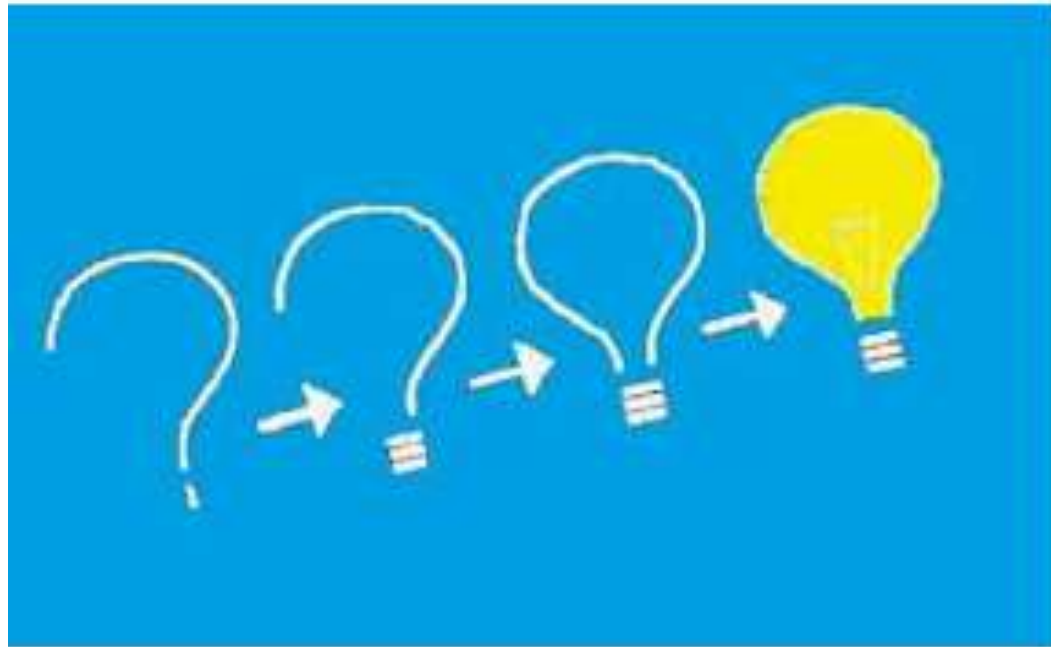


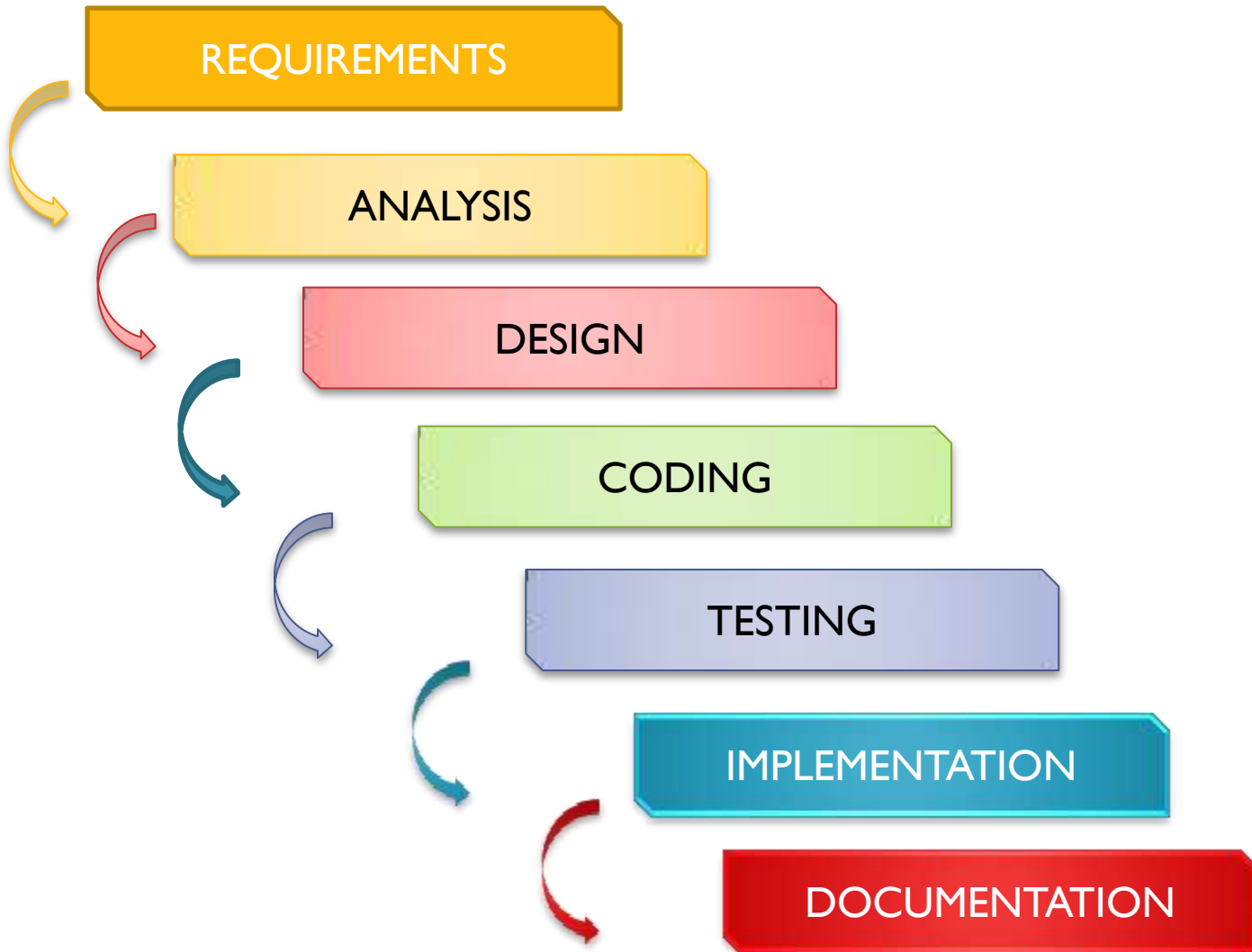
Introduction to Problem Solving



What is Problem solving?

- Problem solving is a process of transforming the description of a problem into the solution of that problem by using our knowledge of the problem domain and by relying on our ability to select and use appropriate problem-solving Strategies, Techniques and Tools.
- Problem solving (with in the context of developing programs) refers to analyzing a problem with the intention of deriving a solution for the problem

SDLC – Software Development Life Cycle



REQUIREMENTS

- ❖ What the problem is?
- ❖ What is needed to solve it?
- ❖ What the solution should provide
- ❖ If there are constraints and special conditions?

ANALYSIS

- **INPUTS:** To the problem, their form and the input media to be used.
- **OUTPUTS:** Expected from the problem, their form and the output media to be used.
- Special constraints or (necessity) conditions (if any).
- Formulas or equations to be used

DESIGN

- In Design phase, we design the proposed solution without writing a computer program by using the techniques:
 - Algorithm
 - Pseudocode
 - Flow Chart

Coding

- It is the process of transforming design (Algorithm, Pseudocode, Flow Chart) in a computer program using any programming language.
- The output of program must be the solution of intended problem.

Testing

- program testing is the process of executing a program to demonstrate its correctness.
- Program verification is the process of ensuring that a program meets user requirement
- After the program is compiled we must run the program and test/verify it with different inputs before the program can be released to the public or other users (or to the instructor of this class)

Implementation

- It is the process of installing the software developed on customer's site.
- Installation may be done by replace the entire manual work with the software developed or in a pilot mode i.e. running the manual and automated system in parallel or installing only a part module with manual work.
- It also involves training of software to the intended users.

Documentation

- Contains details produced at all stages of the program development cycle.

