

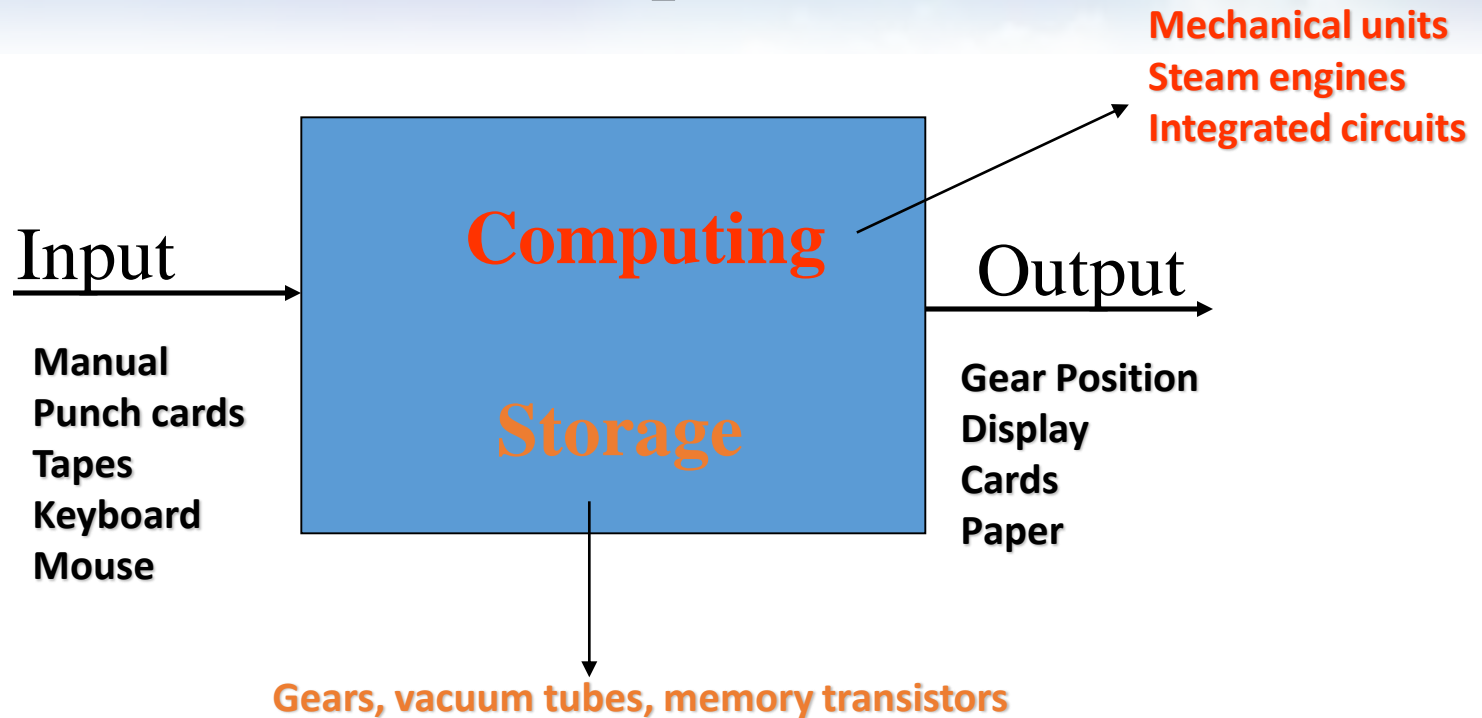



Chapter 1: Introduction

Overview of Discussion

- What is computer science?
 - What is a computer?
 - What can computers do?
 - How do computers solve problems?
 - What is computer science?
- Who invented computers?
 - Conceptual computers
 - Computing devices

A Computer



Five classic components of a computer:  **Processor**

Input, Output, Memory, Data path, Control

Definition of a Computer

- a general purpose,
- programmable,
- information processor
- with input and output



What is a computer?

- Definition of a *computer* is narrow
- Definition of *computing agent* is broad
- Although many computer scientists focus on the computer, some computer scientists deal with computing agents

How do computers solve problems?

