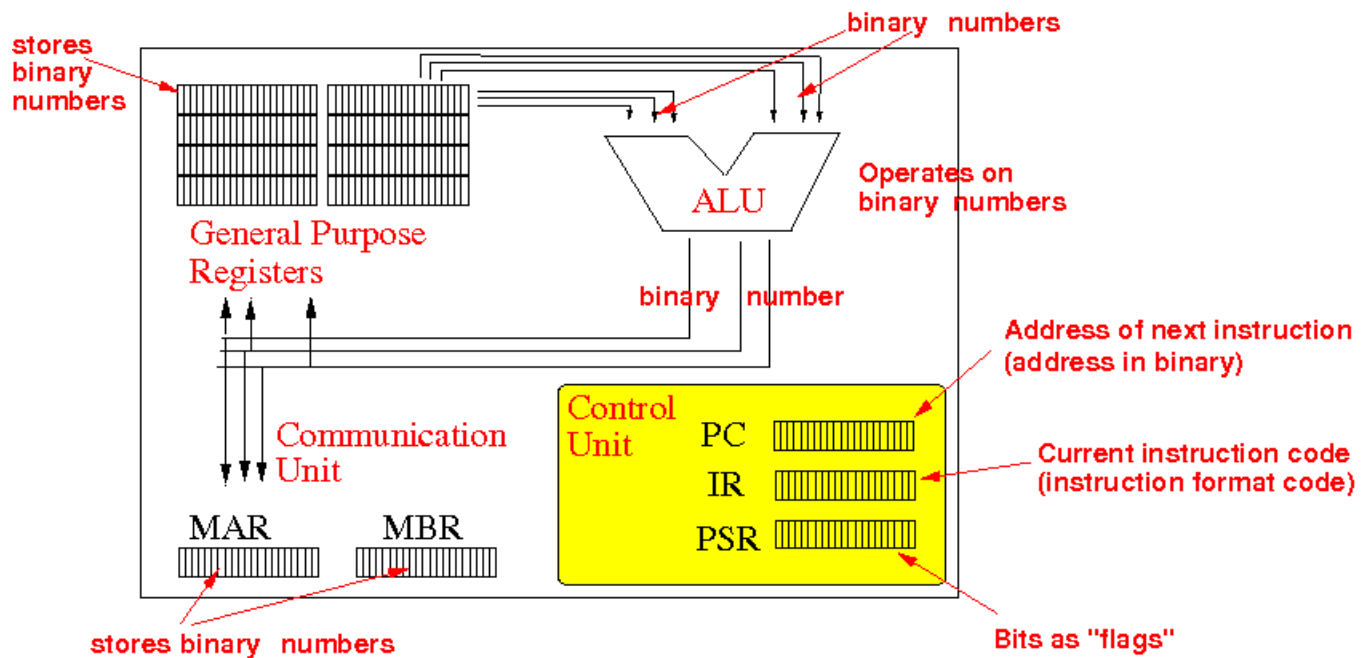


## CPU Architecture

- **Structure of the CPU of a computer:**



- **General Purpose Registers:**

- very fast memory located inside the CPU
- is usually 10 to 50 times faster than main memory (located outside the CPU)
- used to store results of calculations

- **ALU (Arithmetic and Logic Unit)**

- performs arithmetic (+, -, \*, /, %) and logic (AND, OR, NOT) operations
- takes input from general purpose registers and sometimes also from MBR (memory operand)
- produce output that will be stored in a general purpose register or sometimes in MBR (result is written to memory)
- certain outcome of the operation (negative, zero, overflow and carry) are stored in the condition flags in the PSR (see later)

- **Communication unit:**

- performs data transfer functions between CPU and main memory
- use **two special purpose registers** in its task

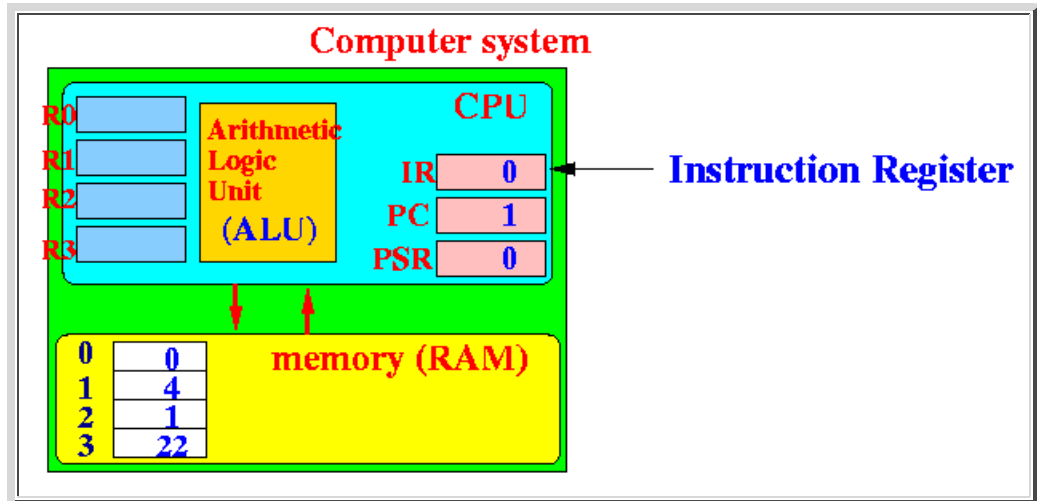
- **MAR** = Memory Address Register, contains the address of the memory location that the CPU wants to transfer from/to.
- **MBR** = Memory Buffer Register, contains the data being transferred (MBR works like a temporally transfer depot)

