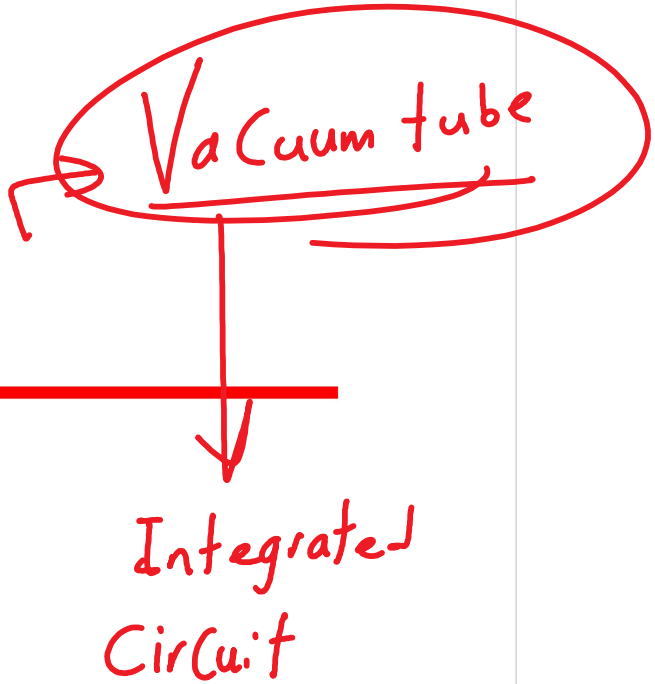
William Stallings Computer Organization and Architecture 6th Edition



Chapter 2 Computer Evolution and Performance

ENIAC - background

- Electronic Numerical Integrator And Computer
- Eckert and Mauchly
- University of Pennsylvania
- Trajectory tables for weapons
- Started 1943
- Finished 1946
  - —Too late for war effort
- Used until 1955

Hydrogen bomb

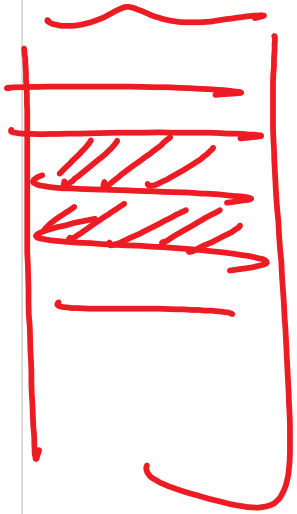
General-purpose

ENIAC - details

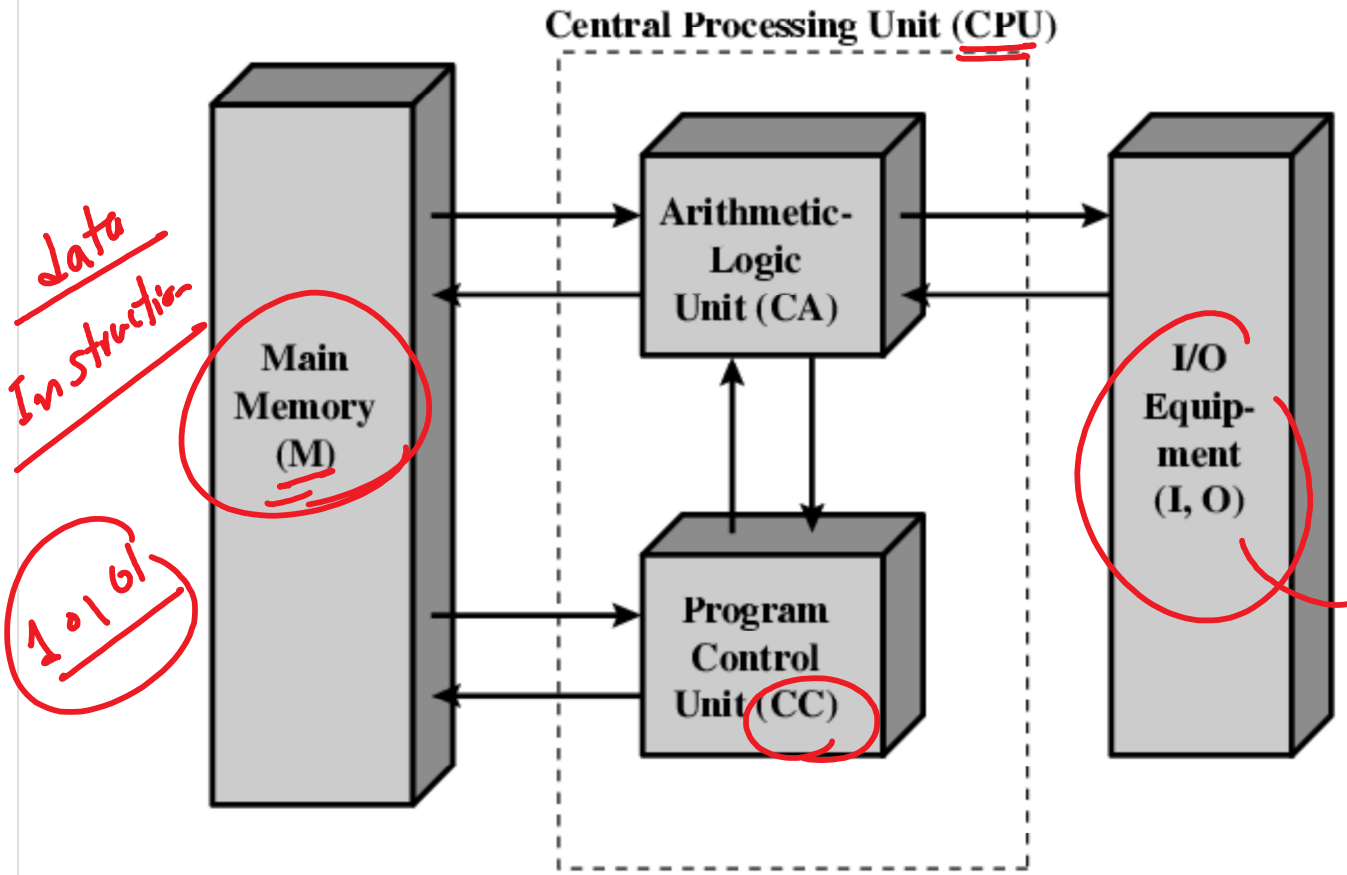
- Decimal (not binary)
- 20 accumulators of 10 digits
- Programmed manually by switches
- 18,000 vacuum tubes
- 30 tons
- 15,000 square feet
- 140 kW power consumption
- 5,000 additions per second