- Humans deconstruct problems into small operations that a computer can carry out
 - Writing an *algorithm*
- Solve a problem by computer requires
 - State the problem clearly in a *problem statement*
 - Solve the problem with an *algorithm* that gives clear instructions
 - Use a *computing agent* to carry out the instructions

Stating the problem clearly

- Describes *what* to do, not *how* to do it
 - How do I get from Campus to the Highway?
- Solve general classes of problems
 - How do I get from point *A* in this class to point *B*?
 - What is the square root of y ?

Specifying a problem

- Clear problem statement is called the *specification*
 - What information can we use as input
 - What the output, or solution, to our problem should look like
- Specification for the square root problem
 - Input: A positive number $y > 0$
 - Output: A positive number x such that $x^2 = y$
- Make sure specification is not ambiguous

Solving the problem using an Algorithm

- Algorithm – a clear sequence of instructions for performing a task
 - a well-ordered sequence
 - of well-defined,
 - feasible operations
 - that takes finite time to carry out

What is Computer Science?

Computer Science is the discipline that seeks to build a *scientific* foundation for such topics as computer design, computer programming, information processing, and algorithmic solutions of problems.

- **Computing** is the execution of an “algorithm”
- A **computer** is a machine that performs computing (provides computing capabilities to its users)

What is computer science?

- The study of computers
- The study of algorithmic processes including their
 - Theory
 - Analysis
 - Design
 - Efficiency
 - Implementation
 - Application



Computer Science is NOT

Computer science is NOT the study of computers.

Computer science is NOT the study of how to write computer programs.

Computer science is NOT the study of the uses and applications of computers and software

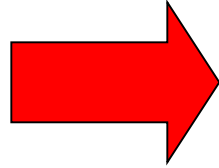
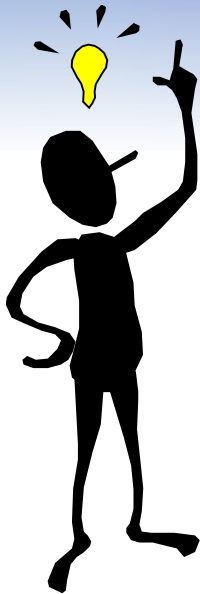
Computer Science is

Computer science: The study of **algorithms**, including

- Their formal and mathematical properties
- Their hardware realizations
- Their linguistic realizations
- Their applications

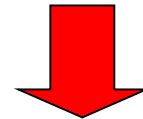
Terminology

- **Algorithm:** A set of steps that defines how a task is performed
- **Program:** A representation of an algorithm
- **Programming:** The process of developing a program
- **Software:** Programs and algorithms
- **Hardware:** Equipment / Machinery

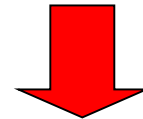


Algorithm:

A set of instructions describing how to do a task (or process)



