ALGORITHMS AND FLOWCHARTS

Dr. Sheak Rashed Haider Noori
Associate Professor & Associate Head
Department of Computer Science

ALGORITHMS AND FLOWCHARTS

- A typical programming task can be divided into two phases:
- ***Problem solving phase***
  - produce an ordered sequence of steps that describe solution of problem
  - this sequence of steps is called an ***algorithm***
- ***Implementation phase***
  - implement the program in some programming language

Steps in Problem Solving

- First produce a general algorithm (one can use ***pseudocode***)
- Refine the algorithm successively to get step by step detailed ***algorithm*** that is very close to a computer language.
- ***Pseudocode*** is an artificial and informal language that helps programmers develop algorithms. Pseudocode is very similar to everyday English.

Pseudocode & Algorithm

- **Example 1:** Write an algorithm to determine a student's final grade and indicate whether it is passing or failing. The final grade is calculated as the average of four marks.

Pseudocode & Algorithm

Pseudocode:

- *Input a set of 4 marks*
- *Calculate their average by summing and dividing by 4*
- *if average is below 50*

  Print “FAIL”

  else

  Print “PASS”

Pseudocode & Algorithm

- Detailed Algorithm
- Step 1: Input M1,M2,M3,M4
  Step 2: GRADE ← (M1+M2+M3+M4)/4
  Step 3: if (GRADE < 50) then
  Print “FAIL”
  else
  Print “PASS”
  endif

The Flowchart

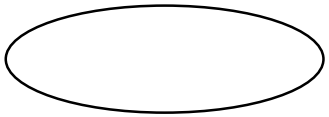
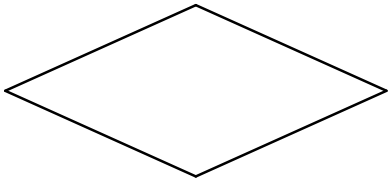
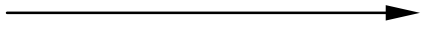
- (Dictionary) A schematic representation of a sequence of operations, as in a manufacturing process or computer program.
- (Technical) A graphical representation of the sequence of operations in an information system or program. Information system flowcharts show how data flows from source documents through the computer to final distribution to users. Program flowcharts show the sequence of instructions in a single program or subroutine. Different symbols are used to draw each type of flowchart.

The Flowchart

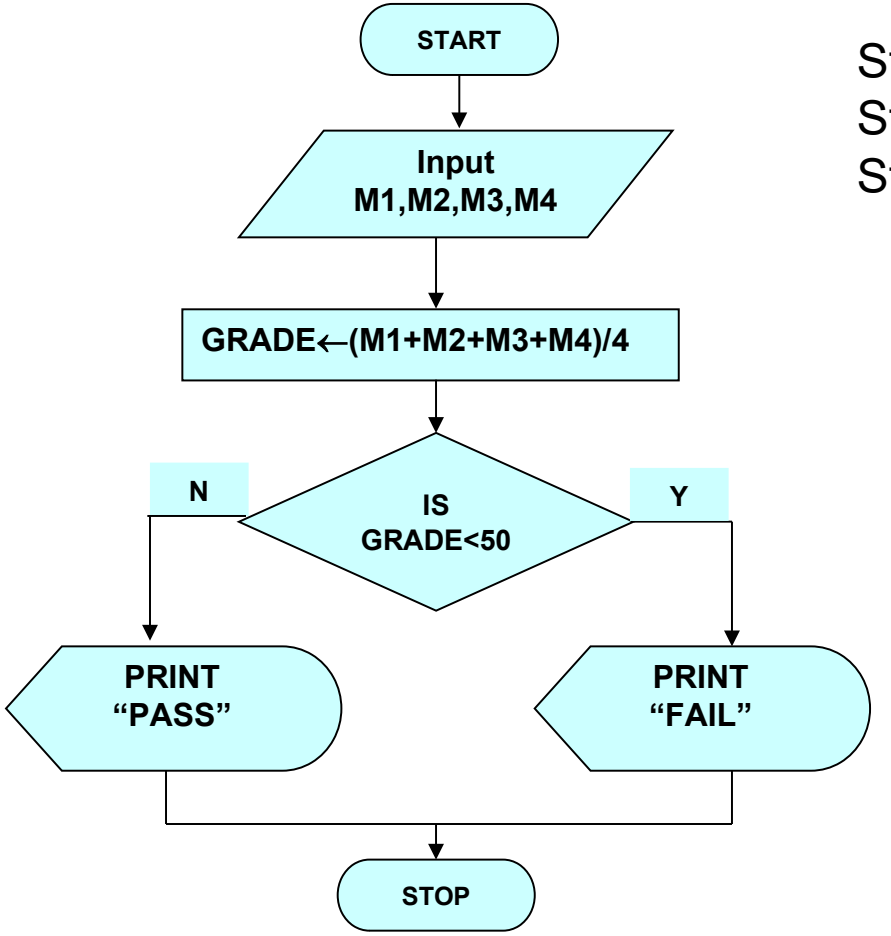
- An organized combination of shapes, lines and text which graphically illustrate a process/program.
- A type of diagram that represents an algorithm, workflow or process, showing the steps as boxes of various kinds, and their order by connecting them with arrows. This diagrammatic representation illustrates a solution to a given problem.
- Emphasizes individual steps and their interconnections
- Flowcharts are used in analyzing, designing, documenting or managing a process or program. Like other types of diagrams, they help visualize what is going on and thereby help the people to understand a process, and perhaps also find flaws, bottlenecks, and other less-obvious features within it.
- Very helpful in explaining program to others.

