CSI31 Lecture 1

Topics:

1.1 The Universal Machine
1.2 Program Power
1.3 What is Computer Science?
1.4 Hardware Basics

Book costs $45 (from the publisher) at https://fbeedle.com/

1.1 The Universal Machine

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

Computers are used to:

- make movies,
- play games,
- 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?

1.1 The Universal Machine

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, usefull forms,

and then outputed for our interpretation

«under control of changeable program»:

computers are not built to perform just one specific task.

1.1 The Universal Machine

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, hense, 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.

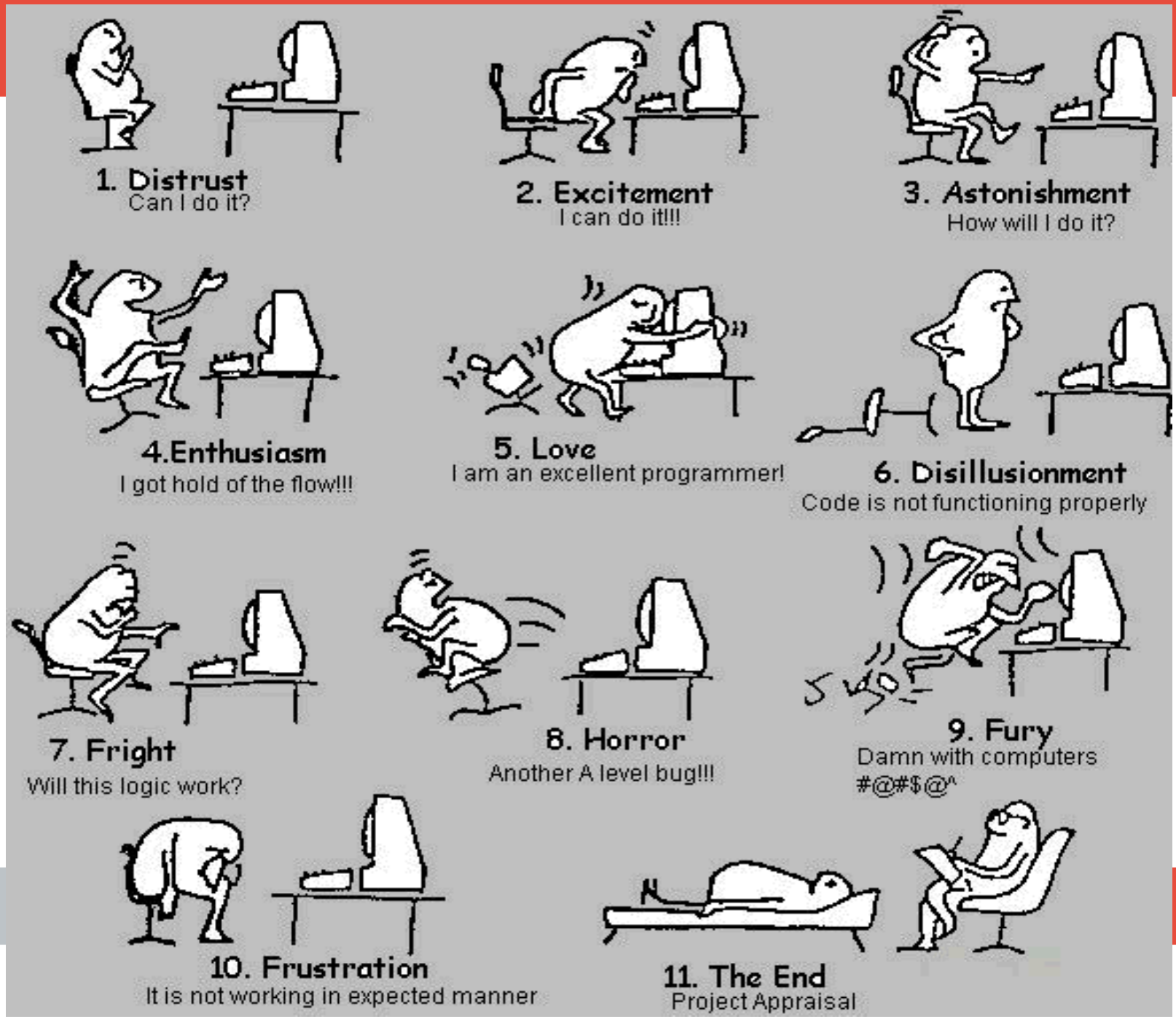
1.2 Program Power

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*.

