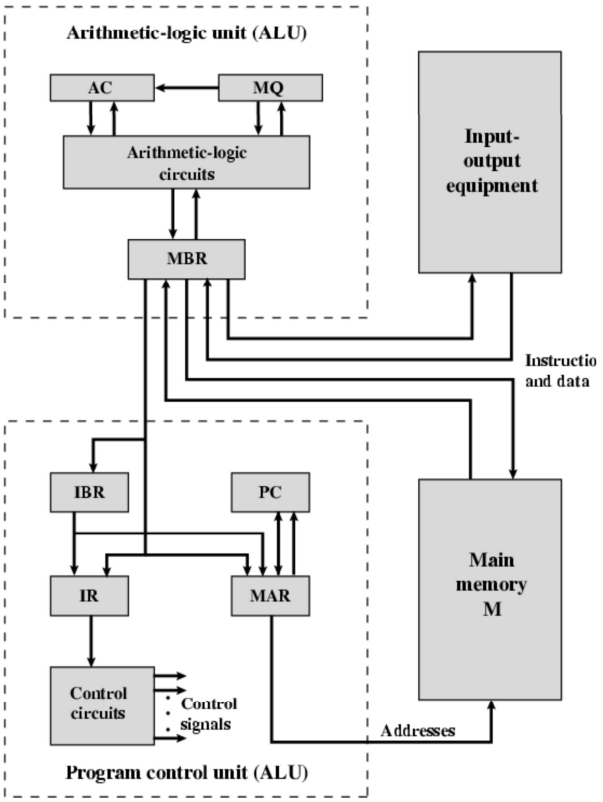
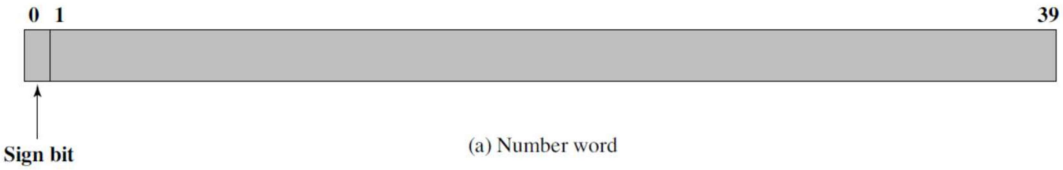
William Stallings
Computer Organization and Architecture
6th Edition

Chapter 2
Computer Evolution and Performance

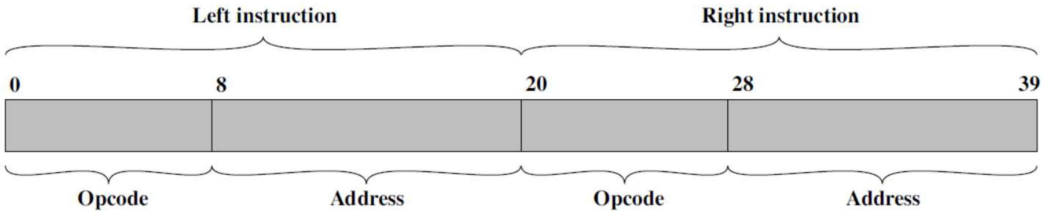
Structure of IAS – detail



Instruction Word



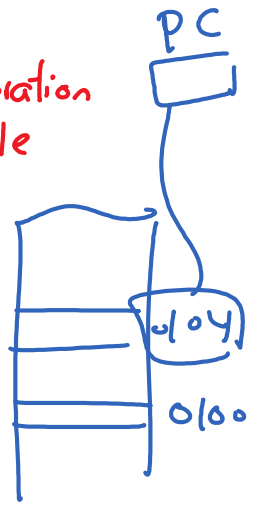
(a) Number word



(b) Instruction word

IAS Registers

- **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.



IAS Architecture

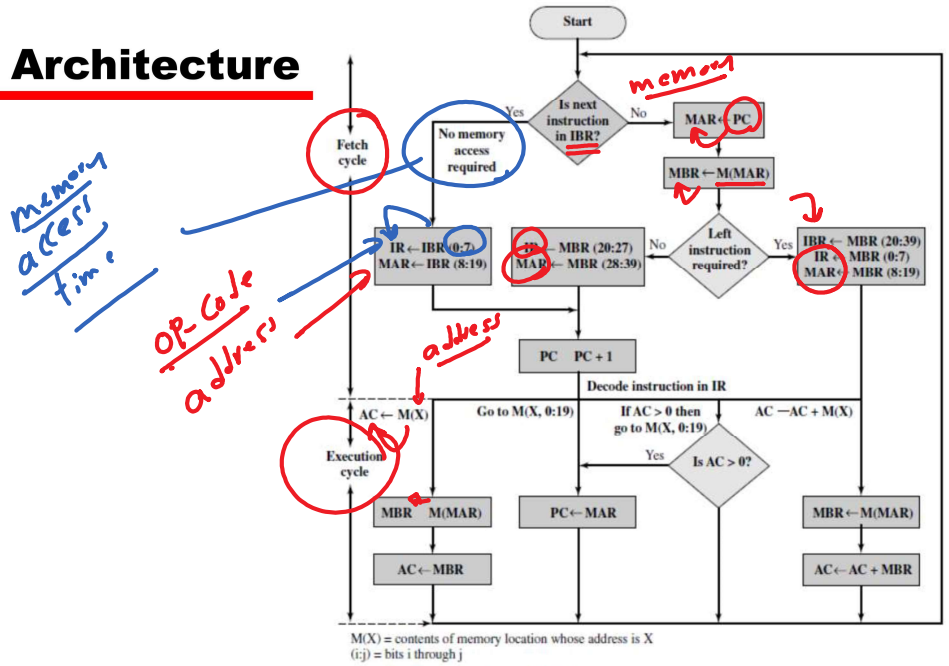
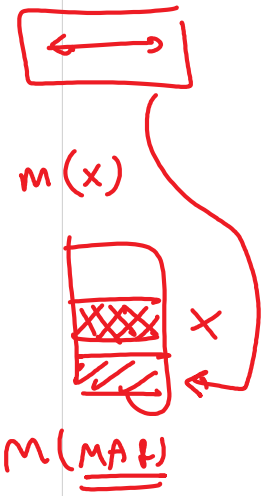


Figure 2.4 Partial Flowchart of IAS Operation



Instruction Set

- The set of commands that is understood by the MP
- This is given by the manufacturer
- In general, the instructions are classified as
  - Data transfer
  - Arithmetic and logic
  - Bit manipulation
  - Loops and jumps
  - Strings
  - Subroutines and interrupts
  - Control
- The mnemonics codes are microprocessor – or microcontroller- specific and should be obtained from the manufacturer's data sheet

MP Basic Operation

- A microprocessor executes a program by repeatedly cycling through the following three steps:
  - **Fetch** an instruction from memory and place it in the CPU.
  - **Decode** the instruction; if other information is required by the instruction, fetch the other information. In the decode step, the program counter is updated to point to the next instruction.
  - **Execute** the instruction (do what the instruction says). Results are returned to registers and memory during this step.