Flowchart Symbols

Different symbols are used for different states in flowchart, For example: Input/Output and decision making has different symbols. The table below describes most of the symbols that are used in making flowchart

Name	Symbol	Use in Flowchart
Oval		Denotes the beginning or end of the program
Parallelogram		Denotes an input operation
Rectangle		Denotes a process to be carried out e.g. addition, subtraction, division etc.
Diamond		Denotes a decision (or branch) to be made. The program should continue along one of two routes. (e.g. IF/THEN/ELSE)
Hybrid		Denotes an output operation
Flow line		Denotes the direction of logic flow in the program

Example



Step 1: Input M1,M2,M3,M4
Step 2: GRADE ← (M1+M2+M3+M4)/4
Step 3: if (GRADE <50) then
Print “FAIL”
else
Print “PASS”
endif

Example 2

- Write an algorithm and draw a flowchart to convert the length in feet to centimeter.

- **Pseudocode**:
  - *Input the length in feet (Lft)*
  - *Calculate the length in cm (Lcm) by multiplying LFT with 30*
  - *Print length in cm (LCM)*

Example 2

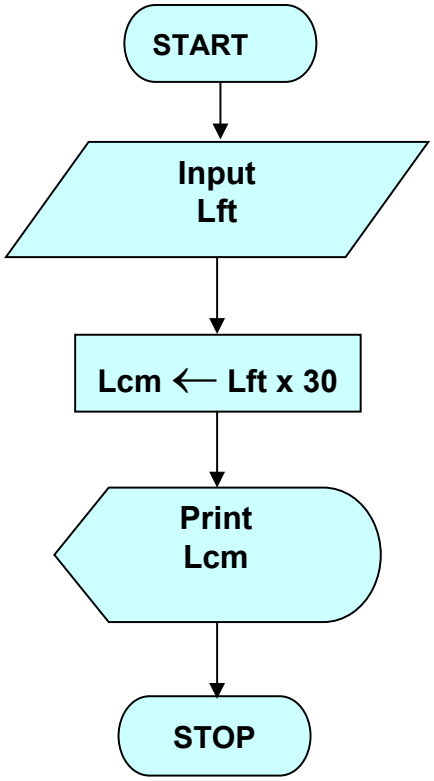
- **Algorithm**

  Step 1: Input Lft

  Step 2: Lcm ← Lft x 30

  Step 3: Print Lcm

Flowchart



Example 3

- Write an algorithm and draw a flowchart that will read the two sides of a rectangle and calculate its area.
- **Pseudocode**
  - *Input the width (W) and Length (L) of a rectangle*
  - *Calculate the area (A) by multiplying L with W*
  - *Print A*