Can be done in 2 ways

- * writing comments between your line of codes.
 - * Creating a separate text file to explain the program.
- Important not only for other people to use or modify your program, but also for you to understand your own program after along time.

Algorithm

[Watch on YouTube](#)

- An algorithm is a list of steps to be executed with the right order in which these steps should be executed.
- According to D.E. Knuth, an algorithm has the following characteristics:
 - ◆ An algorithm has fixed number of steps.
 - ◆ Each step in an algorithm specifies the action to be performed.
 - ◆ The steps in an algorithm specify basic operations.
 - ◆ An algorithm accepts input data.
 - ◆ An algorithm generates one or more outputs after the input is processed

Algorithm to withdraw money from ATM

- ◆ The algorithm to withdraw a required amount from an ATM will be:
 1. Start the algorithm.
 2. Go to any local ATM.
 3. Insert/swipe your ATM card.
 4. Press the language button that you want to choose.
 5. Enter the pin code number.
 6. Press the account type (Savings or Current) button from which you want to withdraw the money.
 7. Press the cash withdrawal button.
 8. Enter the amount you want to withdraw.
 9. Collect the amount from the ATM machine.
 10. Collect the statement from the ATM machine.
 11. Collect your ATM card.
 12. End the algorithm.

Algorithm of getting out of bed and prepare to go to work

1. Get out of Bed.
2. Take Shower.
3. Get Dressed

If a same steps are performed in a slightly different order:

1. Get out of Bed.
2. Get Dressed.
3. Take Shower

What will be the result?

Just a minute...

- ◆ Write an algorithm to accept two numbers, divide the first number by the second, and display their quotient.
 - ◆ *Allocated time to solve the problem is 05 minutes.*
- ◆ Write an algorithm that accepts distance in kilometers, converts it into meters, and then displays the result.
 - ◆ *Hint: Distance in meters = Distance in kilometers * 1000*
 - ◆ *Allocated time to solve the problem is 05 minutes.*
- ◆ Write an algorithm that accepts five numbers and displays the sum and average of the numbers.
 - ◆ *Allocated time to solve the problem is 05 minutes.*

Solution - I

1. Start the algorithm.
2. Get the first number.
3. Get the second number.
4. Divide the first number by the second.
5. Display the quotient.
6. End the algorithm.

A diagram illustrating the division of 72 by 9. It consists of five green rounded rectangular boxes. The first box contains the number 72. To its right is a blue division symbol (\div). The second box contains the number 9. To its right is a blue equals symbol ($=$). The final box contains the number 8. Above the first box is another box containing 72, and above the second box is another box containing 9, mirroring the numbers in the main equation.

$$72 \div 9 = 8$$

Solution - 2

1. Start the algorithm.
2. Get the distance in kilometers.
3. Multiply the distance by 1000.
4. Display the result of multiplication as distance in meters.
5. End the algorithm.

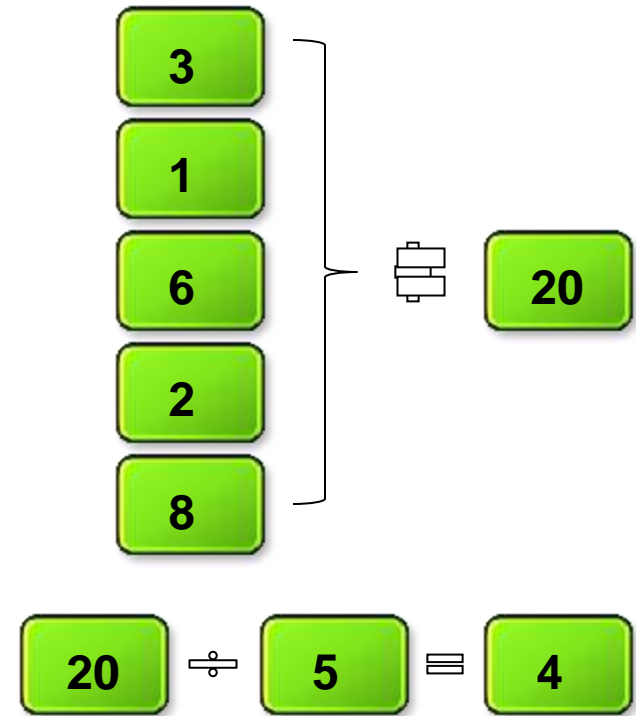
A diagram illustrating the multiplication step of the algorithm. It features three green rounded rectangular boxes. The first box contains the number '50'. To its right is a multiplication symbol '×'. The second box contains the number '1000'. To its right is an equals sign '='. The final box contains the result '50000'. Above the first box, there is another green rounded rectangular box containing the number '50'.

