



COMPUTER FUNDAMENTALS



Computers: An Overview

+ What is a computer?

- programmable electronic device
- that can store data,
- That can retrieve data
- that can process data.

+ Classifications of computers based on their sizes, capabilities, and speed:

- Supercomputers
- Mainframe computers
- Minicomputers
- Microcomputers



Computers: An Overview . . .

+ Supercomputers

- Fastest – 1,000x than the mainframe
- Most expensive
- They have 100s of processors
- Uses the very latest and most expensive hardware
- Mostly designed for the most demanding of computational applications
 - + e.g. weather forecasting, 3-D modeling, computer animation



+ Mainframe computers

- Large, expensive
- Faster than minicomputer
- Mostly designed to meet the information processing needs of large organizations
- can support several hundred users and execute hundreds of programs simultaneously
- have extensive I/O capabilities and support a large amount of primary and secondary storage
- used mostly in large business environments/institutions: banks, hospitals, and universities
- Mostly require a trained support staff for operation and maintenance.





Computers: An Overview . . .

+Minicomputers

- original function involved performing specialized tasks
- used primarily in universities and scientific environments.
- capable of providing information processing services for multiple users
- can execute many application programs concurrently
- cheaper than mainframe
- easy to install and maintain



+Microcomputers

- a.k.a. personal computers or PC
- least costly and most popular
- Small enough to fit on a desk top
- Vary widely in cost and power, and capable of running many business apps
- Can function as stand-alone units or hooked up with others to extend their capabilities



Figure 1-10 Microcomputers



Computers: An Overview . . .

Class	Typical Specifications	Approximate Speed
Microcomputer	64+ million main memory cells 4 billion disk storage cells single user	10+ million instructions per second
Minicomputer	128+ million main memory cells 10 billion disk storage cells 1 tape drive 128 interactive users	30+ million instructions per second
Mainframe	1+ billion main memory cells 100 billion disk storage cells multiple tape drives 100s interactive users 4+ central processing units or more	50+ million instructions per second
Supercomputer	1+ billion main memory cells 100 billion disk storage cells 64+ central processing units or more	2+ billion floating-point operations per second

This table shows each class of computers, their typical specifications (memory size, number of users, etc.), and their approximate speeds.



Computer Hardware

+ A computer has four fundamental functions:

- Input
- Processing
- Output
- Storage

+ Two distinct parts

- Hardware
- Software

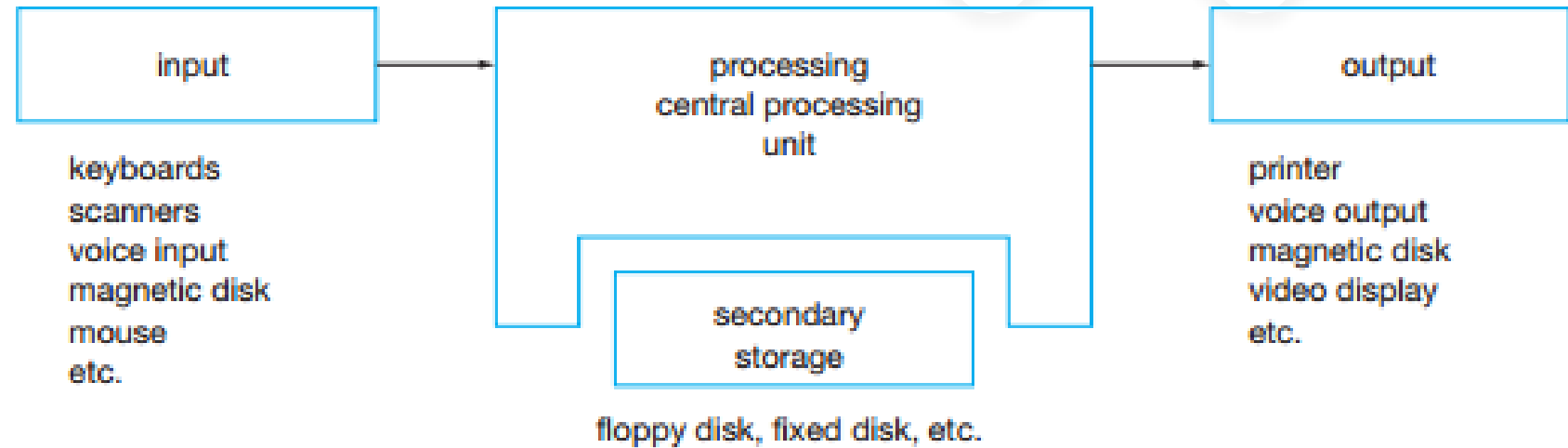


Figure shows the four functions of a computer system and the typical hardware devices associated with each function

+ The way these components are put together and arranged is called the **system hardware configuration**



Computer Hardware . . .

+ Input devices

- Used to enter instructions or data into the computer. E.g. keyboard, mouse, scanner, etc.

