SAXONY EGYPT UNIVERSITY
FOR APPLIED SCIENCE AND TECHNOLOGY

ECT 113
Information Technology

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Lecture 2

Problem-Solving and Program Design

what is Problem-Solving ?

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- ***Problem-solving*** *is the process of identifying an issue, analyzing possible solutions, and implementing the best one to achieve a desired outcome.*

Why is it Important ?

- Essential for programming and real-world applications.
- Helps in creating efficient and logical solutions.
- Used in artificial intelligence, automation, and data analysis.

Understanding the Problem

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- Before solving a problem, it's important to fully understand it.

➢ Ask yourself the following questions:

1. **What is the problem statement?** Clearly define what needs to be solved.
2. **What are the inputs?** What data is needed?
3. **What are the expected outputs?** What should the solution produce?
4. **Are there any constraints?** Time limits, memory limits, etc.
5. **What are the possible solutions?** Consider different approaches.

Steps for Problem-Solving

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- **Problem-solving** typically follows these steps:

1. Understand the Problem – Identify inputs, outputs, and constraints.

2. Plan a Solution (Algorithm) – Develop a step-by-step approach.

3. Represent the Solution (Flowchart & Pseudocode) – Visually or textually describe the logic.

4. Implement and Test the Solution – Convert to code, run tests, and optimize.

What is an Algorithm?

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An **Algorithm** is a step-by-step sequence of logical instructions designed to solve a specific problem. It takes an input, processes it through a set of well-defined rules, and produces an output.

- Algorithms are generally created independent of underlying languages.

- Every algorithm should have the following 4 characteristic feature:

1. Start
2. Input
3. Processing
4. Output

What is an Algorithm?

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Example 1:

Write an algorithm that takes two numbers as input and calculates their sum.

Algorithm:

1.Start

2.Input: Read two numbers, A and B.

3.Processing : SUM = A + B

4.Output: SUM = A + B

What is an Algorithm?

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Example 1 (Cont.):

Input: A = 8, B = 5

Steps Execution:

Step 1: Read A = 8 and B = 5.

Step 2: Compute SUM = 8 + 5 = 13.

Step 3: Print 13.

Output: 13.

What is an Algorithm?

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Example 2:

Given a list of numbers, find the largest number in the list.

Algorithm:

1.Start

2.Input: Read a list of numbers.

3.Initialize: Set the first number as the maximum.

4.Loop through the remaining numbers in the list:

- If a number is greater than the current maximum, update the maximum

5.Output: Print the maximum number

What is an Algorithm?

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Example 2 (Cont.):

Input: [12, 45, 7, 89, 23, 56]

Steps Execution:

Step 1: Assume max = 12.

Step 2: Compare 45 > 12, update max = 45.

Step 3: Compare 7 > 45, no change.

Step 4: Compare 89 > 45, update max = 89.

Step 5: Compare 23 > 89, no change.

Step 6: Compare 56 > 89, no change.

Output: 89 (The largest number).

What is Flowchart ?

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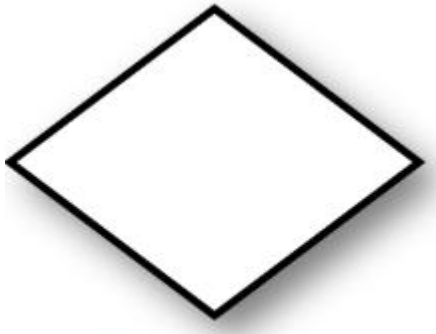
- A **Flowchart** is a type of diagram that represents an algorithm, workflow or process, showing the steps as boxes of various kinds, and their order by connecting them with arrows.

- This diagrammatic representation illustrates a solution model to a given problem.

Main Symbols for Flowchart

Start & End

Flow line



Decision

Process

Input/output

How to Read A Flowchart 2

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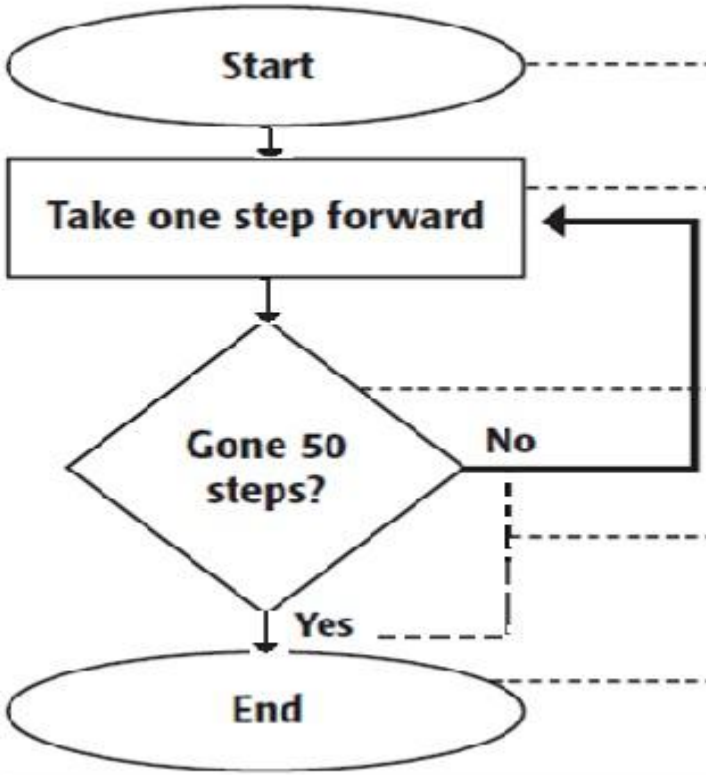

PARTS of a FLOW CHART

Start of Program - Marks the beginning of the program, begin here. Follow the line to get to the next block.