$$50 \times 1000 = 50000$$

Distance in meters: 50000

Solution - 3

1. Start the algorithm.
2. Get the first number.
3. Get the second number.
4. Get the third number.
5. Get the fourth number.
6. Get the fifth number.
7. Add the five numbers.
8. Divide the sum by 5.
9. Display the addition as sum and result of division as average.
10. End the algorithm.



Sum = 20
Average = 4

Flowchart

- Flowchart is a graph used to depict or show a step by step solution using symbols which represent a task.
- The symbols used consist of geometrical shapes that are connected by flow lines.
- It is an alternative to pseudo coding, where as a pseudo code description is verbal. A flowchart is graphical in nature

Advantages & Disadvantages of Flow Chart

ADVANTAGES

- ◆ It helps in analyzing the problems effectively.
- ◆ It acts as a guide during the program development phase.
- ◆ It help easy debugging of logical errors

DISADVANTAGES

- ◆ A lengthy flowchart may extend over multiple pages, which reduces readability.
- ◆ Drawing a flowchart is time consuming.
- ◆ The changes made to a single step may cause redrawing the entire flowchart

Flowchart Symbols



Terminal: the beginning and end points of an algorithm.



Process: shows an instruction other than i/p, o/p or selection.



Input-output: shows an input or an output operation.



Disk storage i/o: indicates i/p from or o/p to disk storage.



Printer output: shows hard copy printer output.



Selection: shows a selection process for two-way selection.

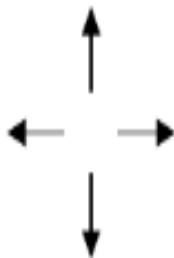
Flowchart Symbols



Off- page connector: its provide continuation of a logical path on another page.

