Introduction to Algorithms and Programming

Lecture 1

T. Kinda Al-Issa

Introduction

What Are We Going To Learn

- We are going to learn how to analyze a problem in various fields starting from regular routines in our daily lives to problems in math, physics and science.

- Then, we are going to learn how to translate our understanding for these problems into a computer program.

Introduction

Course Outline

- What is programming
- What is algorithms
- How to convert a problem into an algorithm
- How to express an algorithm
- How to convert an algorithm into code

Introduction

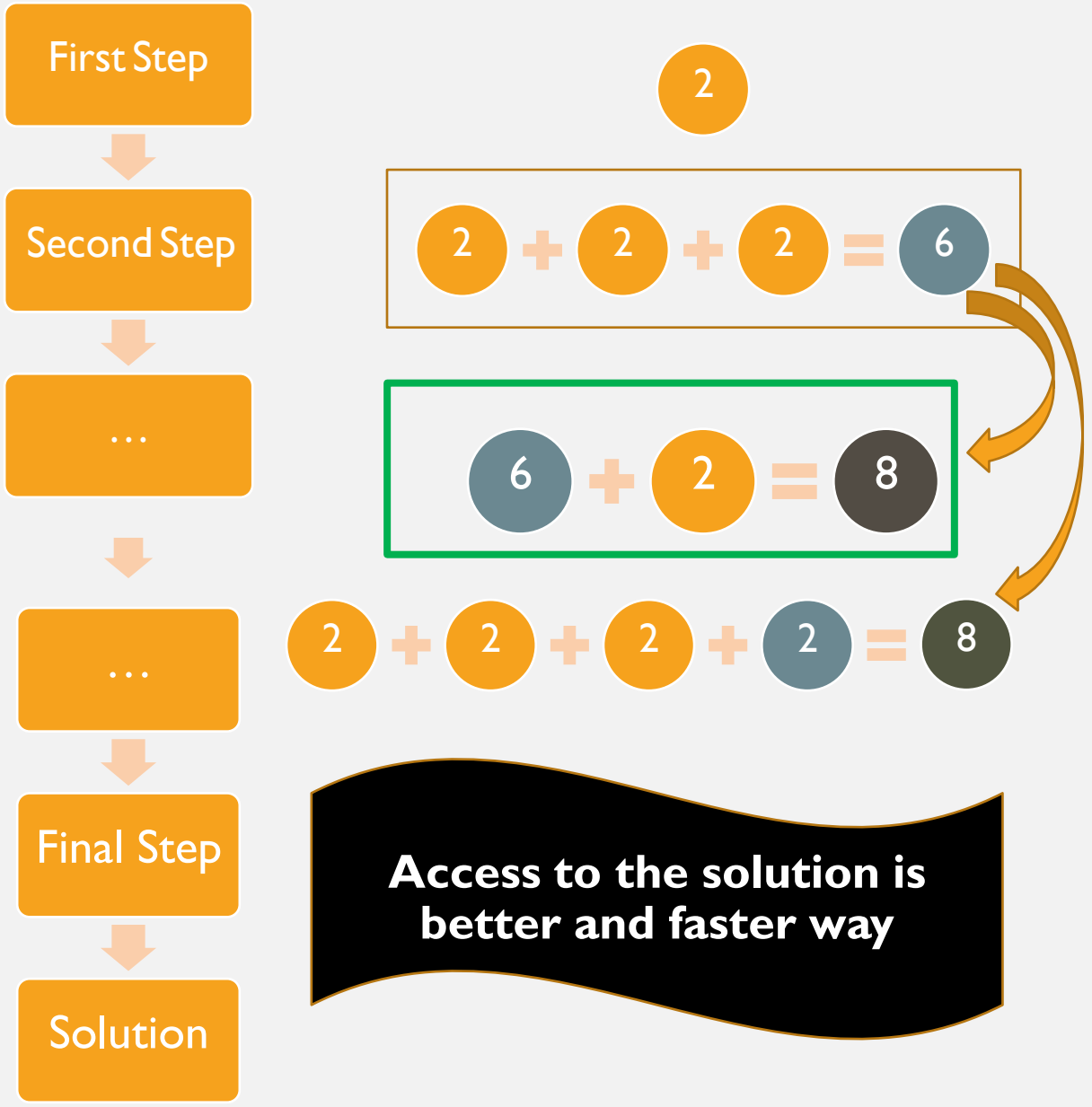
What Is Programming

- **Programming is not about languages!**
- **Programming is all about problem solving**
- **Programming is explaining things to the computer**
- **Coding** has only few main concepts
- **Coding** concepts work in almost the same way in every language!

