Al-Mustaqbal University
College of Sciences
Department of Cybersecurity
المرحلة الاولى- اساسيات البرمجة

كليـــة العلـــوم
قسم الأمن السيبراني

Subject: Programming Fundamentals

First Stage

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Lecture (2)

Algorithms and Flowcharts

2024-2025

1. Introduction to Algorithms

An **algorithm** is a finite set of precise steps or instructions designed to solve a problem or perform a specific task. It forms the foundation of programming, guiding the logical flow of a program.

Properties of a Good Algorithm

1. **Finiteness:** An algorithm must always terminate after a finite number of steps.
2. **Non-ambiguity:** Each step must be precisely defined, ensuring there is no ambiguity.
3. **Effectiveness:** All steps must be simple and directly executable.

2. Writing an Algorithm

An algorithm is often expressed in **plain language or pseudocode**. Let's consider an example:

Example 1: Algorithm to Calculate the Average of a Series of Numbers

1. Initialize the sum to 0 and the count to 0.
2. Read the first number.
3. While there are more numbers:
    - Add the number to the sum.
    - Increment the count.
    - Read the next number.
4. Calculate the average by dividing the sum by the count.
5. Output the average.

Example 2: Algorithm to Find the Maximum and Minimum of a List of Numbers

1. Initialize `max` and `min` variables.
2. Read the first number as both the initial `max` and `min`.
3. For each subsequent number:
    - If the number is greater than `max`, update `max`.
    - If the number is smaller than `min`, update `min`.
4. Output the `max` and `min` values.

3. Introduction to Flowcharts

A **flowchart** is a graphical representation of an algorithm, using symbols to depict the steps and their order of execution. It is often used to visualize the logic of a program before writing the actual code.

Common Flowchart Symbols

1. **Oval:** Represents the start or end of a process.
2. **Arrow:** Shows the flow of control.
3. **Parallelogram:** Represents input or output operations.
4. **Rectangle:** Represents a process or instruction.
5. **Diamond:** Represents a decision-making step.

Symbol	Name	Function
	Start/end	An oval represents a start or end point.
	Arrows	A line is a connector that shows relationships between the representative shapes.
	Input/Output	A parallelogram represents input or ouptut.
	Process	A rectangle represents a process.
	Decision	A diamond indicates a decision.

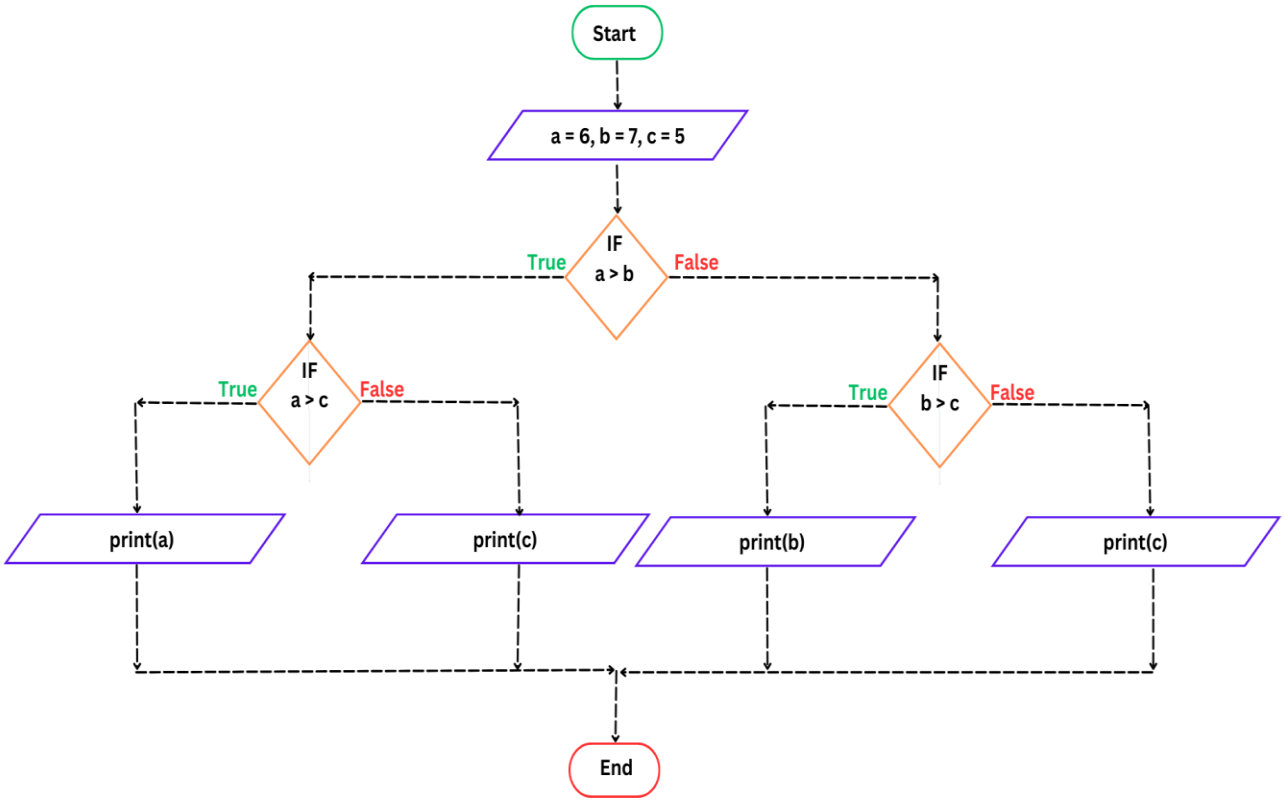
Example 1: Flowchart to Find the Largest of Three Numbers