von Neumann/Turing

- Stored Program concept
- Main memory storing programs and data
- ALU operating on binary data
- Control unit interpreting instructions from memory and executing
- Input and output equipment operated by control unit
- Princeton Institute for Advanced Studies
  —IAS
- Completed 1952



Structure of von Neumann machine



CA: Central Arithmetical

CC: Central Control

data

Instruction

1 0 1 0 1

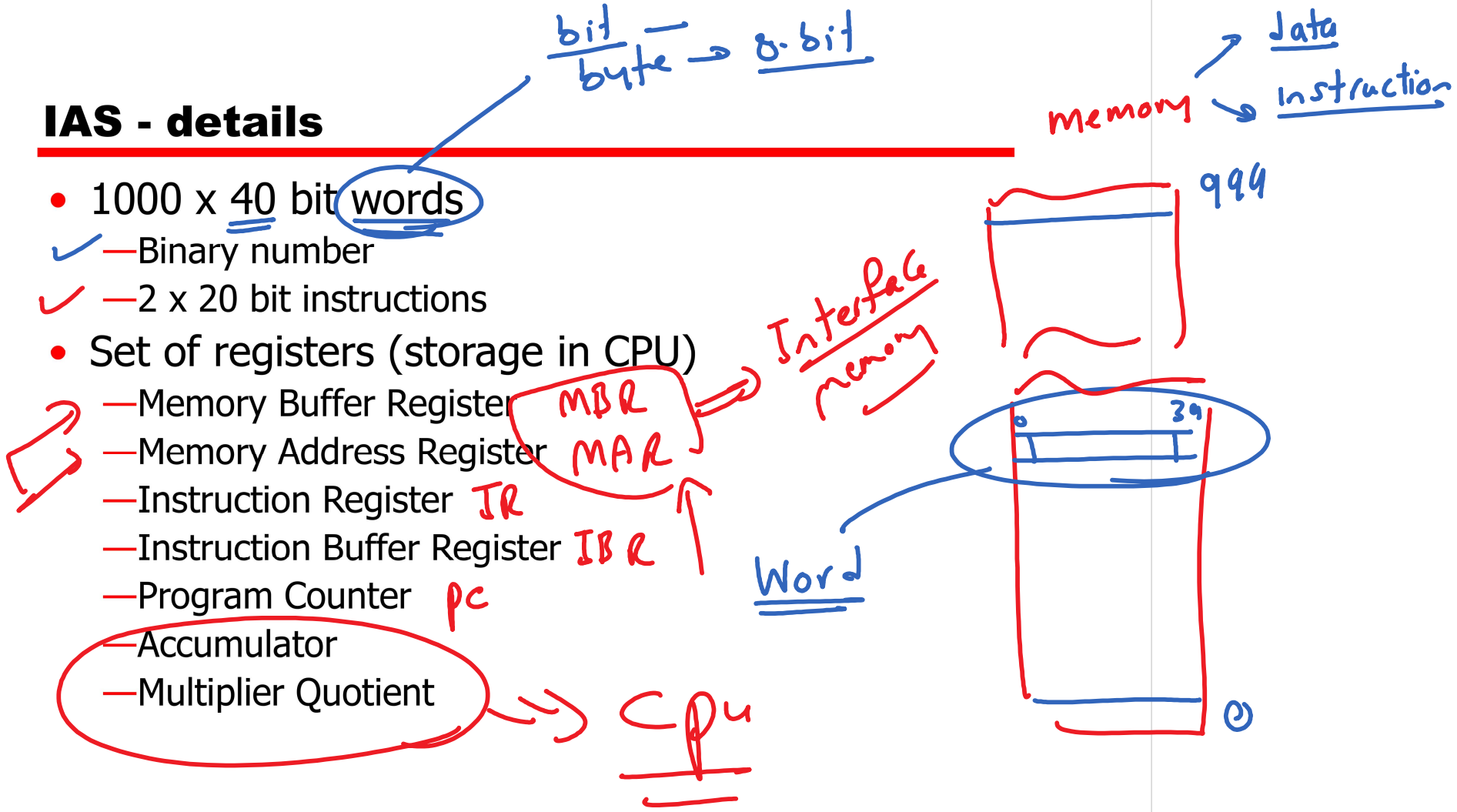
external

peripheral

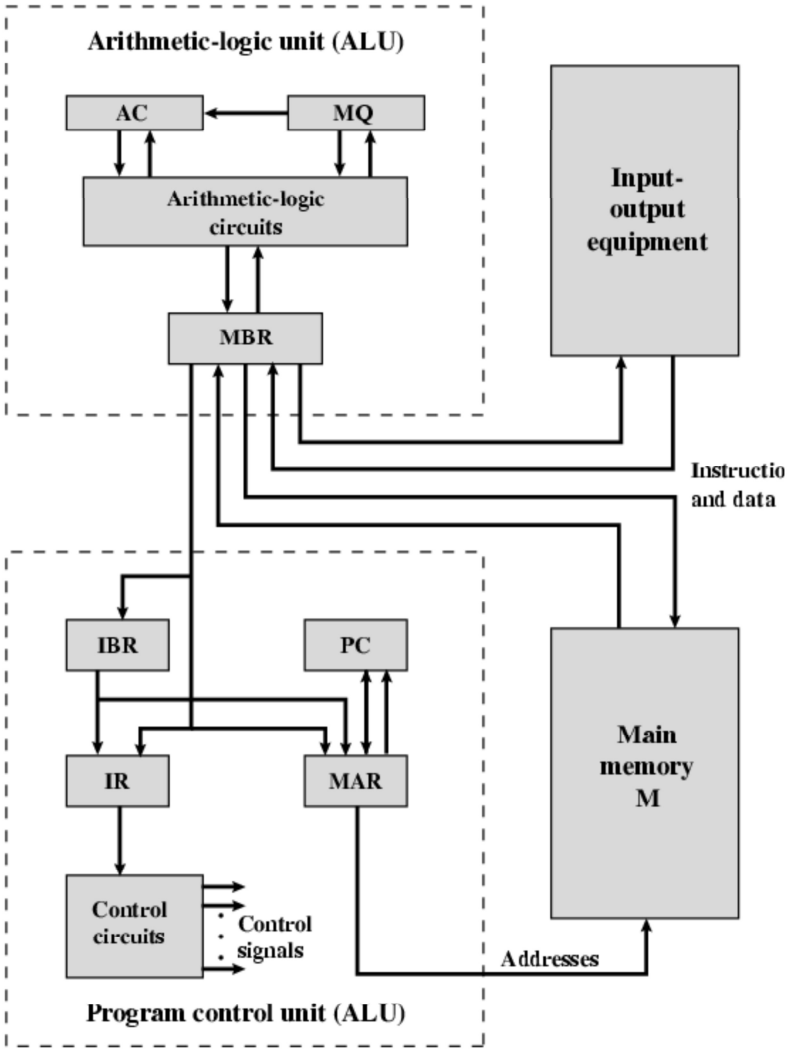
الأجهزة الطرفية

IAS - details

- 1000 x 40 bit words
  - —Binary number
  - —2 x 20 bit instructions
- Set of registers (storage in CPU)
  - —Memory Buffer Register
  - —Memory Address Register
  - —Instruction Register
  - —Instruction Buffer Register
  - —Program Counter
  - —Accumulator
  - —Multiplier Quotient



