

CSI31 Lecture 1

Topics:

- 1.1 The Universal Machine (page 1)
- 1.2 Program Power (page 3)
- 1.3 What is Computer Science? (page 3)
- 1.4 Hardware Basics (page 5)

HW (not for grade):

- p. 20 True/False (1,2,3,4)
 - Multiple Choice (1,2,3,4)
 - Discussion (1 (a,b), 2)
- Install Python on your computer

Book costs \$40 (from the publisher).

<http://www.fbeedle.com/99-6.html> (free shipping)

Used books can be bought too (from \$25) (try Google shopping)

Almost anyone has used a computer at one time or another.

Computers are used to:

- Make movies,
- Design automobiles,
- Write a paper,
- Run businesses,
- Perform financial transactions, etc.

What exactly a computer is? How can one device perform so many different tasks?

A modern computer can be defined as

«*a machine that stores and manipulates information under the control of changeable program*».

Two key elements:

«stores and manipulates»:

we can put information into a computer, which is transformed into new, useful forms, and then outputted for our interpretation

«under control of changeable program»:

computers are not built to perform just one specific task.

computer program

is a detailed, step-by-step set of instructions telling a computer exactly what to do.

If we change the program, then the computer performs a different set of actions, hence, performs a different task.

Every computer is just a machine for *executing* (carrying out) programs.

1.2 Program Power

Software(programs) rules the *hardware*(the physical machine).

Without software, computers would be just expensive paperweights.

Programming is the process of creating software

Computer programming is a challenging activity. Good programming requires an *ability to see the big picture while paying attention to minute detail*.

Programming can be loads of fun, moreover it develops valuable problem-solving skills, especially the ability to analyze complex systems by reducing them to interactions of understandable subsystems.

1.3 What is Computer Science?

Computer Science is **not** the study of computers.

«Computers are to computer science what a telescopes are to astronomy» (Edsger Dijkstra)

Computer is an important tool in computer science, but not the object of the study.

The fundamental question of the computer science is «***What can be computed?***»

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What can be computed?

Computer scientists use numerous techniques to answer this question. The three main ones are:

- Design
- Analysis
- Experimentation

Design:

one way to demonstrate that a particular problem can be solved is to develop a step-by-step process for archiving the desired result (i.e. design a solution)

- called an *algorithm* (basically means **recipe**)

weakness of design:

it can only answer question «what is computable» in positive, i.e. if one can devise an algorithm, then the problem is solvable. However, failing to find an algorithm doesn't necessary mean that the problem is unsolvable.

Analysis:

is the process of examining algorithms and problems mathematically.

Computer scientists have shown that some seemingly simple problems are not solvable by **any** algorithm. Other problems are *intractable* (i.e. the algorithms that solve those problems are either take too long or require too much memory to be of practical value)

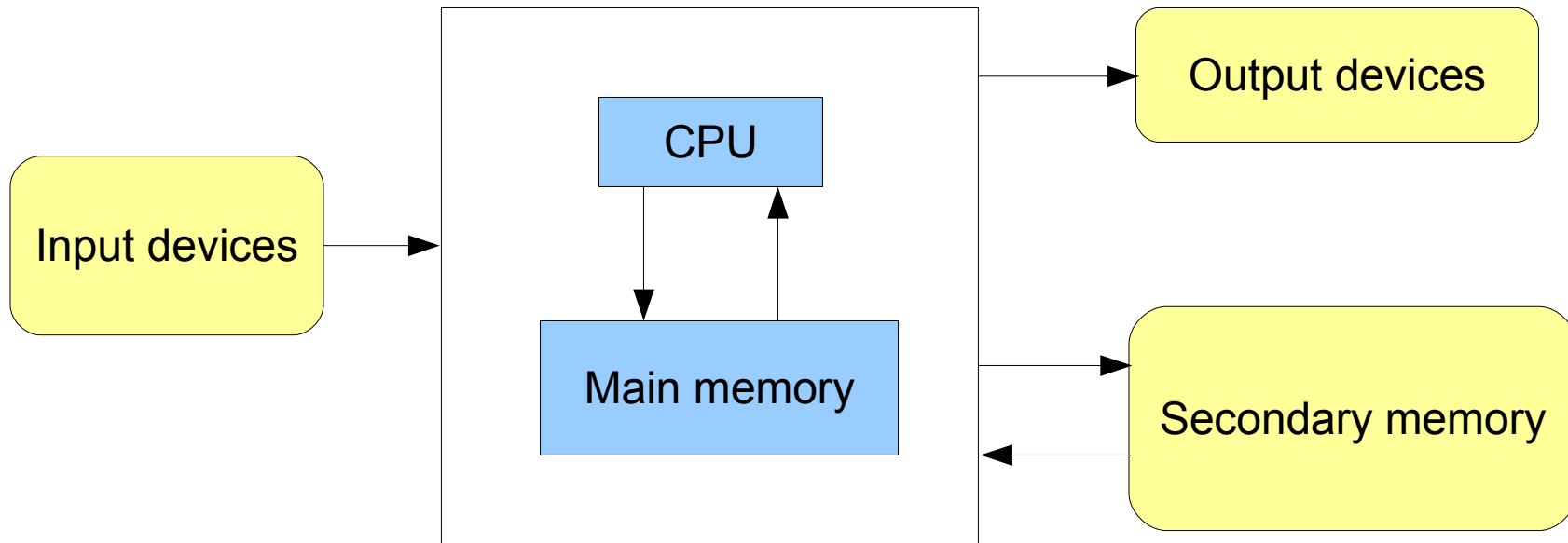
Experimentation:

some problems are too complex or ill-defined to lend themselves to analysis. In such cases, computer scientists rely on experimentation – they actually implement them and study their behavior.

Also, when theoretical analysis is done, experimentation is often needed in order to verify and refine the analysis.

1.4 Hardware Basics

Functional View of a Computer:



CPU (Central Processing Unit – is the «brain» of the machine

memory stores programs and data:

Main memory (RAM, Random Access Memory) – is fast, but volatile

Secondary memory – provides more permanent storage, slower (Hard Drive, Floppy, CD, DVD)

humans interact with the computer through input and output devices:

Input device – send instructions to computer (Keyboard, mouse)

Output device – (Display, Printer)