Statement Block - A statement to execute, or a behavior to perform.

Decision Block - A decision point in your program. Ask a simple question, and do different things depending on the answer.

Yes/No (also True/False, etc.) - Answers to the question posed in the decision block. Follow the line labeled with the appropriate answer.

End of Program - Marks the end of the program. If you reach this point, the program is done!

Flowchart?

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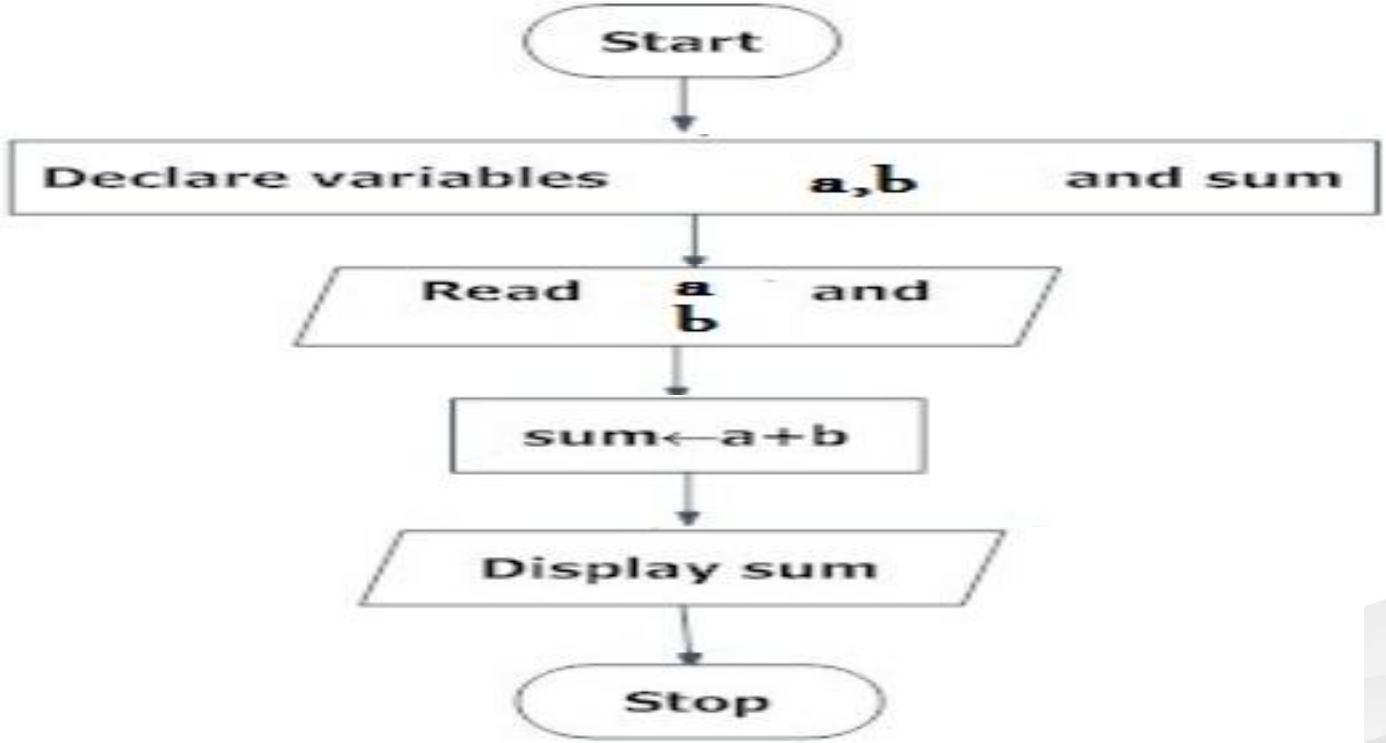
Example 1:

Design a flowchart that takes two numbers as input and calculates their sum.



Algorithm: Convert Fahrenheit to Celsius

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Example 2:

Write an algorithm then design a flowchart that change the temp. from F to celicus. C=5*(F-32)/9

Algorithm:

1.Start

2.Input: the temperature in Fahrenheit (F).

