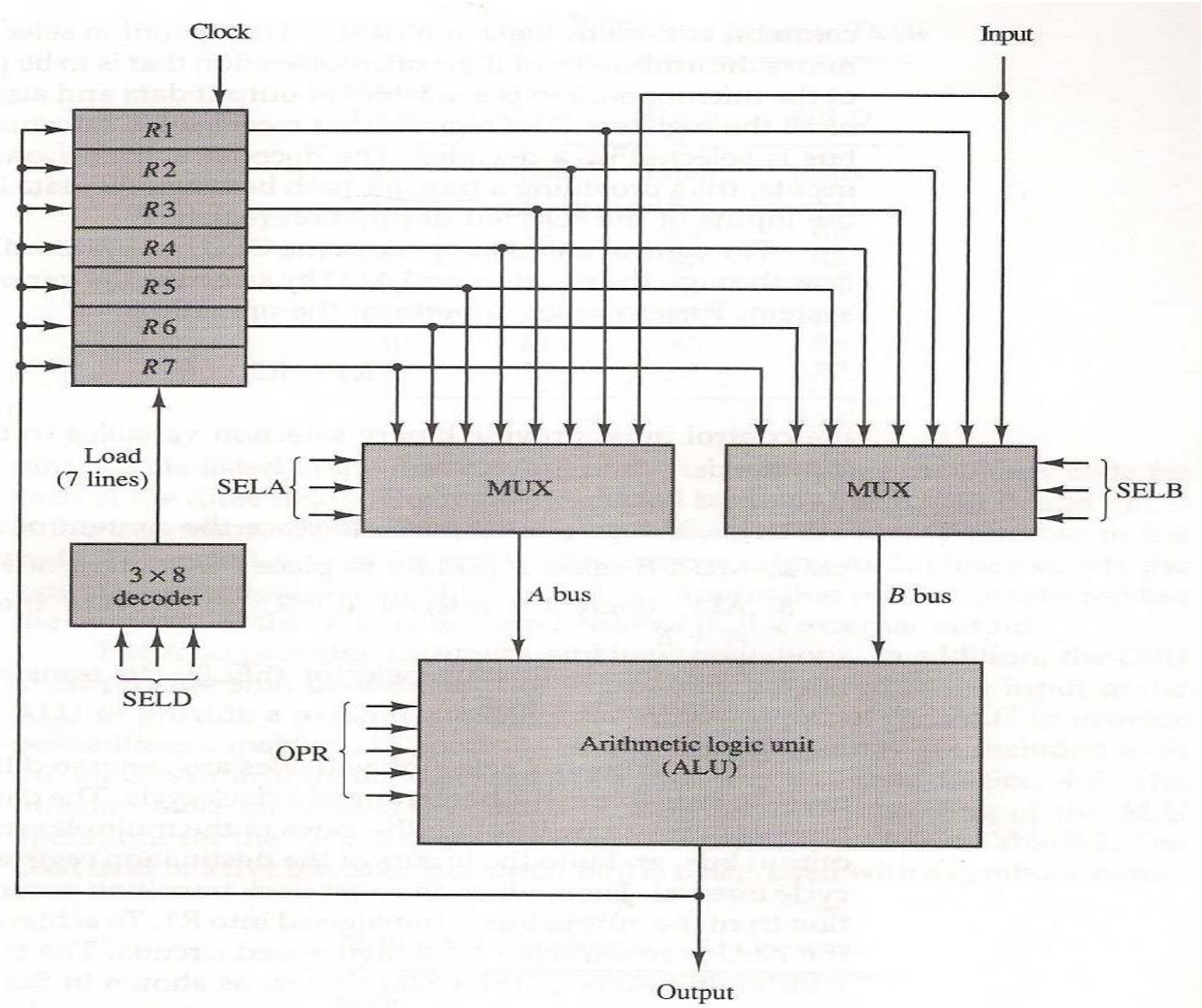
- **Memory**: stores both program instructions and data
- **PC**: *program counter*: points to the next instruction to be fetched
- **IR**: *instruction register* stores current instruction
- **Control unit**:decodes current instruction, manages processing unit to carry out instruction


MEMORY
MAR
MDR
INPUT
* Keyboard
* Mouse
* Scanner
* Card reader
* Disk
PROCESSING UNIT
ALU
TEMP
OUTPUT
* Monitor
* Printer
* LED
* Disk
CONTROL UNIT
PC
IR

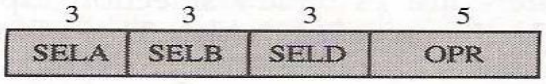
# General Register Organization

| Binary Code | SELA | SELB | SELD |
|---|---|---|---|
| 000 | Input | Input | None |
| 001 | R1 | R1 | R1 |
| 010 | R2 | R2 | R2 |
| 011 | R3 | R3 | R3 |
| 100 | R4 | R4 | R4 |
| 101 | R5 | R5 | R5 |
| 110 | R6 | R6 | R6 |
| 111 | R7 | R7 | R7 |

| OPR Select | Operation | Symbol |
|---|---|---|
| 00000 | Transfer $A$ | TSFA |
| 00001 | Increment $A$ | INCA |
| 00010 | Add $A + B$ | ADD |
| 00101 | Subtract $A - B$ | SUB |
| 00110 | Decrement $A$ | DECA |
| 01000 | AND $A$ and $B$ | AND |
| 01010 | OR $A$ and $B$ | OR |
| 01100 | XOR $A$ and $B$ | XOR |
| 01110 | Complement $A$ | COMA |
| 10000 | Shift right $A$ | SHRA |
| 11000 | Shift left $A$ | SHLA |




(a) Block diagram




(b) Control word