

# Computer Architecture Notes

## IAS

**Structure:** the way in which the components are interrelated.

**Function:** the operation of each individual component as part of the structure.

**4 Function the computer can perform:**

1. Data processing
2. Data storage
3. Data movement
4. Control

**Main Structural component:**

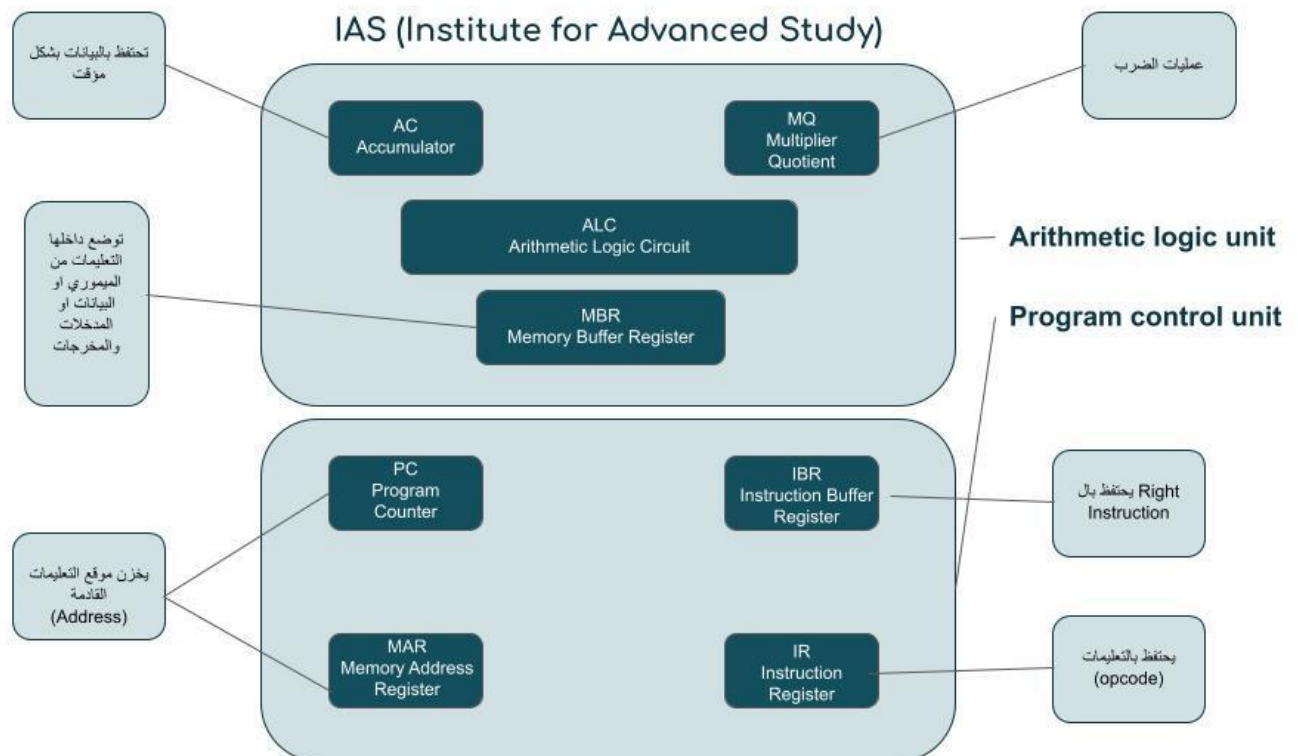
1. **CPU:** controls the operation of the computer and performs its data processing functions.
2. **Main Memory:** stores data
3. **I/O:** moves data between the computer and its external environment.
4. **System Interconnection:** some mechanism that provides for communication among CPU, main memory, and I/O.