3.Compute: the Celsius temperature using the formula:

C=5*(F-32)/9

4. **Print:** the Celsius temperature

5. **Stop**

Flowchart

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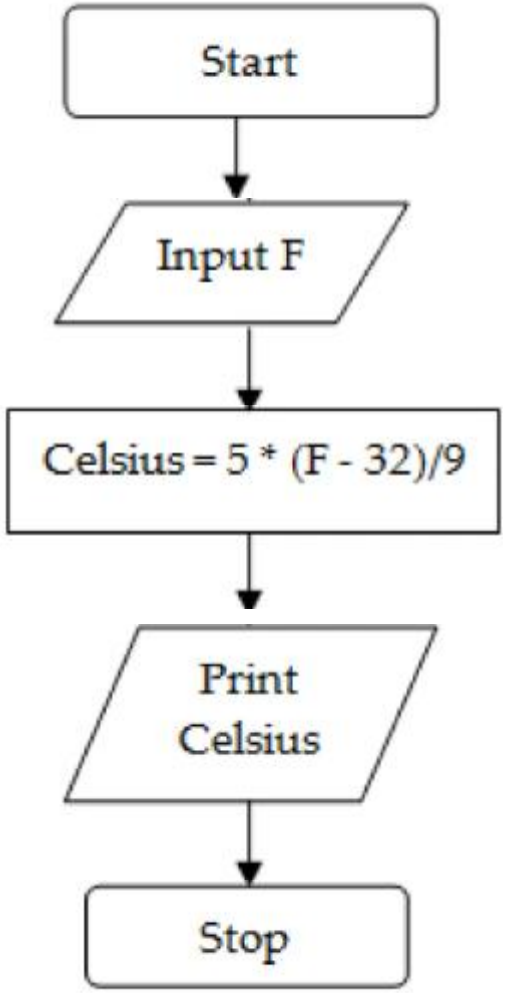
Example 2 (Cont.):



Flowchart

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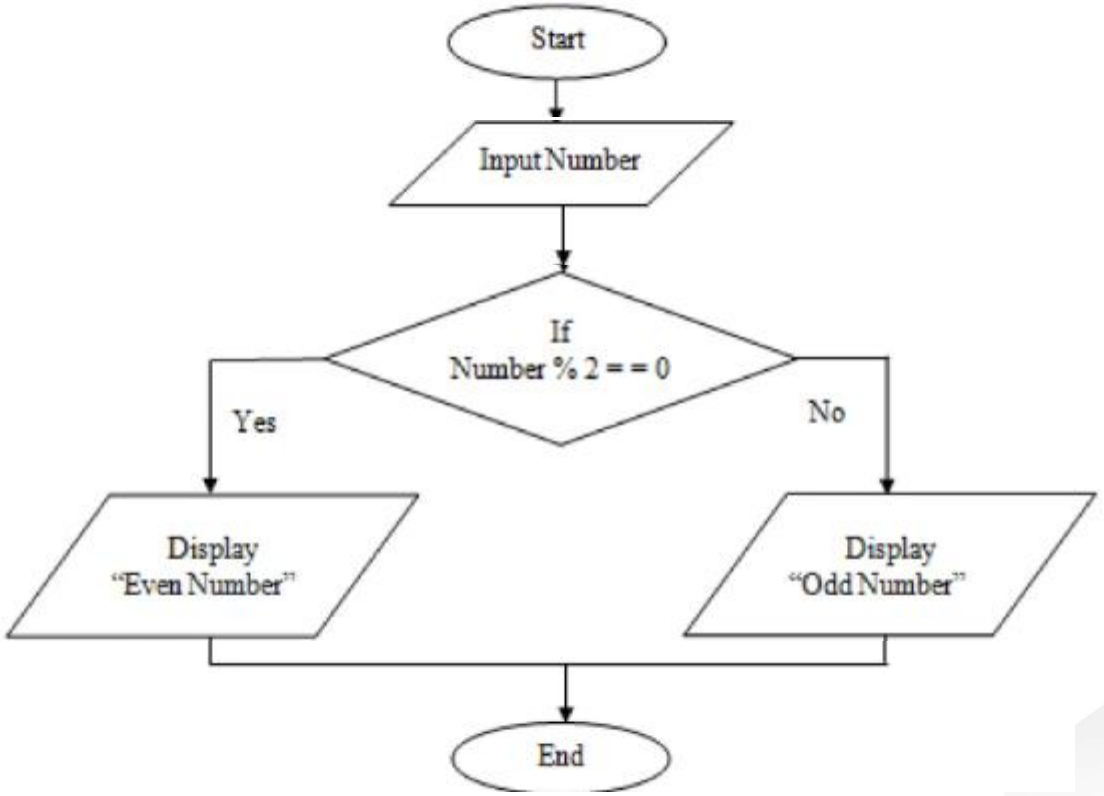
Example 3:

Design a flowchart that display the even number.



Quiz

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Quiz:

Write an algorithm and design a flowchart 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

Algorithm:

1.Start

2.Input: Input M1,M2,M3,M4.