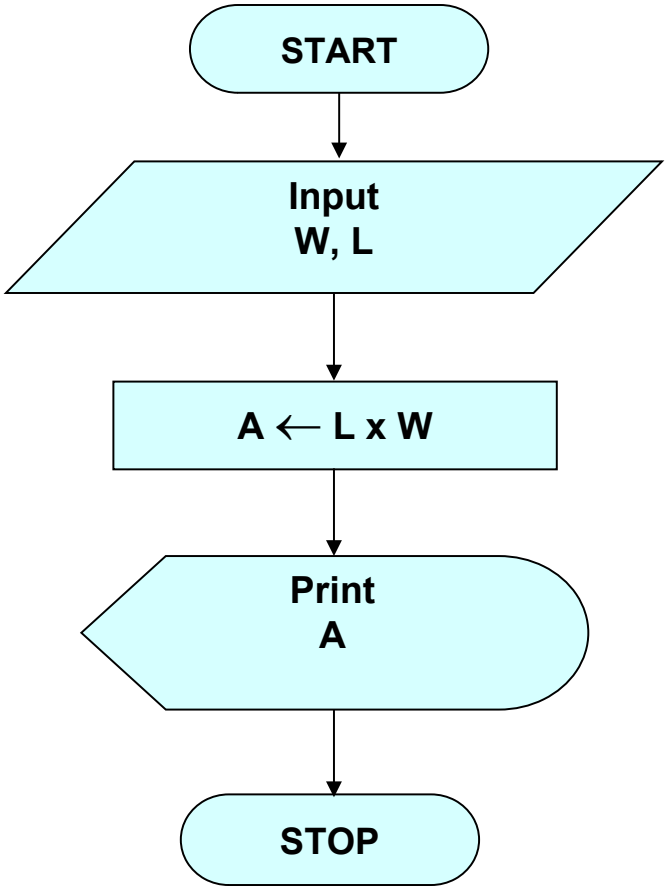
Example 3

Algorithm

Step 1: Input W,L

Step 2: A ← L x W

Step 3: Print A



Example 4

- Write an algorithm and draw a flowchart that will calculate the roots of a quadratic equation

  $ax^2 + bx + c = 0$

- Hint: **d** = sqrt ($b^2 - 4ac$), and the roots are:
  ***x*1** = (–*b* + *d*)/2*a* and ***x*2** = (–*b* – *d*)/2*a*

Example 4

Pseudocode:

- *Input the coefficients (a, b, c) of the quadratic equation*
- *Calculate* **d**
- *Calculate* ***x*1**
- *Calculate* **x2**
- *Print* x*1 and* x2

Example 4

- **Algorithm**:

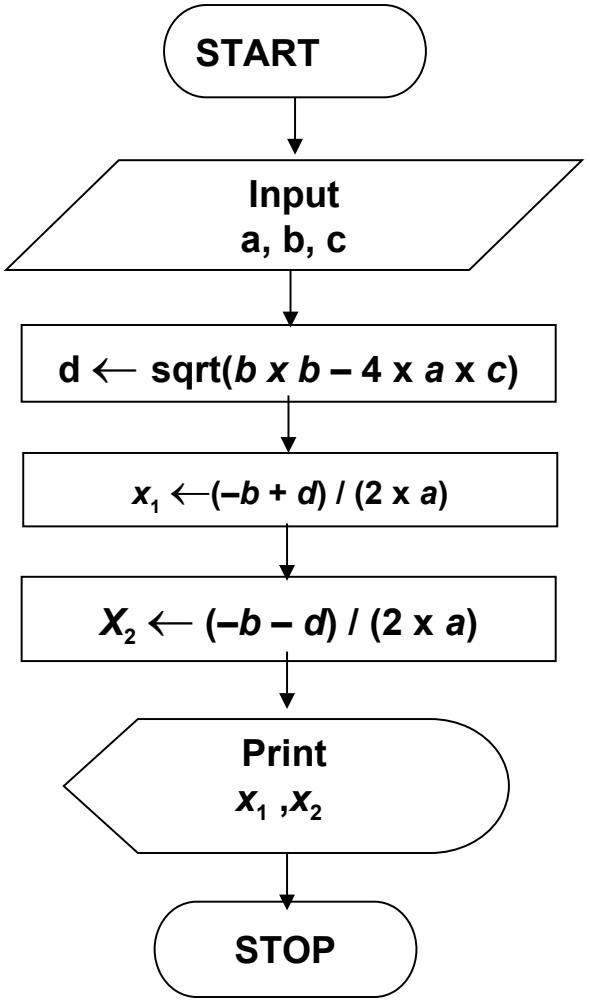
  Step 1: Input a, b, c

  Step 2: $d \leftarrow$ sqrt ($b \times b - 4 \times a \times c$)