1. **Start**: Begin the program execution.
2. **Input**: Initialize three variables a, b, and c with respective values or prompt the user to input them.
3. **Decision 1**: Check if a>b:
   - **True**: Proceed to Decision 2.
   - **False**: Move to Decision 3.
4. **Decision 2**: Check if a>c:

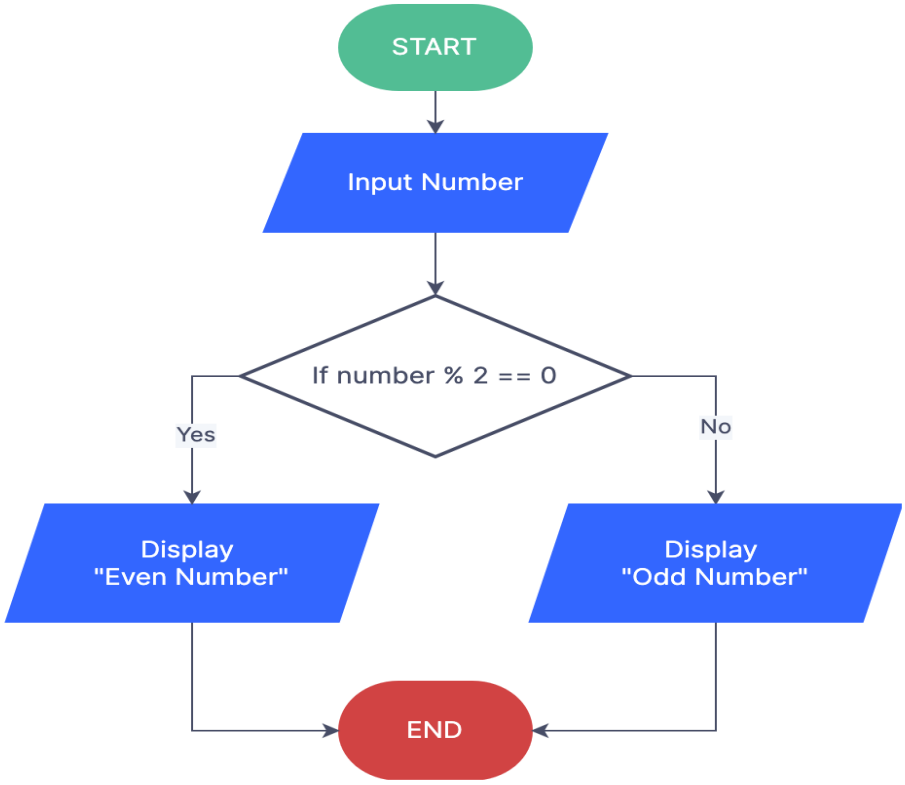
- **True**: Print a as the largest number.
- **False**: Print c as the largest number.

5. **Decision 3**: Check if b>c:
   - **True**: Print b as the largest number.
   - **False**: Print c as the largest number.
6. **End**: Terminate the program.

Flowchart Representation:



Example 2: Flowchart to determines whether a given number is even or odd.



5. Exercises

- **Write an algorithm to calculate the area of a circle given its radius.**
- **Create a flowchart to check whether a given year is a leap year.**