3.Compute: GRADE ← (M1+M2+M3+M4)/4

4. **Print:** if (GRADE < 50) then
Print "FAIL"
else
Print "PASS"
endif

5. **Stop**

Flowchart

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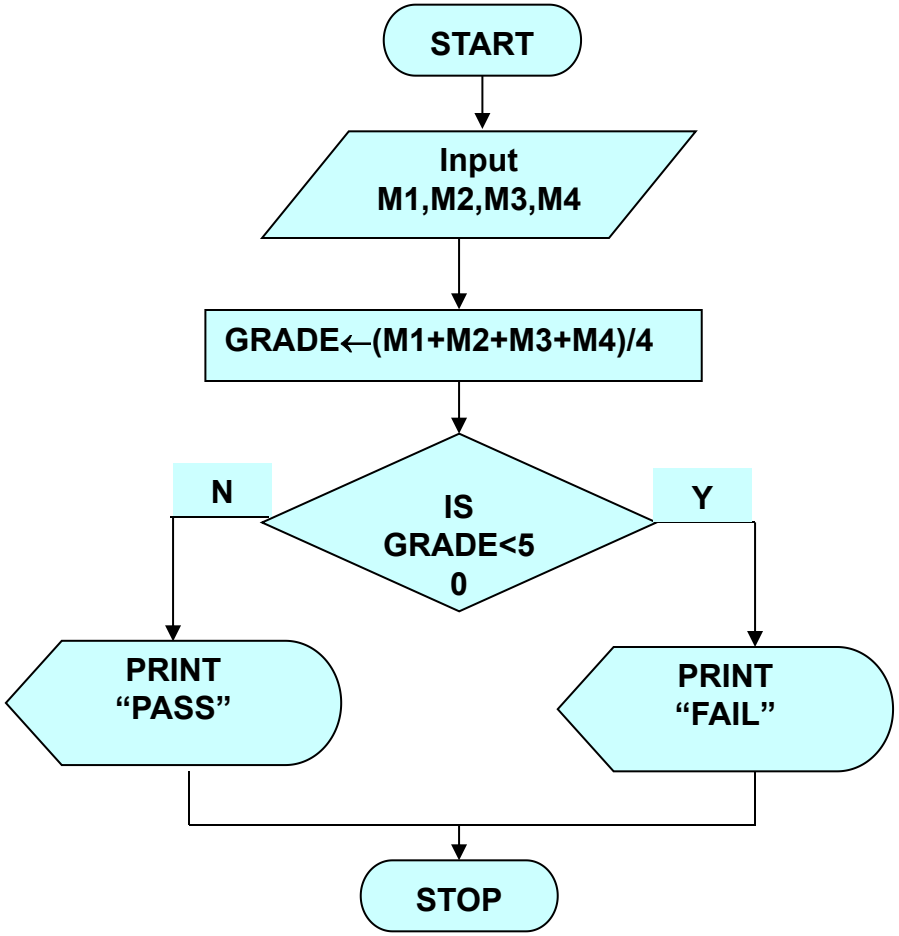
Quiz (Cont.):



Looping in Problem-Solving

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Looping: A control structure that allows a set of instructions to be repeated multiple times until a specific condition is met.

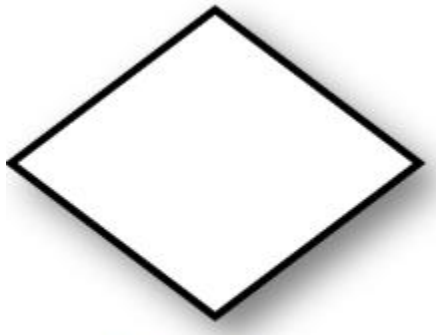
❖ **Why Looping is Important:**

- Reduces code redundancy.
- Simplifies repetitive tasks.
- Essential for processing large datasets or performing iterative calculations.

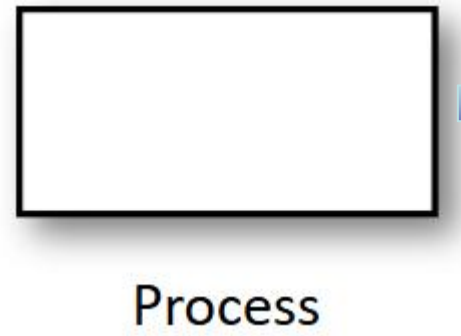
❖ **Common Types of Loops:**

- **For Loop:** Used when the number of iterations is known.
- **While Loop:** Used when the number of iterations is unknown, and the loop continues until a condition is met.
- **Do-While Loop:** Similar to a while loop, but the condition is checked after the loop body is executed.

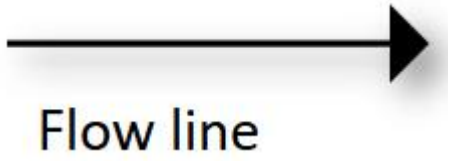
Flowchart Symbols for Looping



Used to check the loop condition (e.g., "Is the condition true?").



Represents the actions to be repeated in the loop.



Flowchart for a For Loop

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Example 1: Write an algorithm and Design a flowchart for a loop that prints numbers from 1 to 5.

Algorithm:

1. Start.

2. Initialize a counter i = 1.

3.Check if i <= 5:

If true, proceed to step 4.
If false, go to step 6.