  Step 3: $x1 \leftarrow (-b + d) / (2 \times a)$

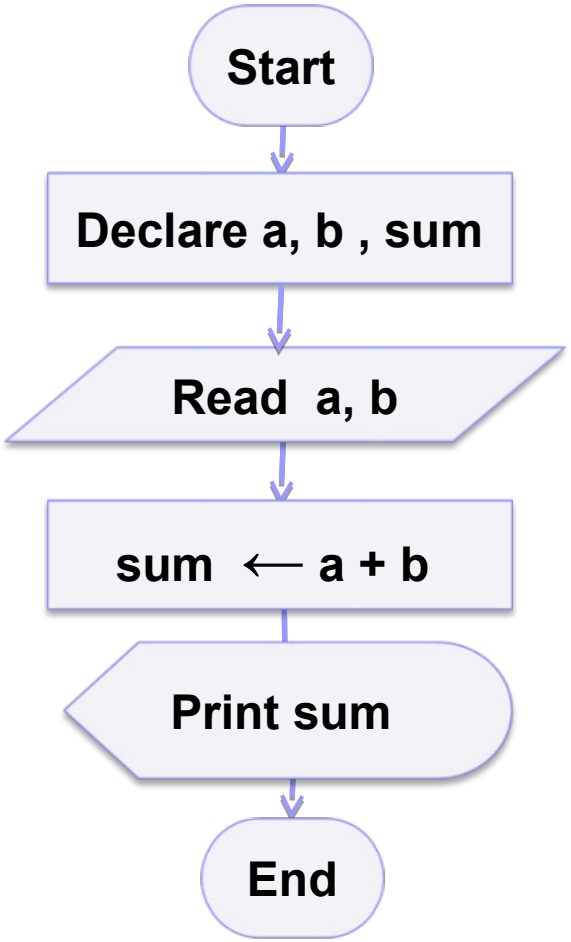
  Step 4: $x2 \leftarrow (-b - d) / (2 \times a)$

  Step 5: Print $x1$, $x2$



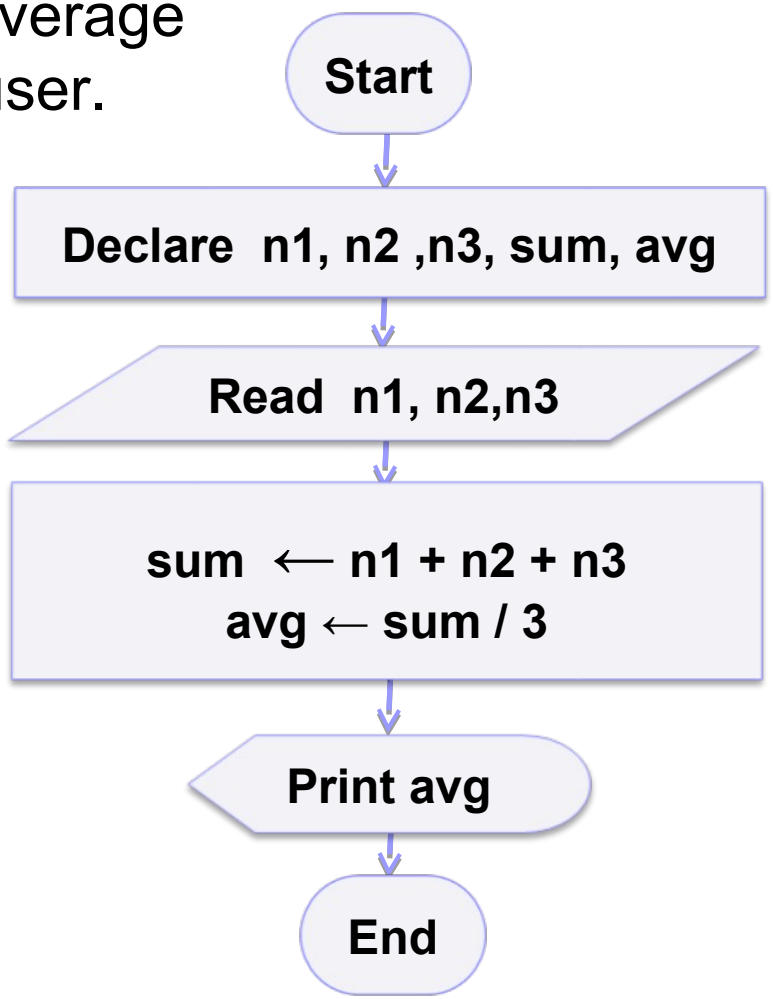
Example 5

- Draw a flowchart to add two numbers entered by user.