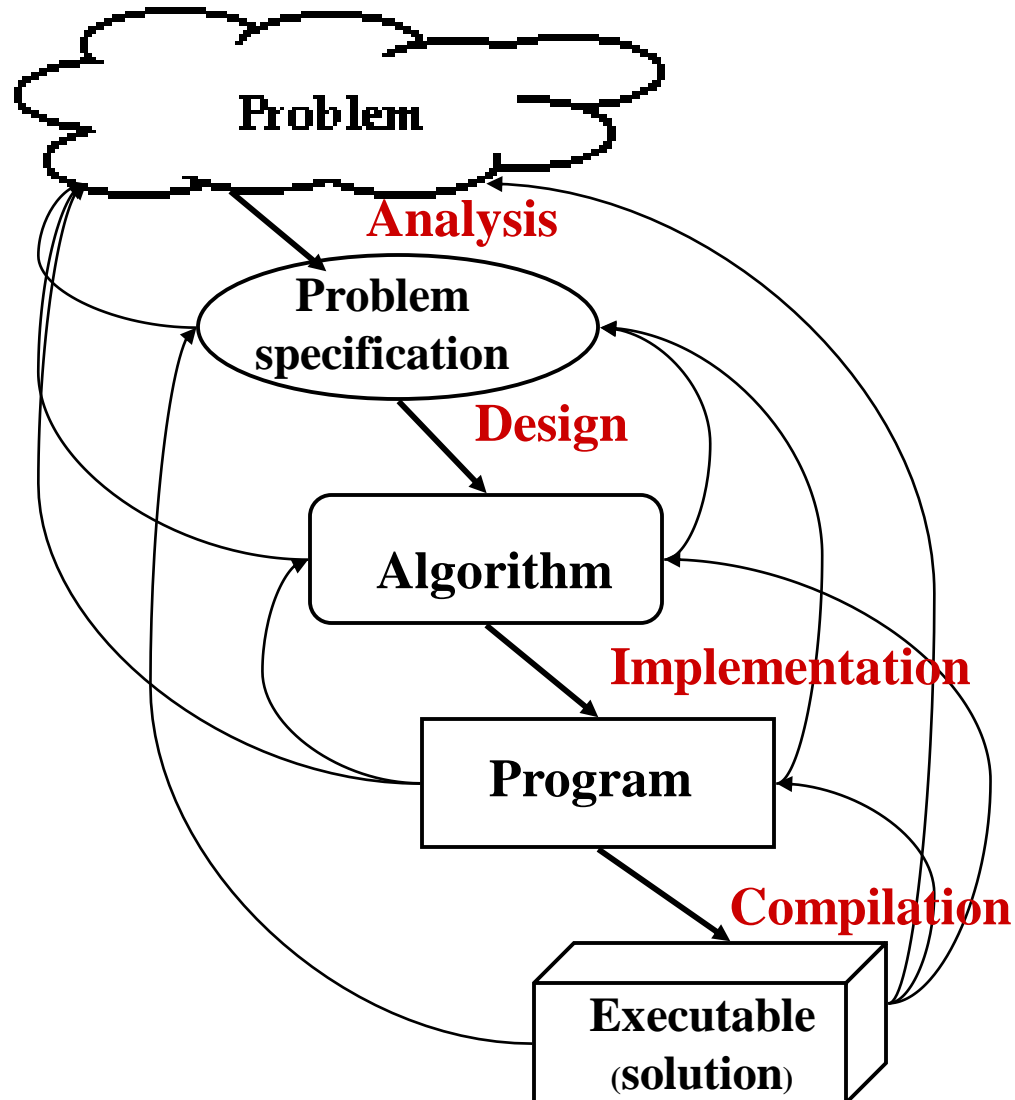
Program: Java



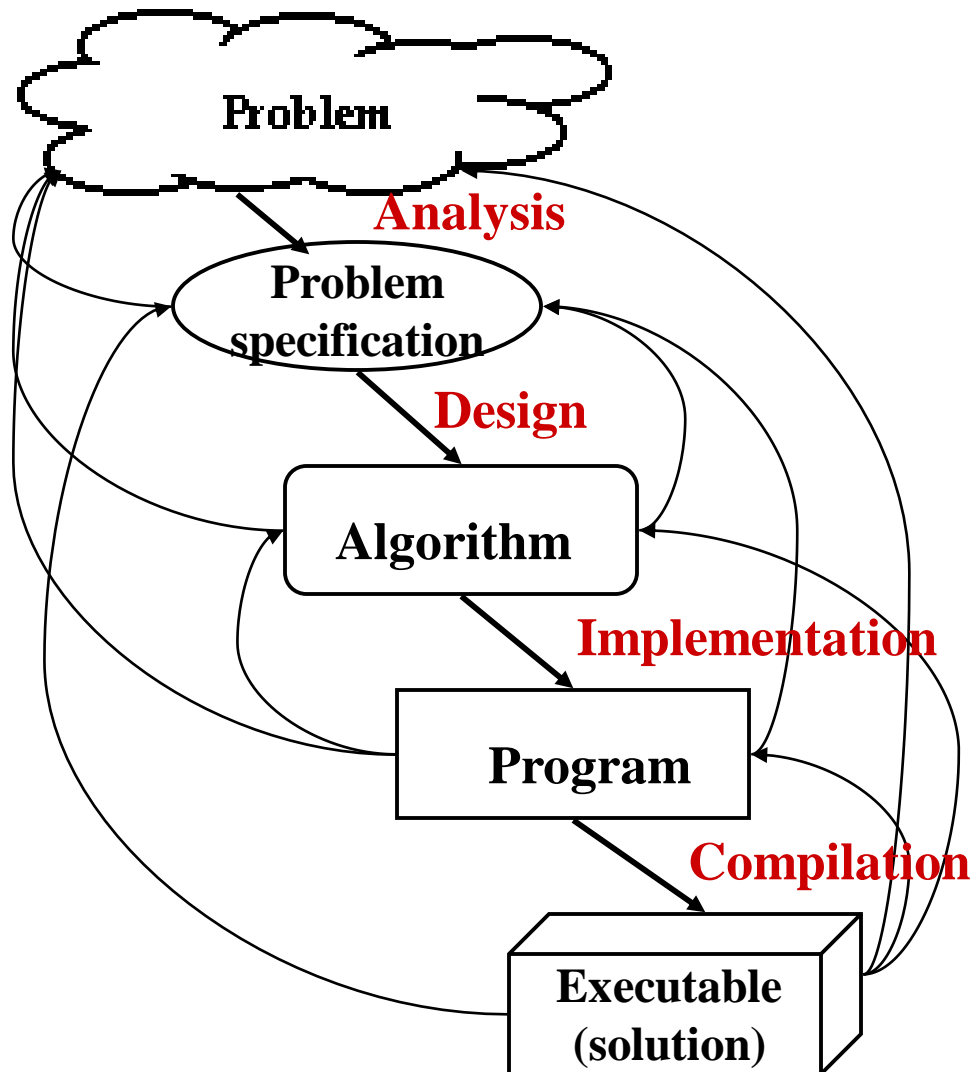
How do we solve problems?

- We "just do"
- Guesswork-and-luck
- Trial-and-error
- Experience (possibly someone else's)
- "Scientifically"

The Problem-solving Process



The Problem-solving Process



"Doctor, my head hurts"