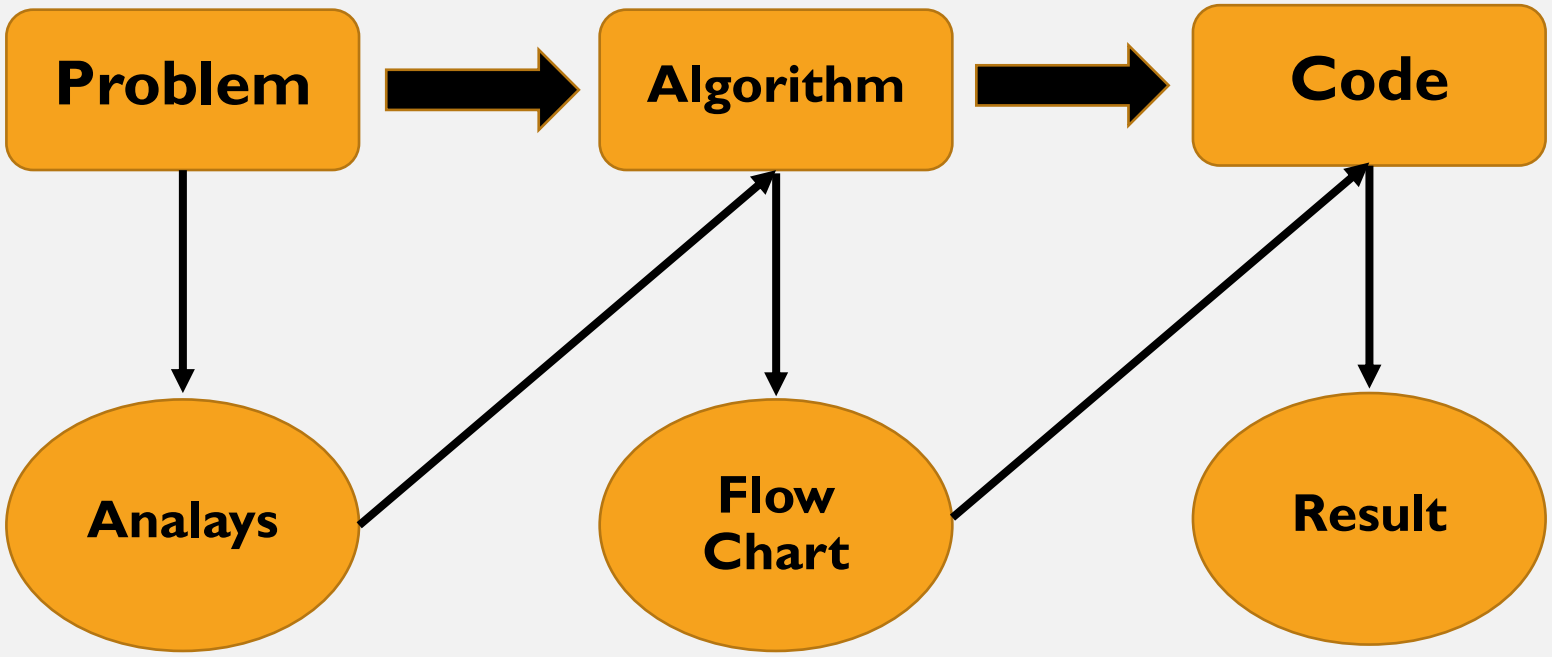
Introduction

What Is An Algorithm

- To make a computer do anything, you have to write a computer program
- To write a computer program, you have specify the required steps
- An algorithm is a set of very specific instructions
- People wrote and used algorithms long before computers even existed


First Step
Second Step
...
...
Final Step
Solution
2
2 + 2 + 2 = 6
6 + 2 = 8
2 + 2 + 2 + 2 = 8
Access to the solution is better and faster way

Algorithms



Algorithms

- How to write an algorithm?

1. Obtain a description of the problem
2. Define the goal you need to achieve
3. Explain the goal in detail in plain language (English/Arabic)
4. Define the step-by-step process to achieve the explained goal
5. Convert the steps into a chart

Algorithms

EXAMPLE 1

- **We need an algorithm for the steps required to go to college**
- **What is the goal?**

  Going to college

- **Explain the goal in plain language (English/Arabic).**

  We need to get to the college 8 AM by college bus

- **What are the step-by-step process to achieve the goal?**

  1. Wake up
  2. Brush your teeth
  3. Dress up
  4. Get into the bus

Algorithms

EXAMPLE 2

- We need an algorithm for the steps required to wash the hands
- What is the goal?

  Washing the hands.

- Explain the goal in plain language (English/Arabic).

  We need to wash our hands using water and soap.

- What are the step-by-step process to achieve the goal?

1. Open the water tap.
2. Put soap on your hands.
3. Clean your hands with water.
4. Shut down the water tap.
5. Dry your hands.