4.Print the value of i.

5.Increment i by 1 (i = i + 1), then go back to step 3.

6.Stop.

Flowchart for a For Loop

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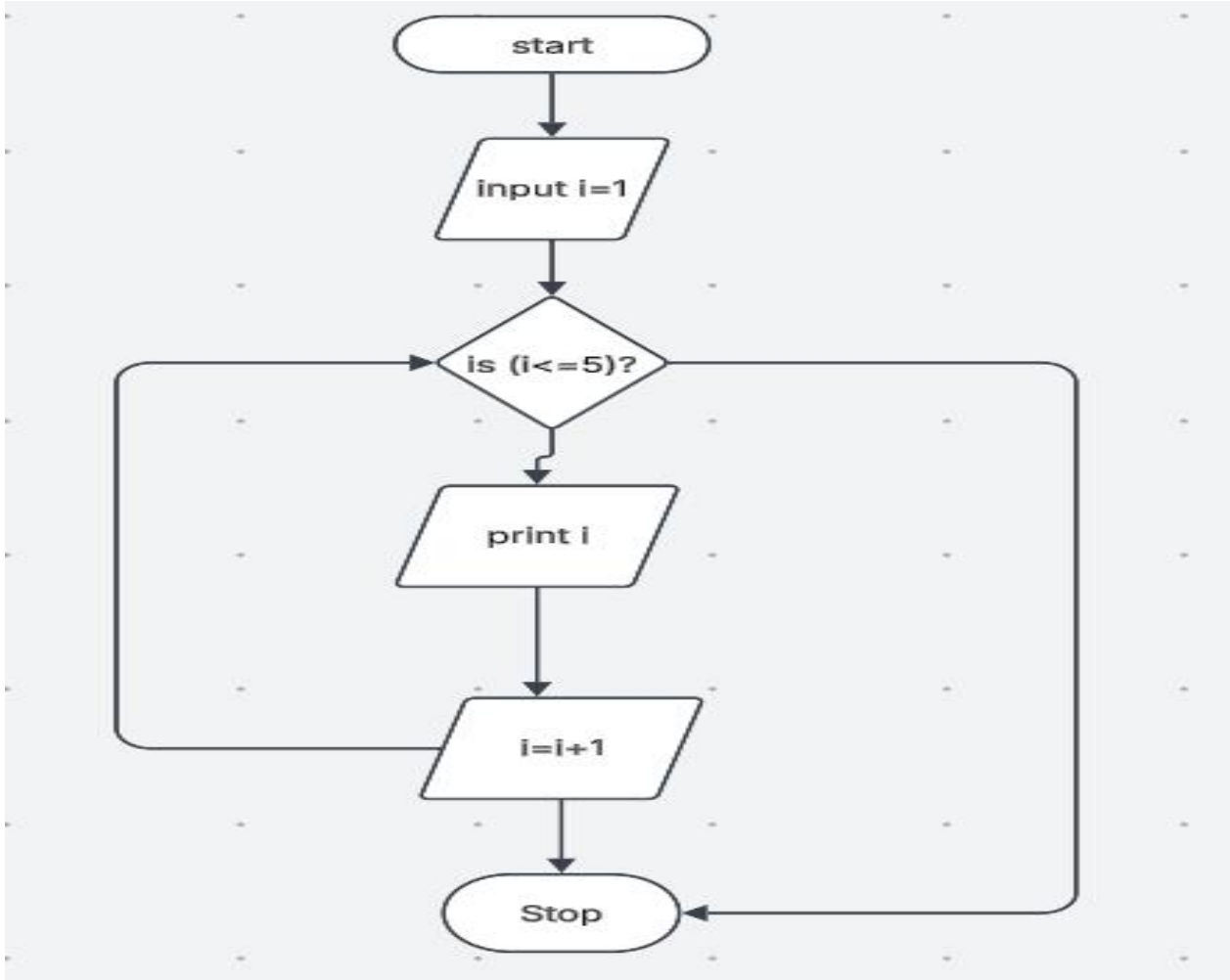
Example 1 (Cont.):



Flowchart for a For Loop

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Example 2: While Loop (Validate User Input>0)

Algorithm:

1. Start.

2.Ask the user for input (e.g., "Enter a number greater than 0").

3.Read the input value**.**

4.Check if the input is valid (e.g., input > 0):

If true, proceed to step 5.

If false, go back to step 2.