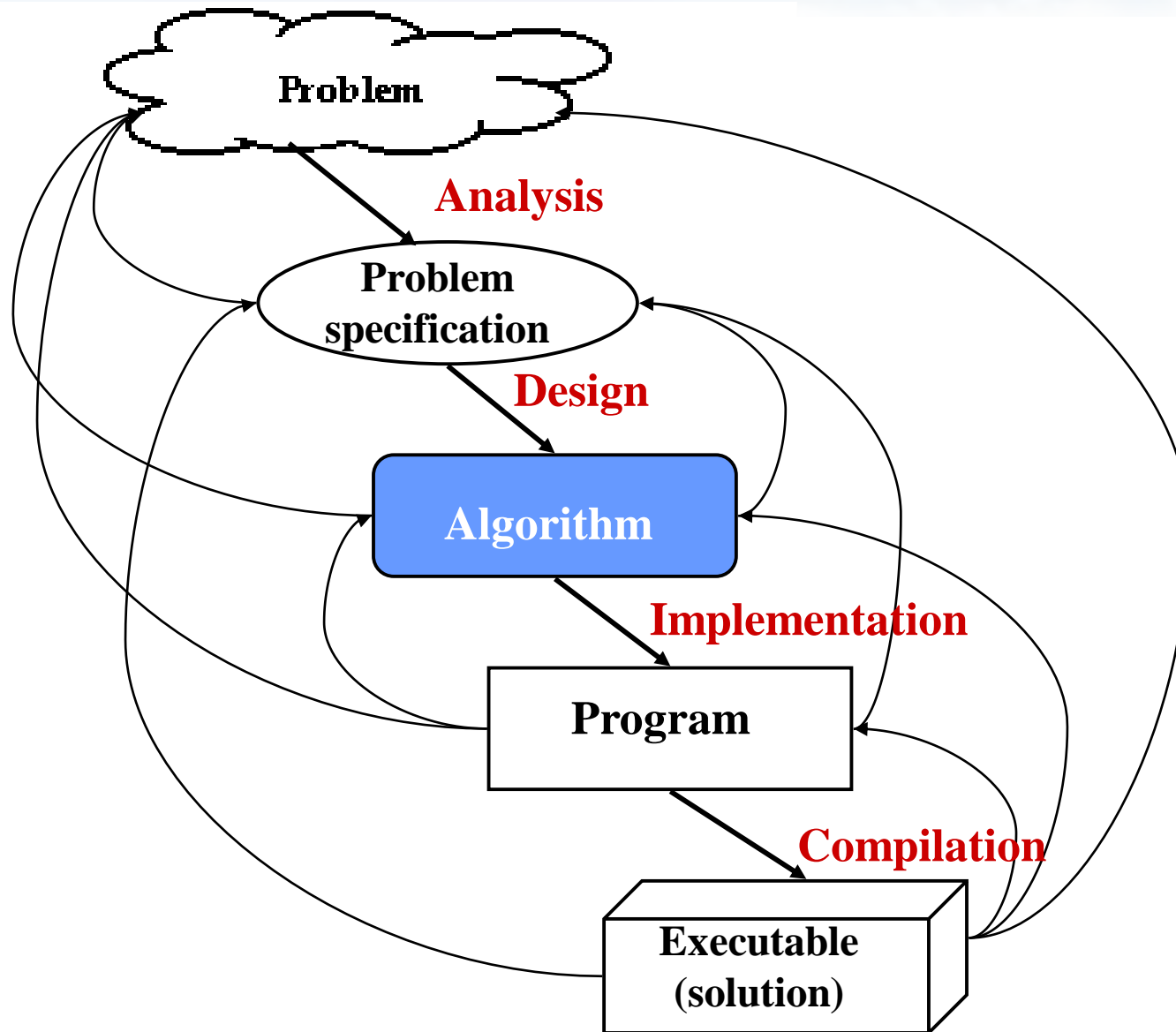
Patient has elevated pressure in anterior parietal lobe.

1. Sterilize cranial saw
2. Anaesthetize patient
3. Remove top of skull
4. Get the big spoon...
5. etc., etc.

```
sterilize(saw, alcohol);  
raise_hammer();  
lower_hammer(fast);  
start(saw);  
/* etc. etc. */
```

```
010011101011001010101010010101  
01010100110010101010100101101  
001110101010100100101110100111  
1010101011110101010001101000011  
01...
```

The Problem-solving Process



Algorithm -Types of algorithmic operations

- These 3 elements are:
- **Sequence** -In a sequence, there is a linear progression of statements.
- **Selection/Conditional /** result of the test is a Boolean - either True or False.
- **Iteration - LOOPS** -A loop is a sequence that gets executed several times. A complete execution of a sequence is called an iteration of the loop. There are two main loop constructs - WHILE and FOR (Will explain in more details at a later date).

Structured algorithms

- **structured algorithm:** Split into coherent tasks.

- 1 Make the cookie batter.

- Mix the dry ingredients.
 - Cream the butter and sugar.
 - Beat in the eggs.
 - Stir in the dry ingredients.

- 2 Bake the cookies.

- Set the oven temperature.
 - Set the timer.
 - Place the cookies into the oven.
 - Allow the cookies to bake.

- 3 Add frosting and sprinkles.

- Mix the ingredients for the frosting.
 - Spread frosting and sprinkles onto the cookies.
 - ...

Removing redundancy

- A well-structured algorithm can describe repeated tasks with less redundancy.
- Using one of the concepts below
- ie. Instead of using 20 steps to bake a cake you can reduced and bake a the cake in 10 Steps
- ***Selection/Conditional*** / result of the test is a Boolean - either True or False.
- ***Iteration*** - **LOOPS** -A loop is a sequence that gets executed several times. A complete execution of a sequence is called an iteration of the loop. There are two main loop constructs - WHILE and FOR (Will explain in more details at a later date).