ESc 101: Fundamentals of Computing

Lecture 2

Jan 4, 2010

REVISITING THE ADDITION PROGRAM

- We start by revisiting the addition program in all three languages.
- We also revisit the execution of the machine language program to emphasize the way computation happens inside a computer.
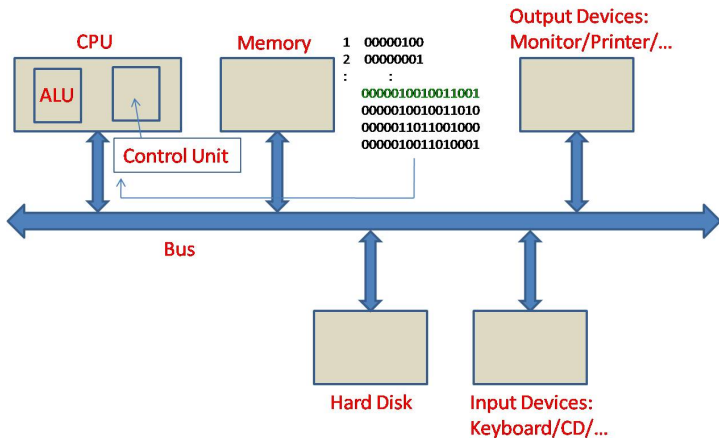
A Small Program

0000010010011001 - read memory location 001
0000010010011010 - read memory location 010
0000011011001000 - add two numbers read
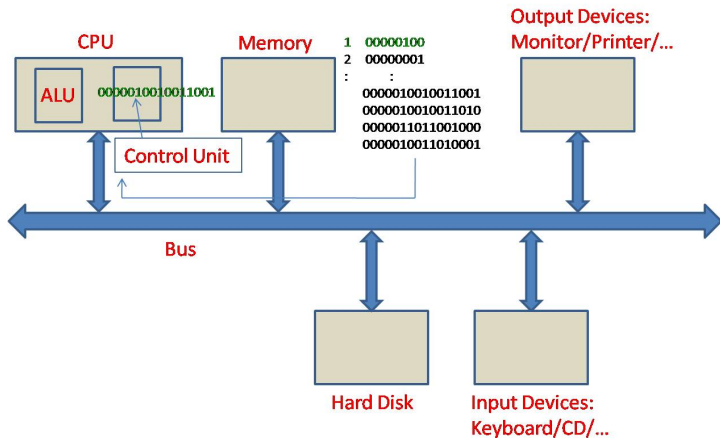0000010011010001 - store the result in memory location 001

EXECUTION

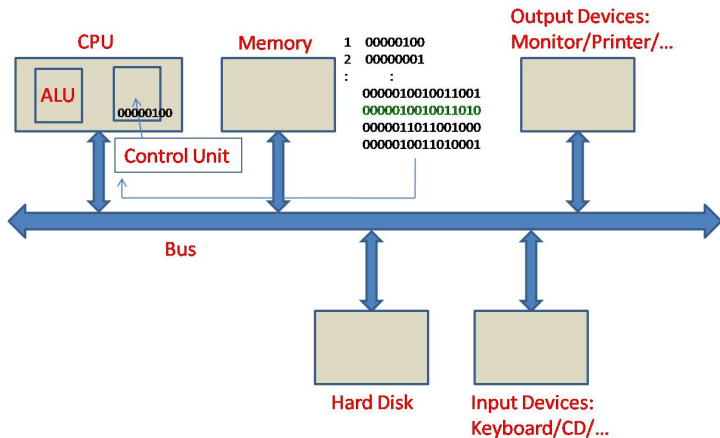Step 1: Bring 0000010010011001 to CPU
0000010010011001 = Bring data stored in memory location 001 to CPU

Step 2: Execution of 0000010010011001 in Control Unit
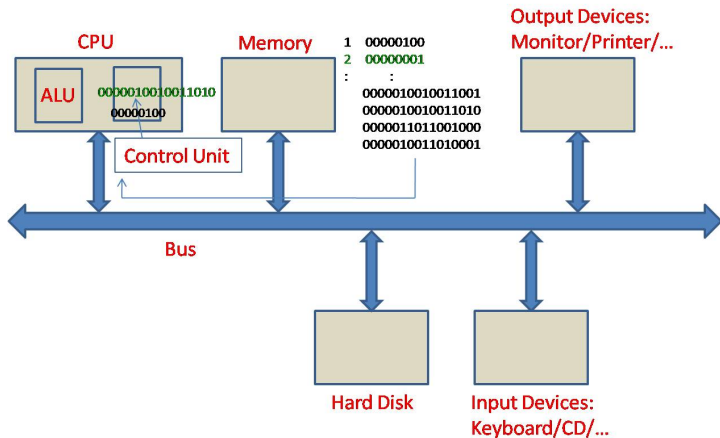   Brings data stored in location 1, number 4, to CPU

EXECUTION

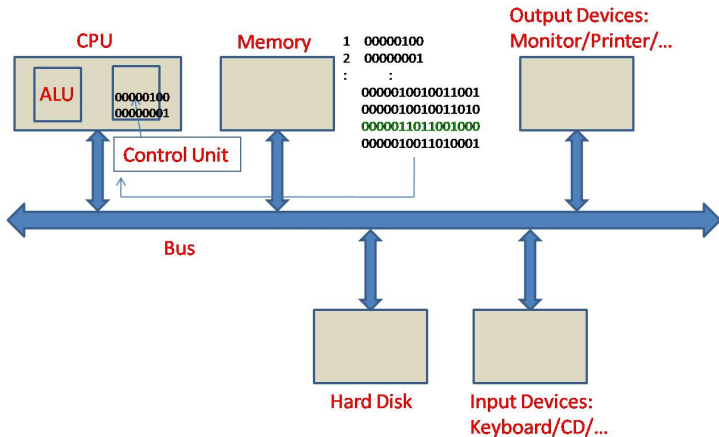Step 3: Bring 0000010010011010 to CPU
0000010010011010 = Bring data stored in memory location 010 to CPU

EXECUTION

CPU — **ALU** — 0000010010011010 — 00000100 — **Control Unit**

Memory

1   00000100
2   00000001
:   :
0000010010011001
0000010010011010
0000011011001000
0000010011010001

Output Devices:
Monitor/Printer/...