**CPU:**

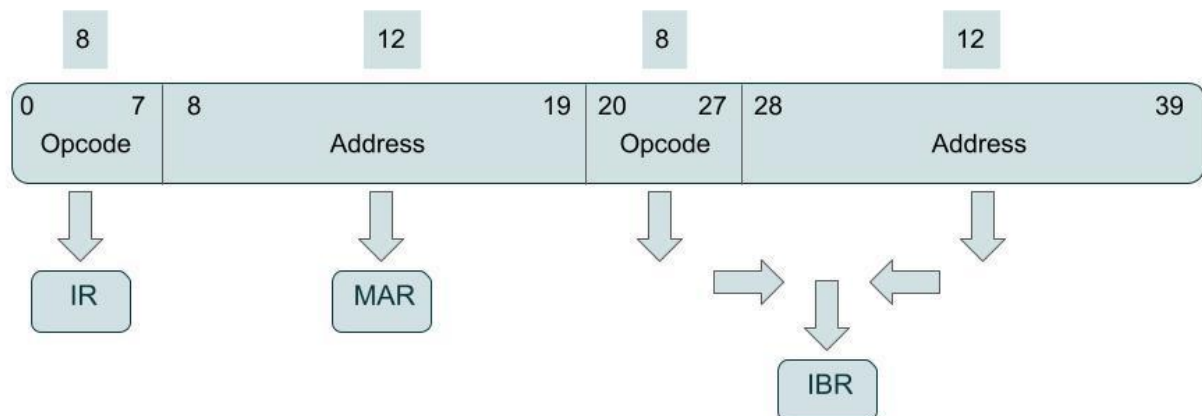
1. **Control unit:** control the operation of the cpu and hence the computer.
2. **Arithmetic and logic unit (ALU):** performs the computer's data processing function.
3. **Registers:** provide storage internal to the CPU.
4. **CPU Interconnections:** some mechanism that provides for communication among CU, ALU, and registers.

**Cache Memory:** is a multiple layer of memory between the processor and main memory, it's smaller and faster than main memory.

**IAS Computer (institute for advanced study):**



### Instruction



Note: 1 Word = 40 Bit

# History of Computer

Integrated Circuits:

1. Gate: is a device that implements a boolean or logical function.
2. Memory cell: is a device that can store 1 bit of data.
3. Data storage: provided by memory cells.
4. Data movement: provided by gates.
5. Control: the paths among components can carry control signals.

DEC PDP-8:

1. Console controller.
2. CPU.
3. Main Memory.
4. I/O module.
5. I/O module.

Microcontroller: is single chip that contains:

1. Processor
  2. Non- volatile memory (ROM)
  3. Volatile memory (RAM)
  4. Clock
- Microcontrollers do not provide human interaction.
  - The microprocessor is programmed for a specific task, embedded in its device, and executes as and where required.

Microprocessor: chip include:

1. Registers
2. Transistor
3. Ships

- Microprocessor faster than microcontroller

## Computer levels & Architectures

SDR: single data rate per clock cycle

DDR: double data rate per clock cycle

DRAM	SRAM
Constructed of tiny capacitors that leak electricity	Constructed of circuits similar to d flip-flops
Requires a recharge every few milliseconds to maintain its data	Holds its contents as long as power is available
Inexpensive	Expensive
Slower than SRAM	Faster than DRAM
Can store many bits per chip	Can not store many bits per chip
Uses less power	Uses more power
Generates less heat	Generates more heat
Used for main memory	Used for cache

Computer memory:

1. Primary memory:
  - a. RAM:
    - i. SRAM
    - ii. DRAM
  - b. ROM
2. Secondary memory:
  - a. HDD
  - b. SSD
  - c. Compact Disk

- d. Floppy Disk
- e. Magnet Tap

SSD	HDD
faster	slower
Shorter life path	Longer life path
More expensive	cheaper
None mechanical	mechanical
Shock resistant	fragile

The computer level hierarchy:

- Level 6: User
- Level 5: High-Level Language
- Level 4: Assembly Language
- Level 3: system software
- Level 2: Machine
- Level 1: control
- Level 0: digital logic

Von Neumann Architecture:

1. Control unit
2. Arithmetic logic unit
3. Store
4. Input
5. output