+ Processor Unit

- The intelligent part of the computer system, called the central processing unit (CPU). It directs computer activities. The brain or heart of the computer
- Consists of **three** basic sections:
 - + Arithmetic and Logic Unit (ALU)
 - Responsible for performing **arithmetic** and **logic** operations
 - arithmetic operations include: addition, subtraction, multiplication, and division. More advanced computational functions: exponentiation and logarithms
 - logic operations include comparisons of letters, numbers, or special characters to recognize whether they are equal to, greater than, or less than one another.
 - + Registers
 - Storing instructions and data within the CPU
 - + Control Unit
 - Activating the other components
 - Transferring instructions and data from the main memory to the registers



Computer Hardware . . .

+Internal Memory

- a.k.a main or primary memory is storage for the following:
 - + Holding current program instructions
 - + Holding data to be processed by a program
 - + Holding intermediate results created by executing program instructions
- Computers usually have two types of main memory:
 - + Random access memory (RAM)
 - + Read only memory (ROM)

+External storage

- a.k.a secondary storage, it is a nonvolatile extension of the main memory

+Output device

- Display terminal, printer, plotter, speaker, etc.



Process Operation

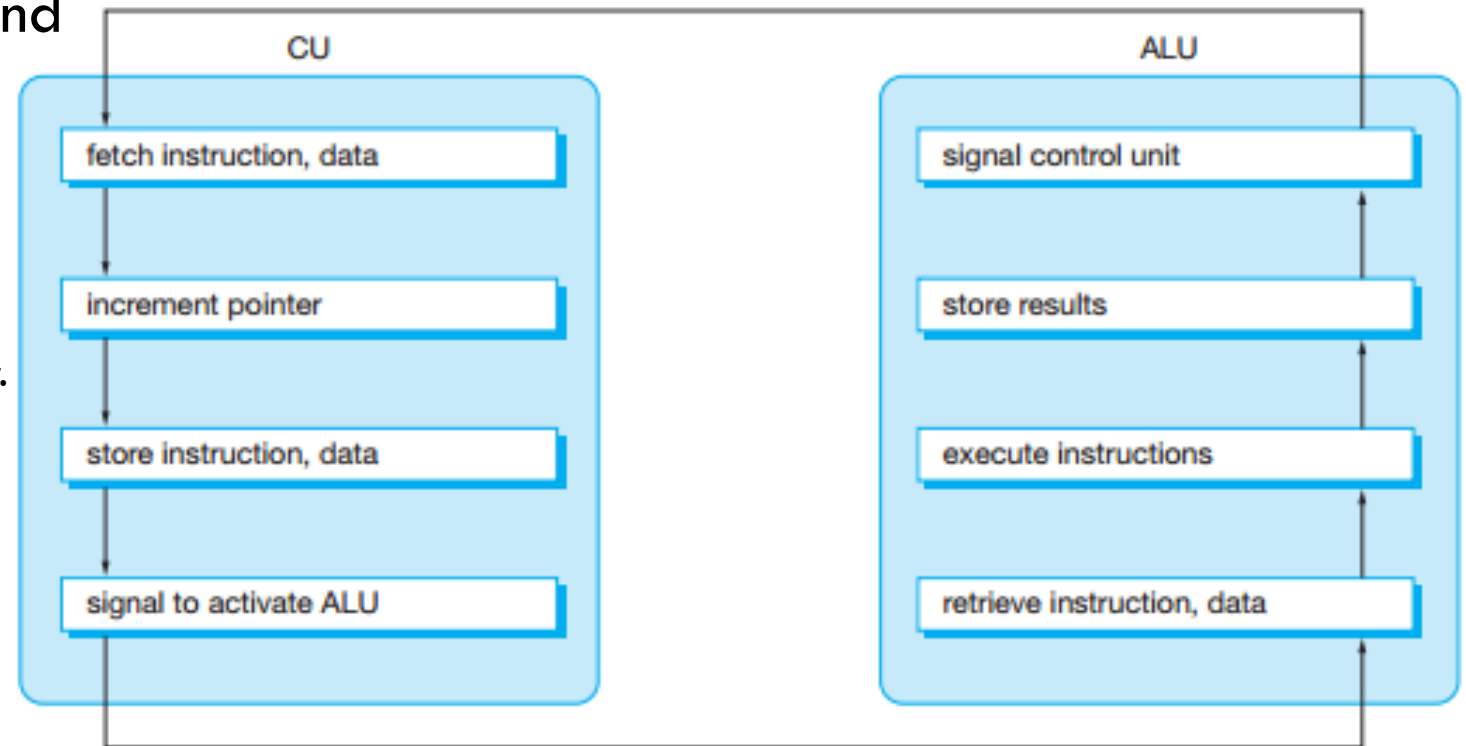
- + A complex chain of events occurs when a computer executes a program...
- + The steps required to process each instruction can be grouped into two phases:
 - the instruction (or fetch) cycle and
 - the execution cycle

Instruction (or fetch) cycle sequence of events

Step 1: The control unit reads an instruction from main memory into a CPU register called the instruction register.