Good reasons to learn programming:
Computers have become a commonplace tool in our society. Understanding its strengths and limitations opens a lot of opportunities for its use.
Programming can also 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.

1.2 Program Power



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?***»

1.3 What is Computer Science?

What can be computed?

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

- Design
- Analysis
- Experimentation

1.3 What is Computer Science?

What can be computed?

Design:
one way to demostrate that a particular problem can be solved is to actually 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 the positive: 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.

1.3 What is Computer Science?

What can be computed?

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)

1.3 What is Computer Science?

What can be computed?

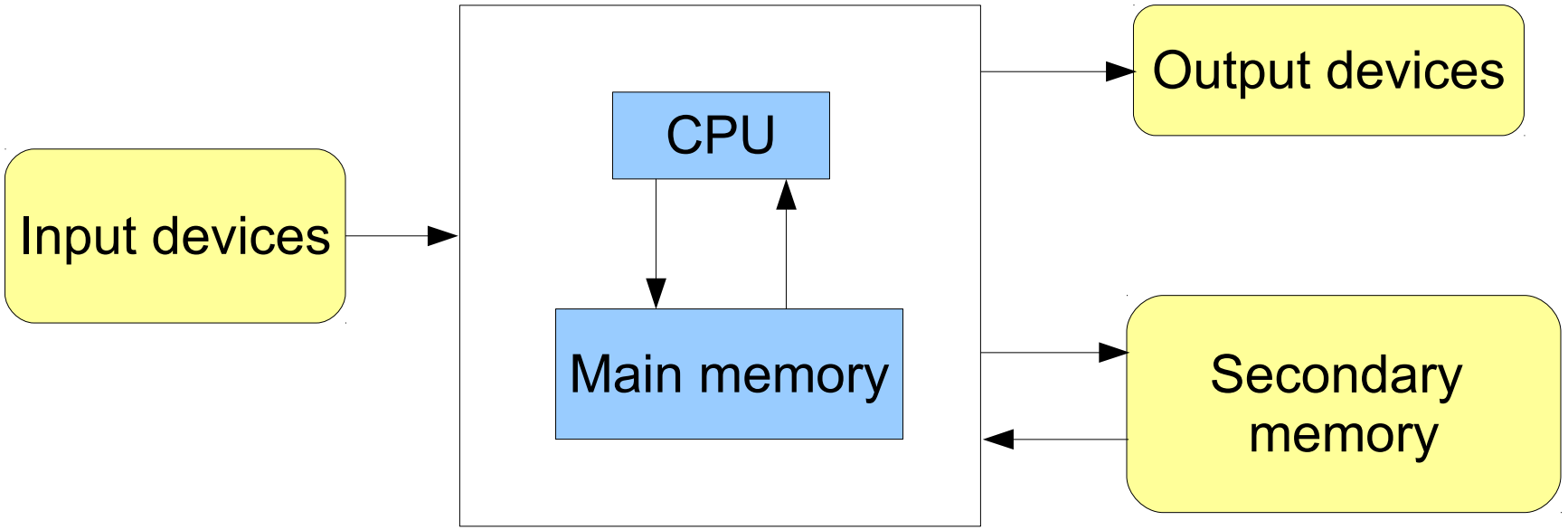
Experimentation:
some problems are too complex or ill-defined to lend themselves to analysis. In such cases, computer scientists rely on experimentation – they actually implement them and study their behavior.

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

For most problems, the bottom line is whether a working, reliable system can be built. Often we require empirical testing of the system to determine that this bottom line has been met.

1.4 Hardware Basics

Functional View of a Computer:



CPU (*Central Processing Unit* – is the «brain» of the machine
main memory (**RAM**, *Random Access Memory*) – is fast, but volatile
secondary memory – provides more permanent storage, slower.
hard drives: either HDD (Hard Disk Drive) or SSD (Solid State Drive);
USB memory sticks, CD, DVD

Output device – (display, printer)

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

1.4 Hardware Basics

Watch a video from YouTube where the desktop computer case is disassembled and assembled back:

https://youtu.be/ctAVC2JwEwI