Bus

Hard Disk

Input Devices:
Keyboard/CD/...

Step 4: Execution of 0000010010011010 in Control Unit
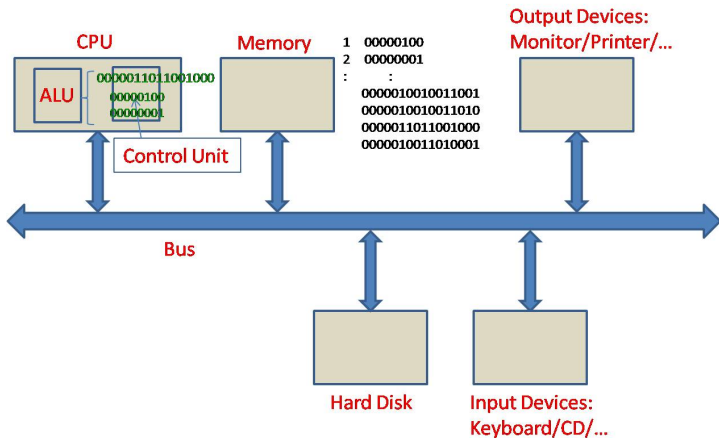Brings data stored in location 2, number 1, to CPU

EXECUTION

Step 5: Bring 0000011011001000 to CPU
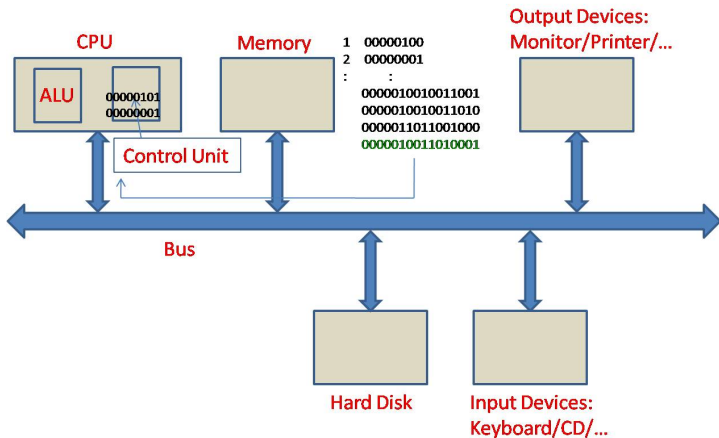
0000011011001000 = Add two stored numbers

EXECUTION

Step 6: Execution of 0000011011001000 in Control Unit
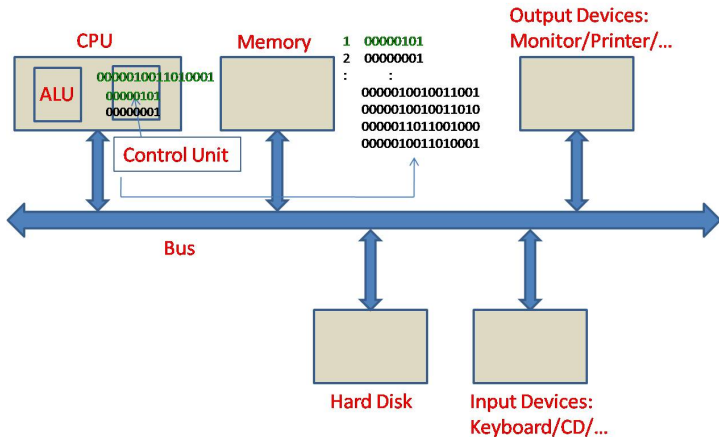Adds two numbers inside CPU using ALU

EXECUTION

Step 7: Bring 0000010011010001 to CPU
0000010011010001 = Store number in ALU to memory location 001

EXECUTION

Step 8: Execution of 0000010011010001 in Control Unit
        Stores data stored in ALU , number 5, in location 1

Example Program in Assembly Language

```
0000010010011001     MOVE  NUM1, R1
0000010010011010     MOVE  NUM2, R2
0000011011001000     ADD   R1, R2
0000010011010001     MOVE  R1, NUM1
```

Move contents of memory location NUM1 to CPU register R1
Move contents of memory location NUM2 to CPU register R2
Add contents of R1 and R2 and store the result in R1
Move the contents of R1 to memory location NUM1

ADDING TWO NUMBERS IN C

```c
main()
{
    int num1;
    int num2;

    scanf("%d", &num1);
    scanf("%d", &num2);

    num1 = num1 + num2;

    printf("%d", num1);
}
```

IMPORTANT CONCEPTS

- Logging in: give your credentials to the login program
- Directory Structure: Data and programs are organized in files on Hard Disk.
- Creating, removing, parsing directories: Done by the shell program; use commands ls, cd, mkdir, rmdir etc.
- Creating and removing files: Use commands vi, emacs, rm etc.
- Compiling C program: use gcc.