Step 2: The control unit increments the instruction pointer register to show the location of the next instruction in the main memory.

Step 3: The control unit generates a signal to the ALU to execute the instruction





Process Operation . . .

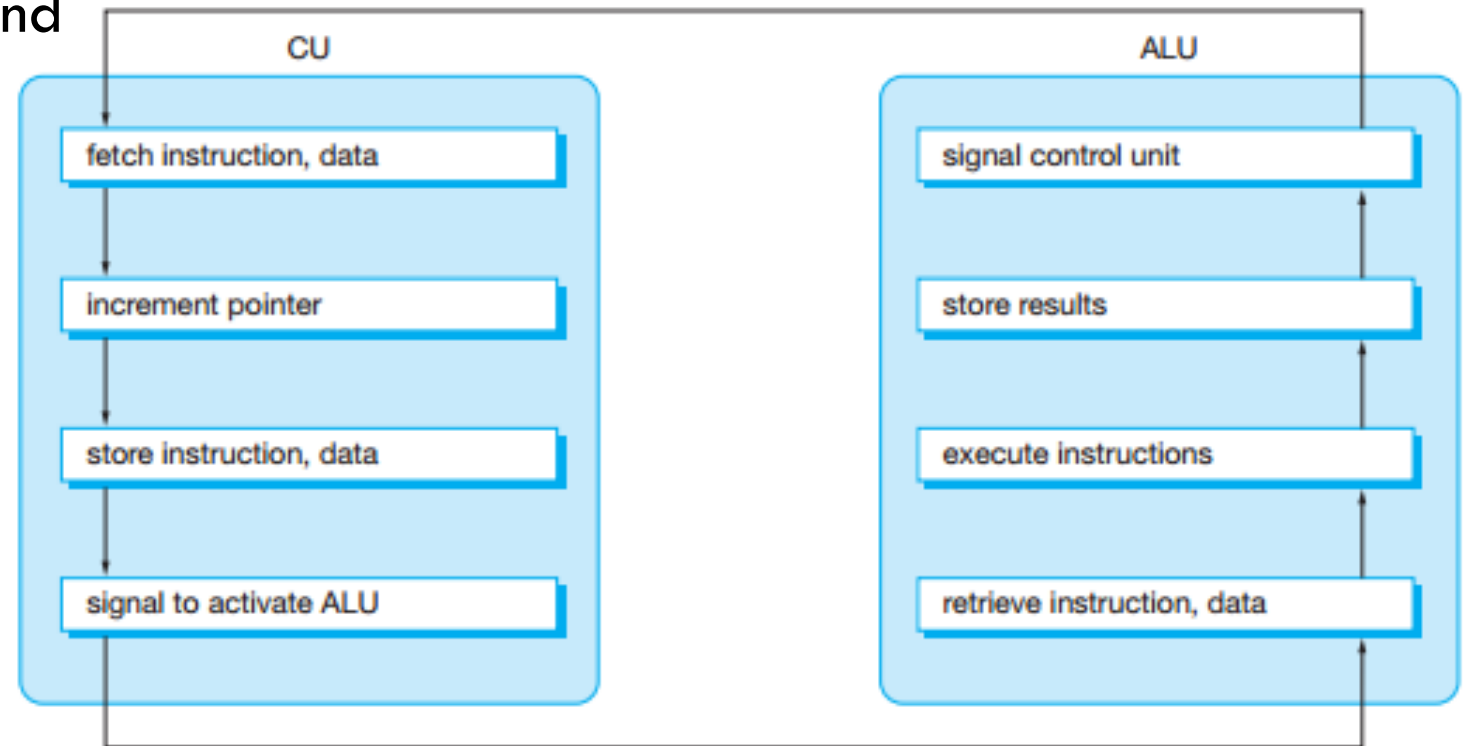
- + A complex chain of events occurs when a computer executes a program...
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Execution cycle sequence of events

Step 1: The ALU accesses the operation code of the instruction in the instruction register to determine which function to perform and to obtain the input data for the instruction.

Step 2: The ALU executes the instruction.

Step 3: The results of the instruction are stored in registers or are returned to the control unit to be written to memory.





Performance Measurement

- + Is it possible to measure the performance of a computer system?
- + CPU speed
 - the speed at which an instruction can be executed. This is usually specified in terms of millions of instructions per second (MIPS).
- + Access time
 - the speed at which the CPU can retrieve data from storage or I/O devices
- + Channel capacity
 - specifies the amount of data that can be moved over the channel in a specified interval of time. For example, one million data items per second



Computer Software

+Assignment 1

- Download the paper titled Assignment1 (pdf) from the student course portal and write a report to summarize the entire paper. Your report should be at most three(3) pages with the first page being a cover page. The cover page should only contain your name, index number, program, course code and name, assignment header, and date.
- Deadline for submission is Monday 5th July, 2021.