- **Control unit:**

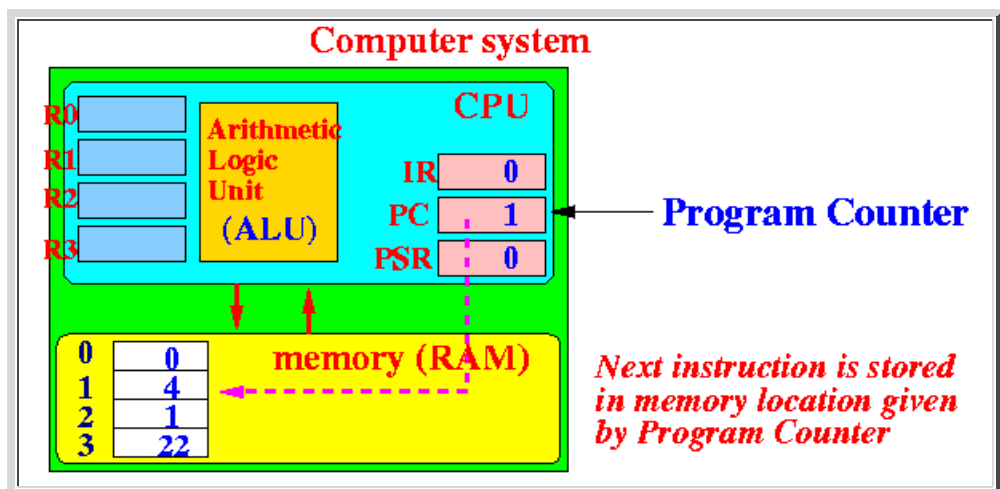
- controls the operation of all other components
- works like an orchestra conductor
- coordinates the registers, ALU and communication unit so that they perform their function at the right moment to achieve the correct functionality.

- Uses these **special purpose registers** to perform its task:

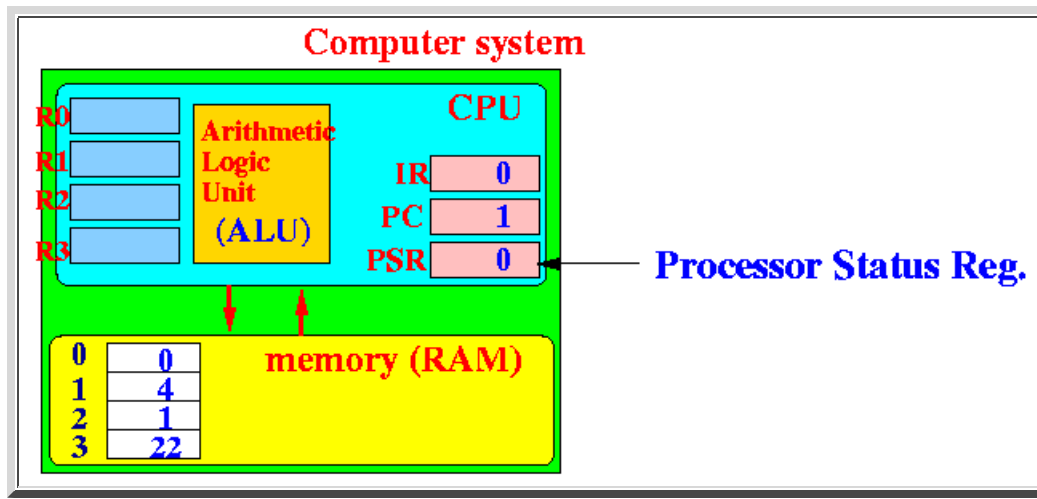
- **IR** = instruction register (contains the **instruction code** of the **current instruction** (that is being executed by the CPU))



- **PC** = program counter (contains the address of the **next** instruction that needs to be fetched)



- **PSR** = processor status register (contains the **state information** of the processor - in cs255, we only care about the **N, Z, V, C flags** in this register (later))



- **PSR in more detail**

- The **PSR** consist of a number of **status indication bits (= flags)** to signal some conditions
- For **assembler programmers**, the following **4 flags (bits)** inside the **PSR** will be important:

- **N** flag/bit = **1** means the result of the operation is **negative**, 0 means  $\geq 0$
- **Z** flag/bit = **1** means the result of the operation is **equal to 0**, 0 means not equal to 0
- **V** flag/bit = **1** means the result of the operation has caused an **overflow**, 0 means no overflow
- **C** flag/bit = **1** means the result of the operation has generated a **carry/borrow**, 0 means no carry/borrow

- **Detailed Connection between CPU and Memory**