5. Print "Valid input received."
6. Stop.

Flowchart for a For Loop

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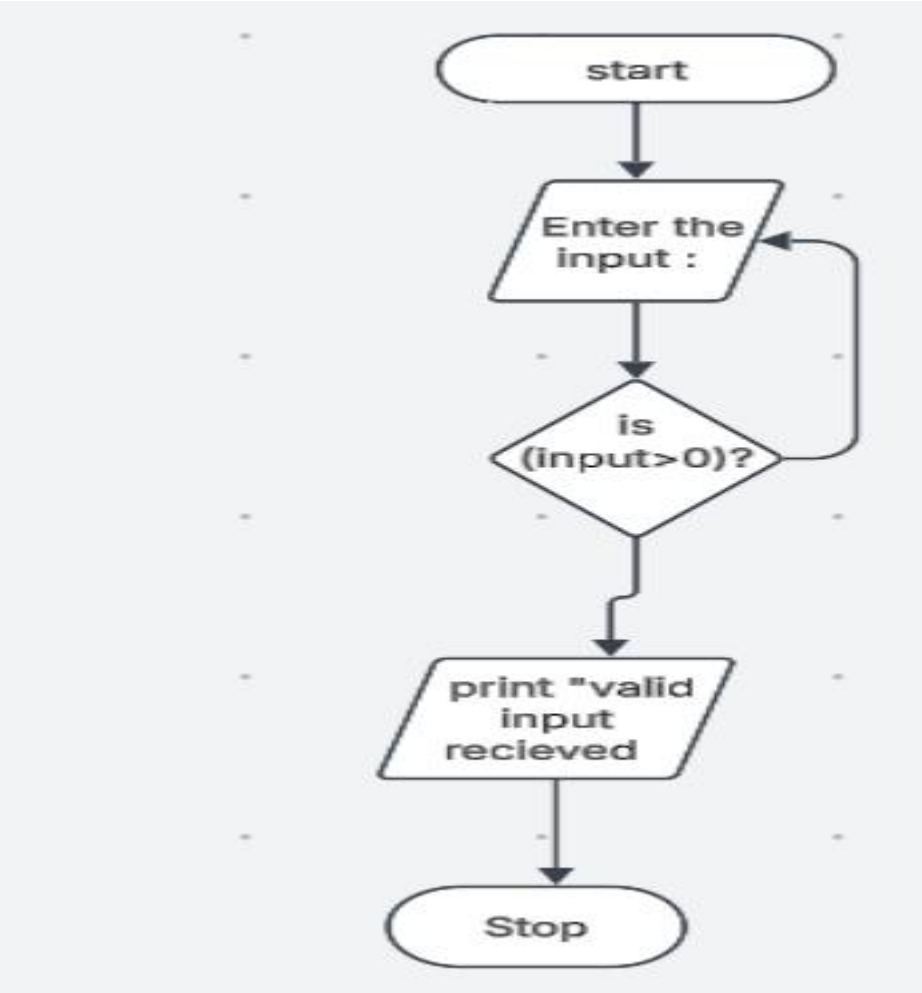
Example 2 (Cont.):



Flowchart for a For Loop

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Example 3: DO-While Loop (Sum of User Inputs Until 0 is Entered)

Algorithm:

1.Start.
2.Initialize a variable sum = 0.
3.Do the following:
4.Ask the user for input (e.g., "Enter a number ").
5.Read the input value.
6.Add the input value to sum (sum = sum + input).
7.Check if the input is 0:
If true, proceed to step 8.
If false, go back to step 3.
8.Print the value of sum.
9.Stop.

Flowchart for a For Loop

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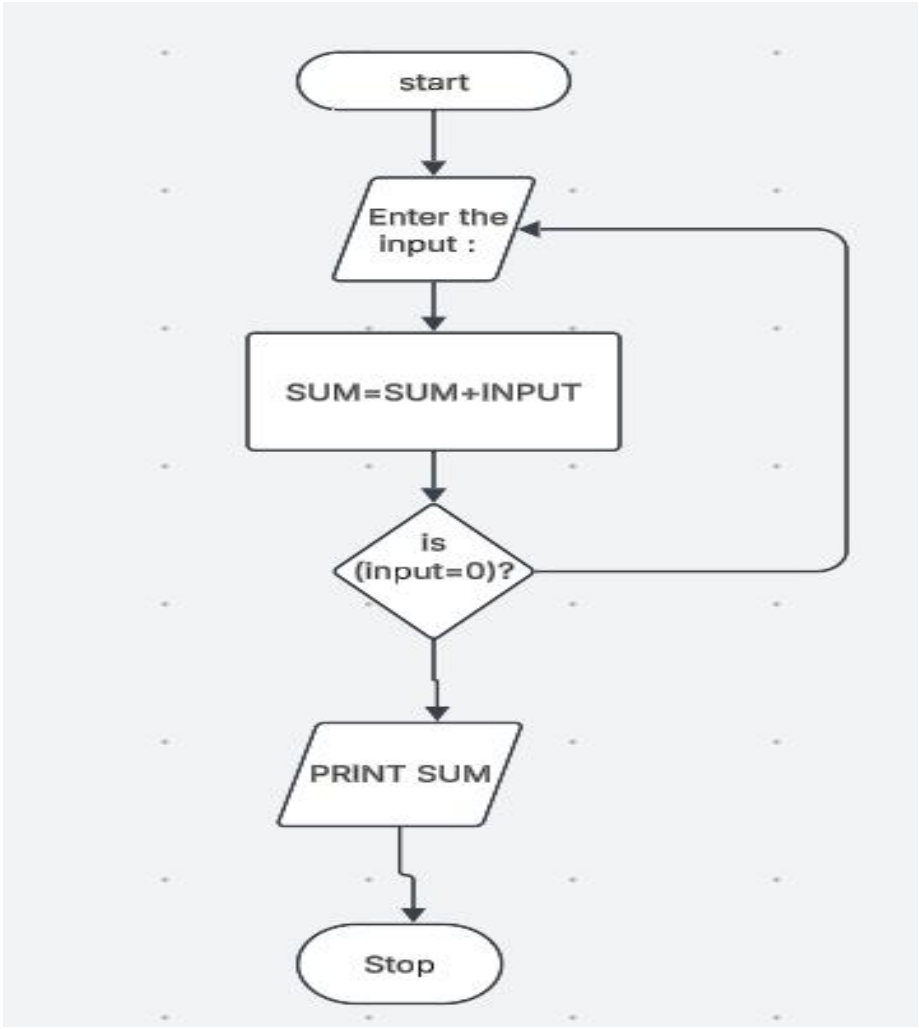
Example 3 (Cont.):



