



# William Stallings Computer Organization and Architecture 10<sup>th</sup> Edition



# + Chapter 3

## A Top-Level View of Computer Function and Interconnection



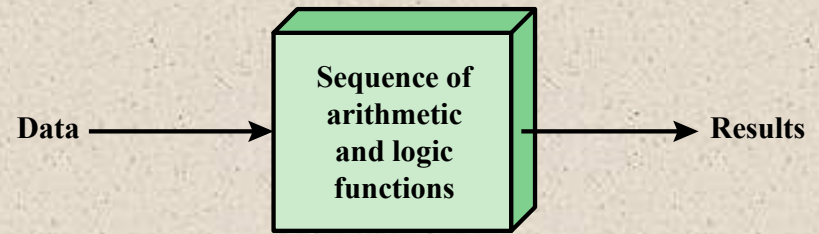
# Computer Components



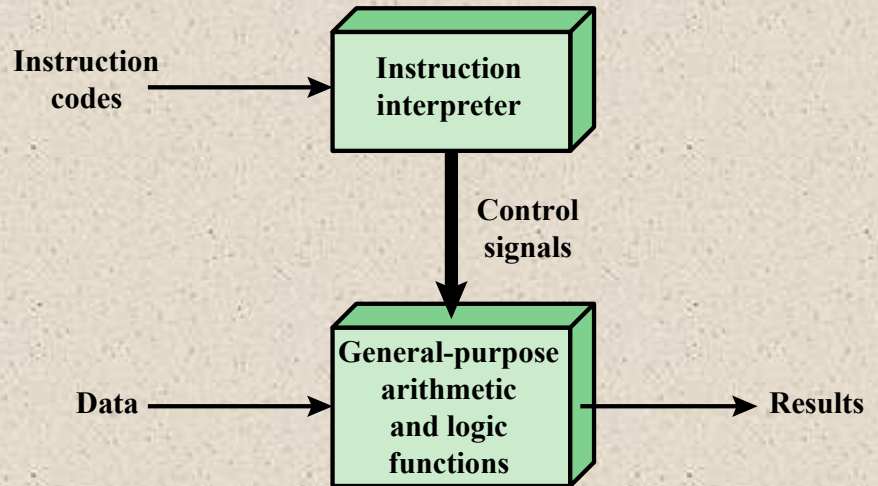
- Contemporary computer designs are based on concepts developed by John von Neumann at the Institute for Advanced Studies, Princeton
- Referred to as the *von Neumann architecture* and is based on three key concepts:
  - Data and instructions are stored in a single read-write memory
  - The contents of this memory are addressable by location, without regard to the type of data contained there
  - Execution occurs in a sequential fashion (unless explicitly modified) from one instruction to the next
- *Hardwired program*
  - The result of the process of connecting the various components in the desired configuration



# Hardware and Software Approaches



(a) Programming in hardware



(b) Programming in software

**Figure 3.1 Hardware and Software Approaches**



# Software

- A sequence of codes or instructions
- Part of the hardware interprets each instruction and generates control signals
- Provide a new sequence of codes for each new program instead of rewiring the hardware