Structure of IAS – detail



- **Memory buffer register (MBR):** Contains a word to be stored in memory or sent to the I/O unit, or is used to receive a word from memory or from the I/O unit.
- **Memory address register (MAR):** Specifies the address in memory of the word to be written from or read into the MBR.
- **Instruction register (IR):** Contains the 8-bit opcode instruction being executed.
- **Instruction buffer register (IBR):** Employed to hold temporarily the right-hand instruction from a word in memory.
- **Program counter (PC):** Contains the address of the next instruction-pair to be fetched from memory.
- **Accumulator (AC) and multiplier quotient (MQ):** Employed to hold temporarily operands and results of ALU operations. For example, the result of multiplying two 40-bit numbers is an 80-bit number; the most significant 40 bits are stored in the AC and the least significant in the MQ.

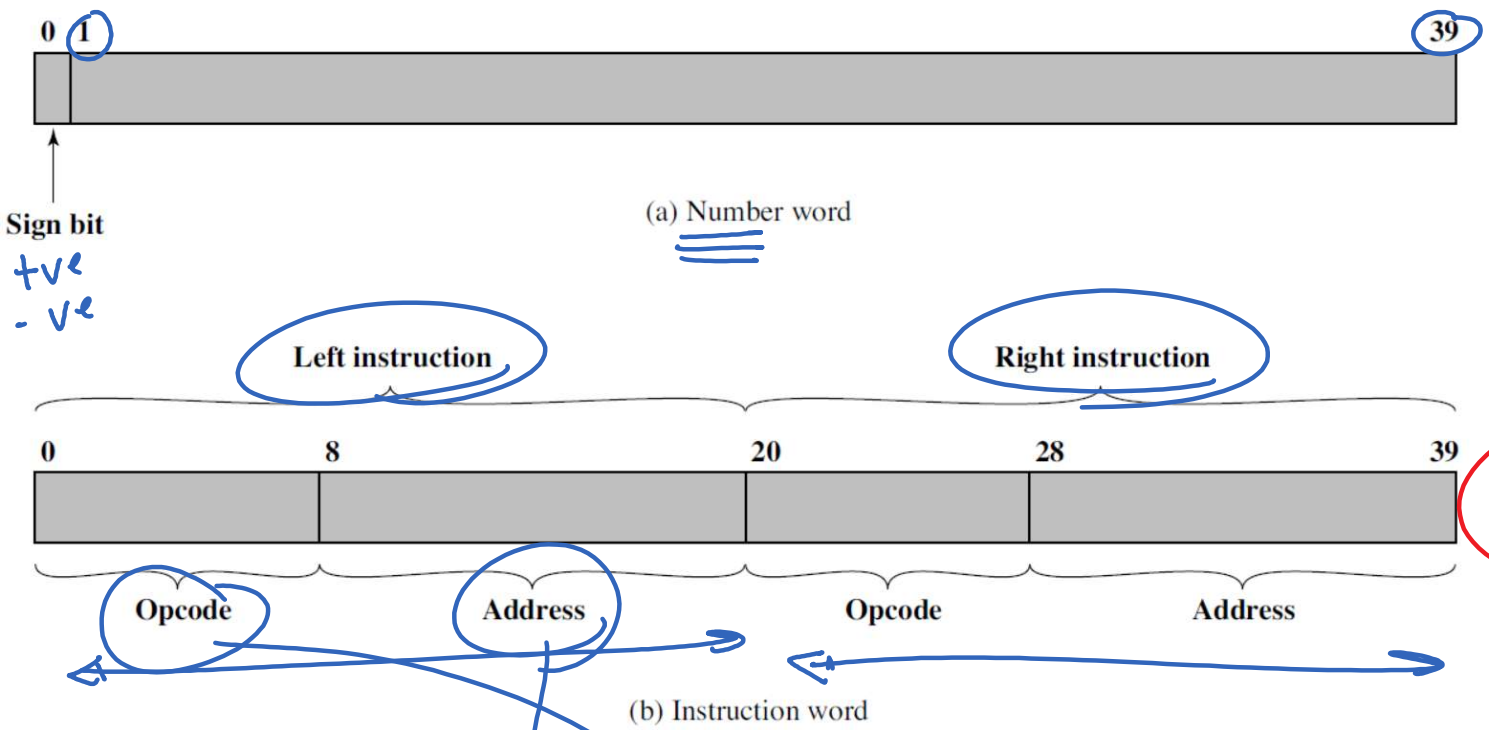


Figure 2.2 IAS Memory Formats

data
word
Instruction
+ve
-ve
Op Code ⇒ operation Code
Address ⇒ memory
خطوة لازم
01101110
Mov
ADD
Sub
mul