Flowchart for a For Loop

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Example 4: Nested Loops (Print Multiplication Table 1x1 to 5x5)

Algorithm:

1.Start.
2.Initialize an outer loop counter i = 1.
3.Check if i <= 5:
If true, proceed to step 4.
If false, go to step 10.
4.Initialize an inner loop counter j = 1.
5.Check if j <= 5:
If true, proceed to step 6.
If false, go to step 8.
6. Calculate the product result = i * j.
7.Print the result (e.g., "i x j = result").
8.Increment j by 1 (j = j + 1), then go back to step 5
9. Increment i by 1 (i = i + 1), then go back to step 3.
10. Stop.

Flowchart for a For Loop

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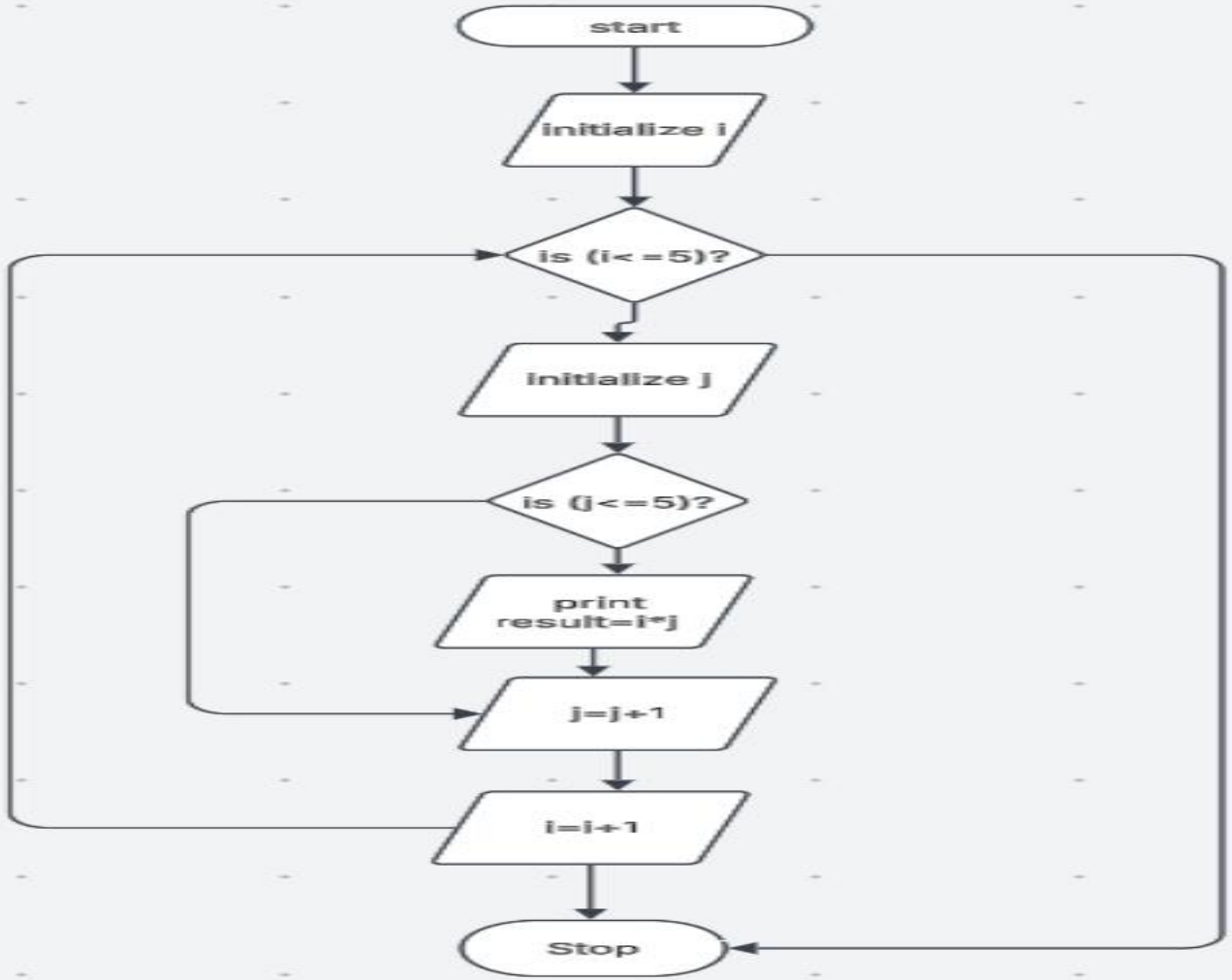
Example 4 (Cont.):