Variables

- Variables are used to store information to be referenced and manipulated in a computer program.
- Variables provide a way of labeling data with descriptive names.

Programming Concepts

INPUT

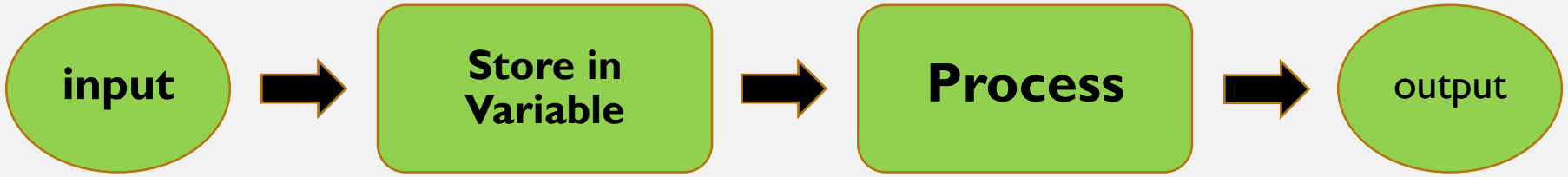
- **A method used to take information from user in order to provide it to the computer program to process it**

- **The input is often stored in a variable**

Programming Concepts

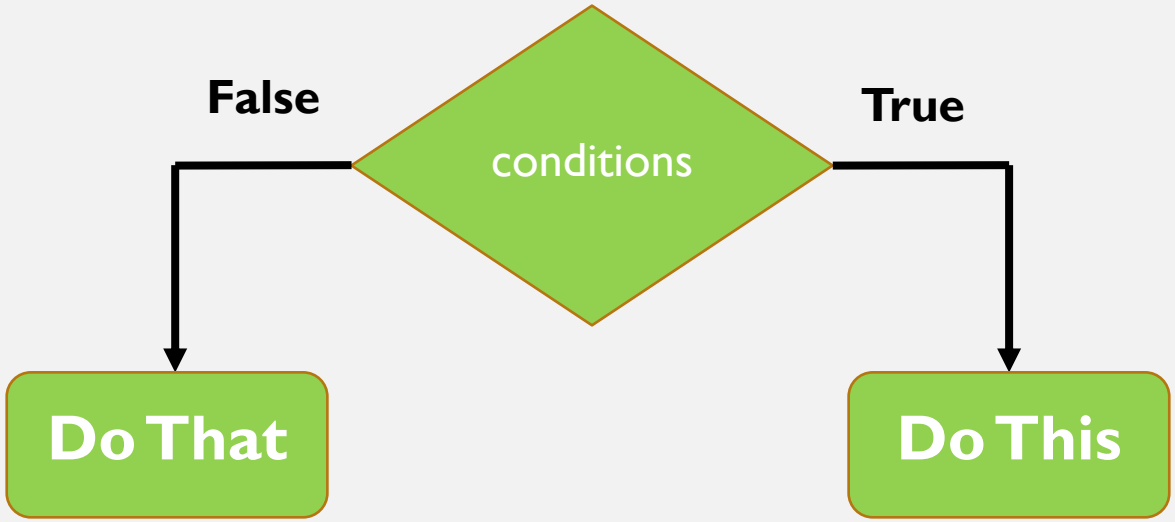
OUTPUT

A method used to inform the user with the result of processing.



CONDITIONS

- It is a method to perform different processing based on a condition.



EXAMPLE 3

❑ We need an algorithm for the steps required to add numbers

- What is the goal?

  Adding numbers.

- Explain the goal in plain language (English/Arabic).

  We need to write an algorithm for a computer program to add two integers.

- What are the step-by-step process to achieve the goal?

1. Define a *variable* for first number (x).
2. Define a *variable* for second number (y).
3. Define a *variable* for the sum (sum).
4. *Input* the first number and save it in variable (x).
5. *Input* the second number and save it in variable (y).
6. Add the two numbers, and save the result in variable (*sum*).
7. *Output* the value of sum.

EXAMPLE 4

- **We need an algorithm for the steps required to find the largest number.**

- What is the goal?

  Finding the largest number.

- Explain the goal in plain language (English/Arabic).

  We need to find the largest number among two integers.

- **What are the step-by-step process to achieve the goal?**

  1. **Define a *variable* for first number (x).**
  2. **Define a *variable* for second number (y).**
  3. ***Input* the first number and save it in variable (x).**
  4. ***Input* the second number and save it in variable (y).**
  5. If x > y then ***output*** x
  6. Else ***output*** y

Assignment

- **Write an algorithm for baking a cake.**
- **Write an algorithm for multiplying three numbers .**