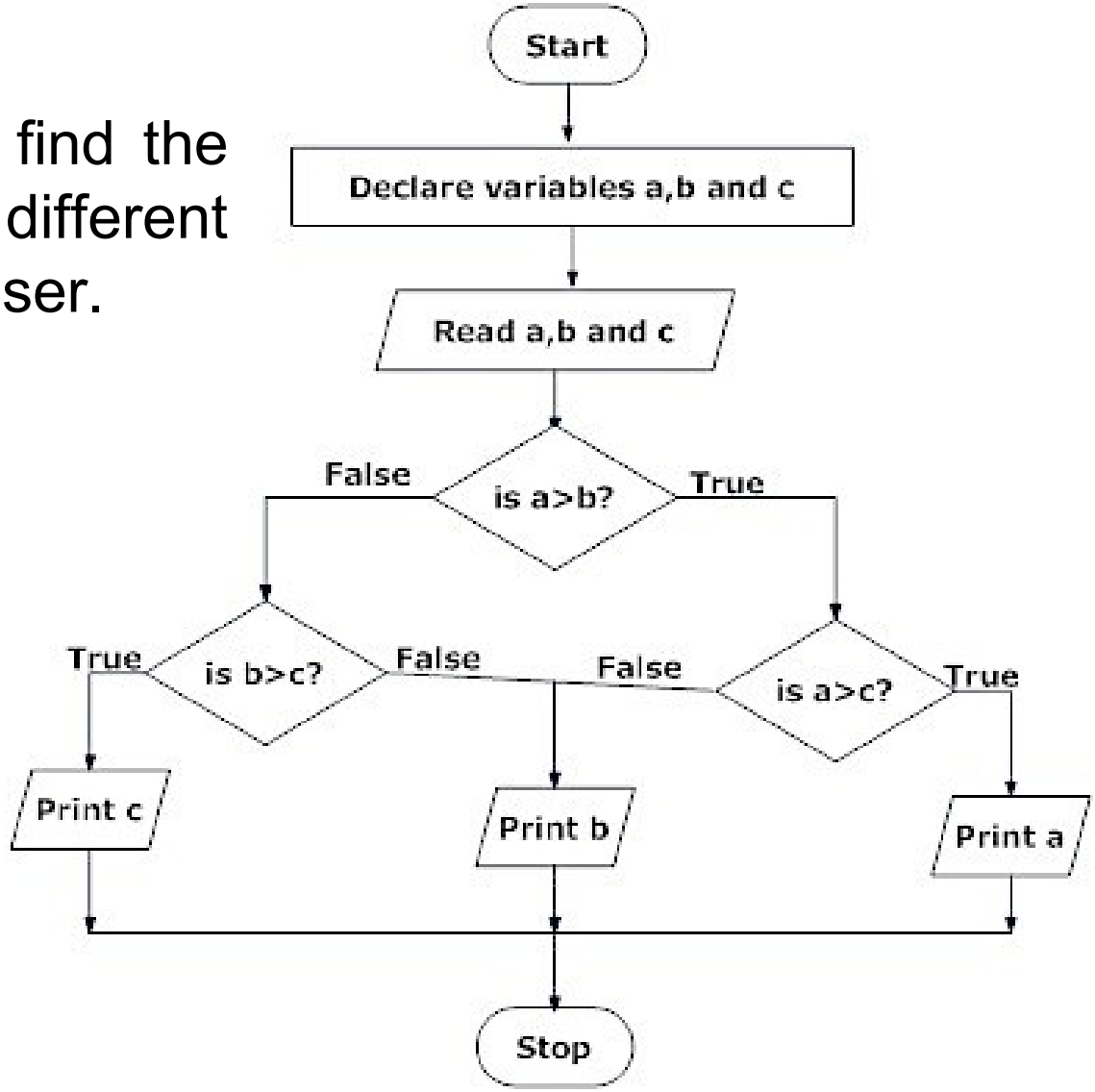
Example 6

- Draw a flowchart to print the average of three numbers entered by user.



Example 7

- Draw a flowchart to find the largest among three different numbers entered by user.



Example 7: Draw a flowchart to print a letter ‘n’ **m** times.