Flowchart for a For Loop

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Example 5: Loop to Print Even Numbers Between 1 and 10

Algorithm:

1.Start.
2.Initialize a counter i = 1.
3.Check if i <= 10:
If true, proceed to step 4.
If false, go to step 7.
4.Check if i is even (i % 2 == 0):
If true, print i.
If false, go to step 5.
5.Increment i by 1 (i = i + 1).
6.Go back to step 3.
7.Stop.

Flowchart for a For Loop

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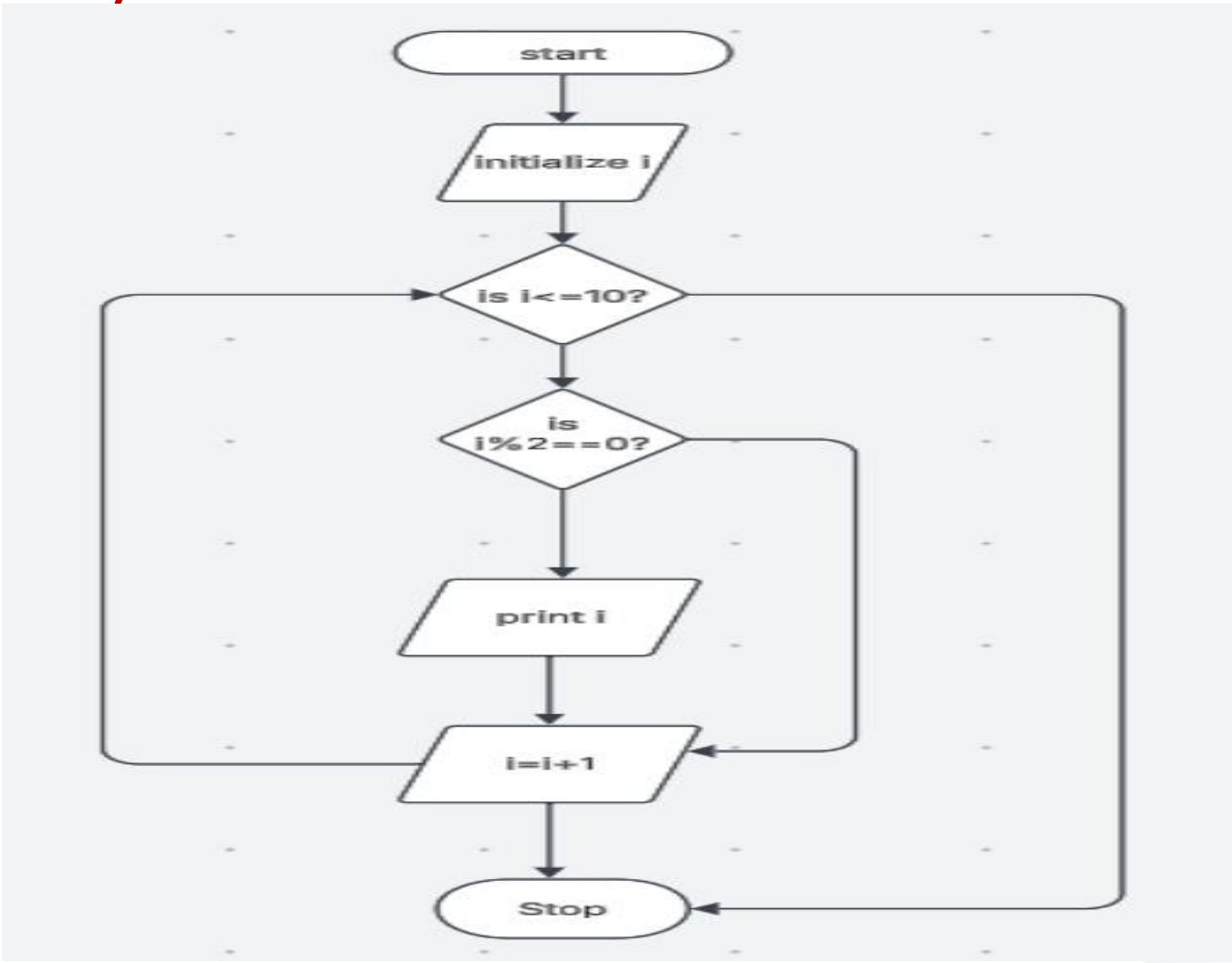
Example 5 (Cont.):



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THANK YOU