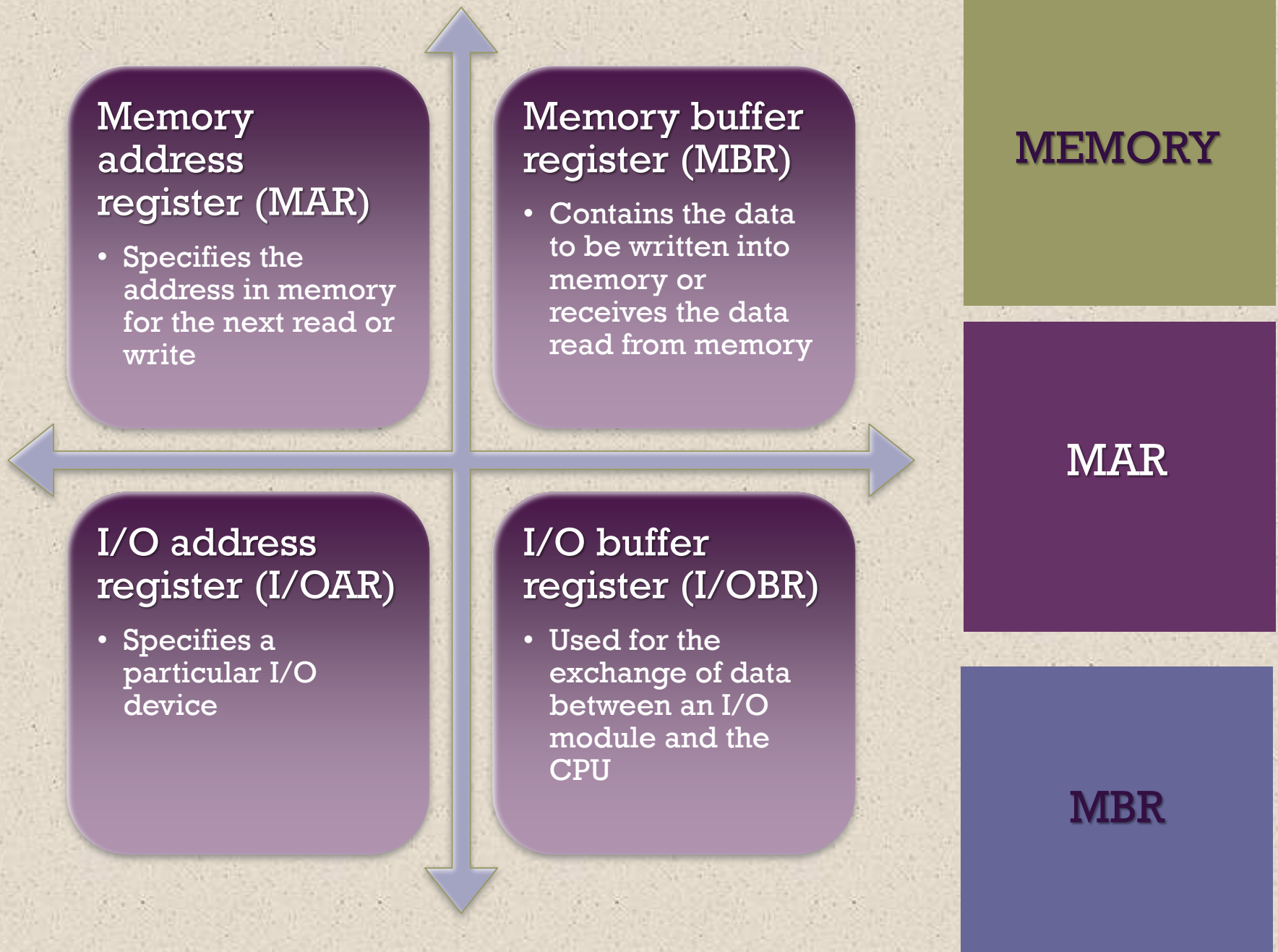
## Major components:

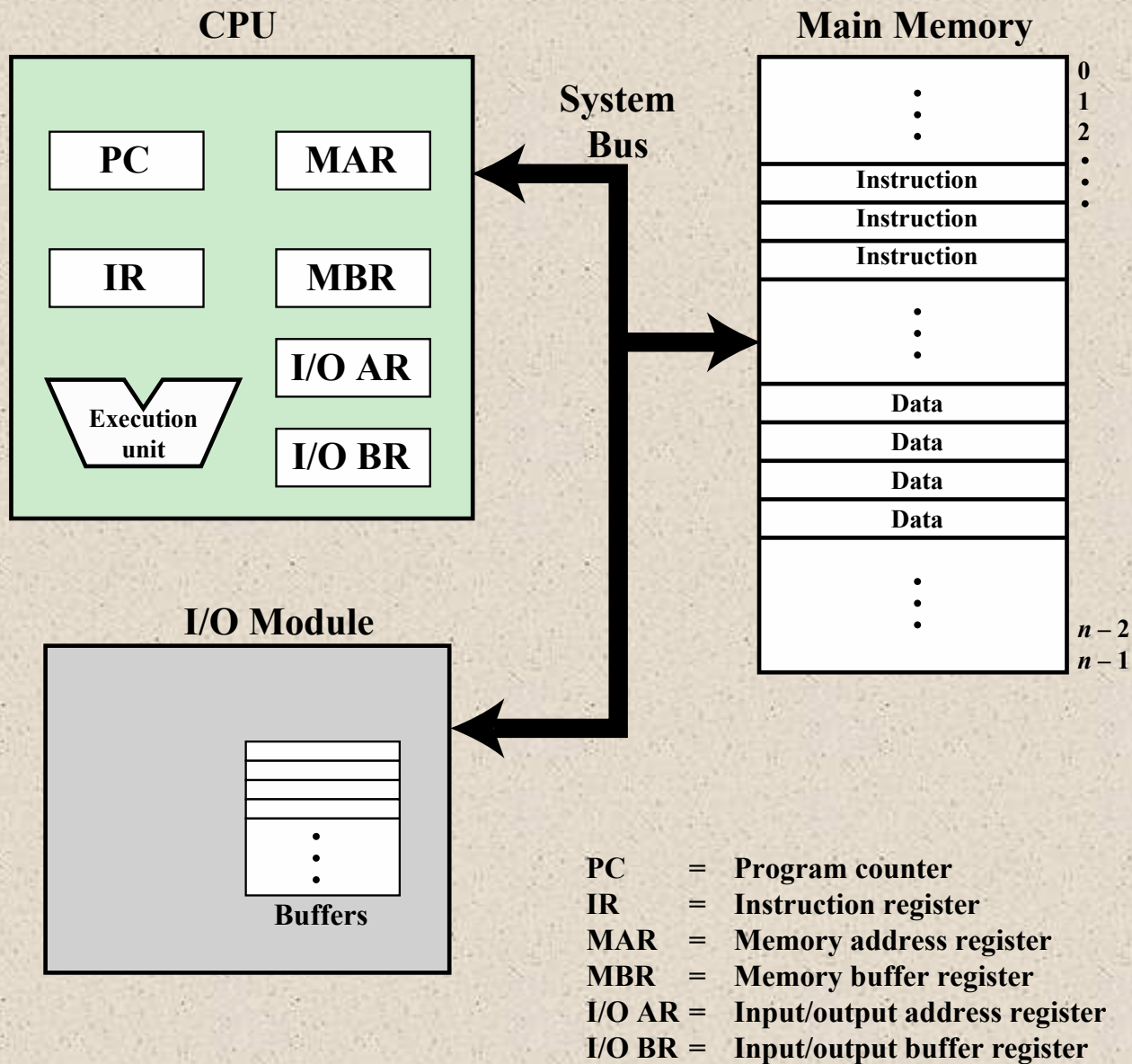
- CPU
  - Instruction interpreter
  - Module of general-purpose arithmetic and logic functions
- I/O Components
  - Input module
    - Contains basic components for accepting data and instructions and converting them into an internal form of signals usable by the system
  - Output module
    - Means of reporting results

Software

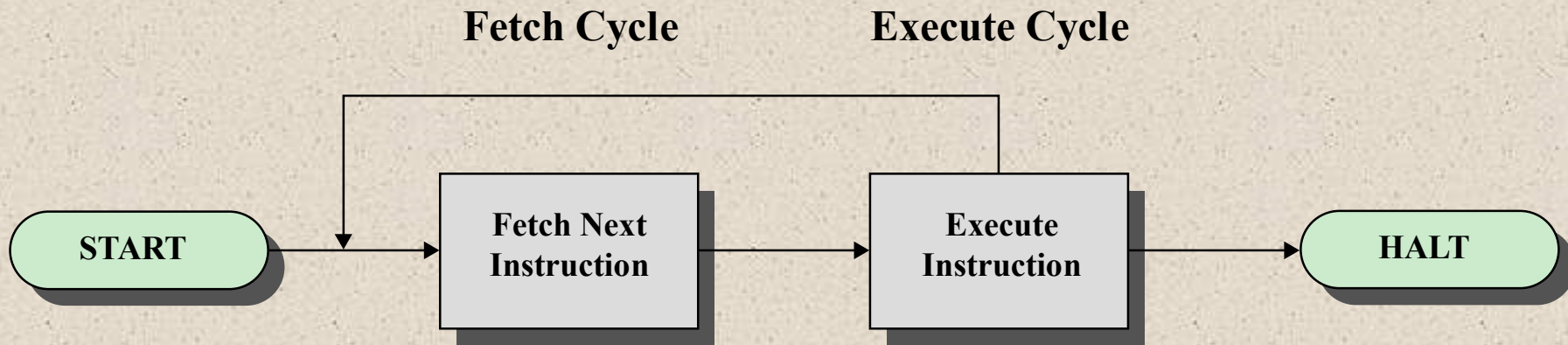
I/O  
Components







**Figure 3.2 Computer Components: Top-Level View**



**Figure 3.3 Basic Instruction Cycle**





# Fetch Cycle



- At the beginning of each instruction cycle the processor fetches an instruction from memory
- The program counter (PC) holds the address of the instruction to be fetched next
- The processor increments the PC after each instruction fetch so that it will fetch the next instruction in sequence
- The fetched instruction is loaded into the instruction register (IR)
- The processor interprets the instruction and performs the required action



# Action Categories