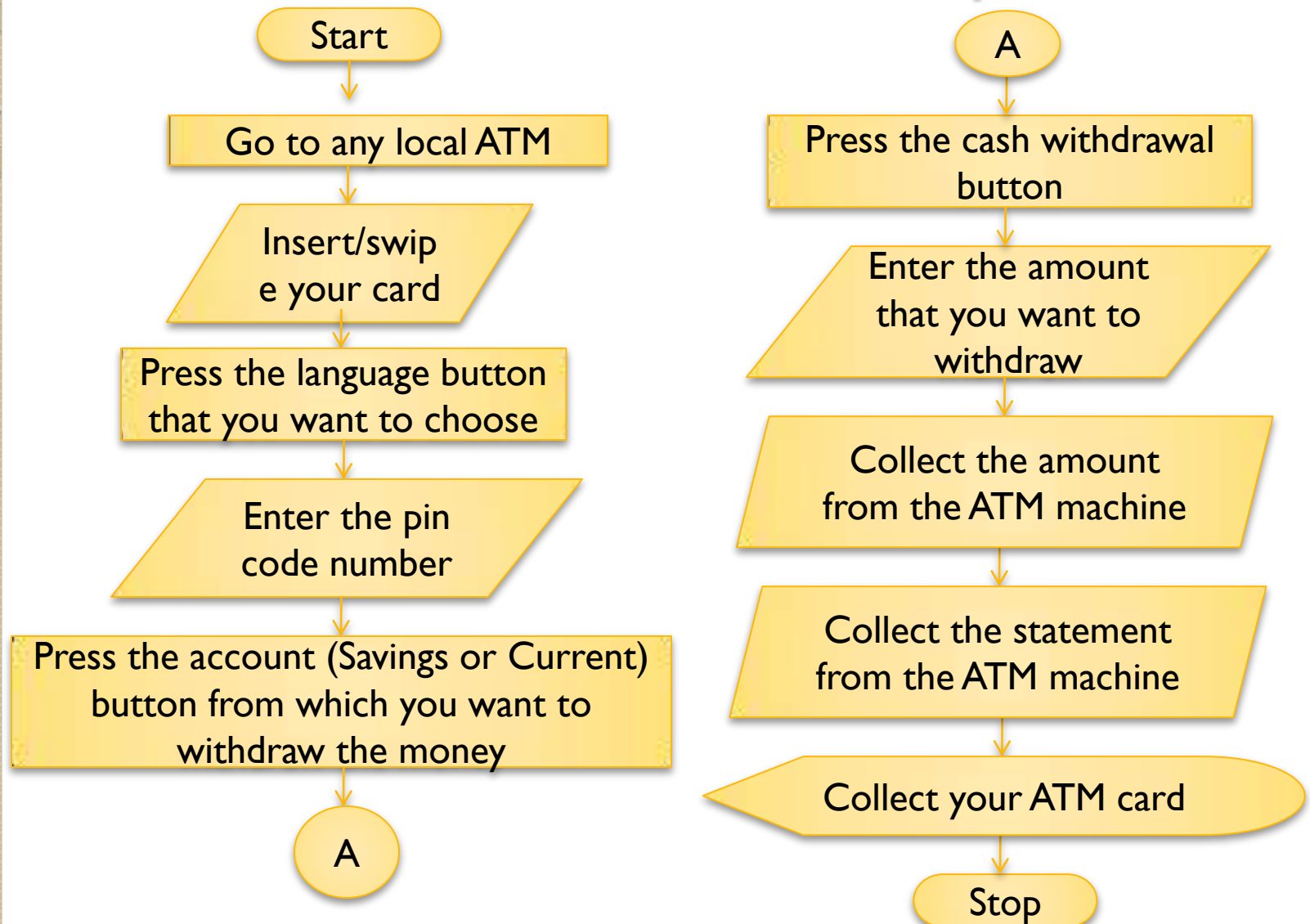


On-page connector: its provide continuation of a logical path on another point in the same page

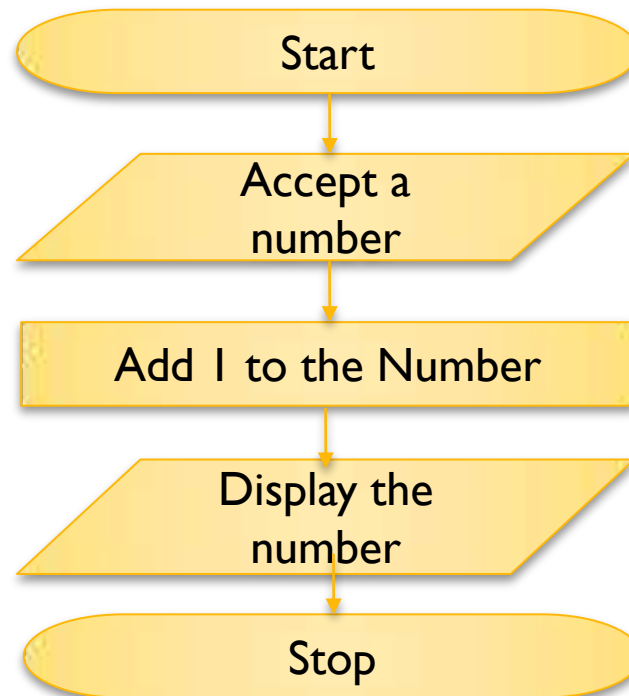


Flow lines: indicate the logical sequence of execution steps in the algorithm.

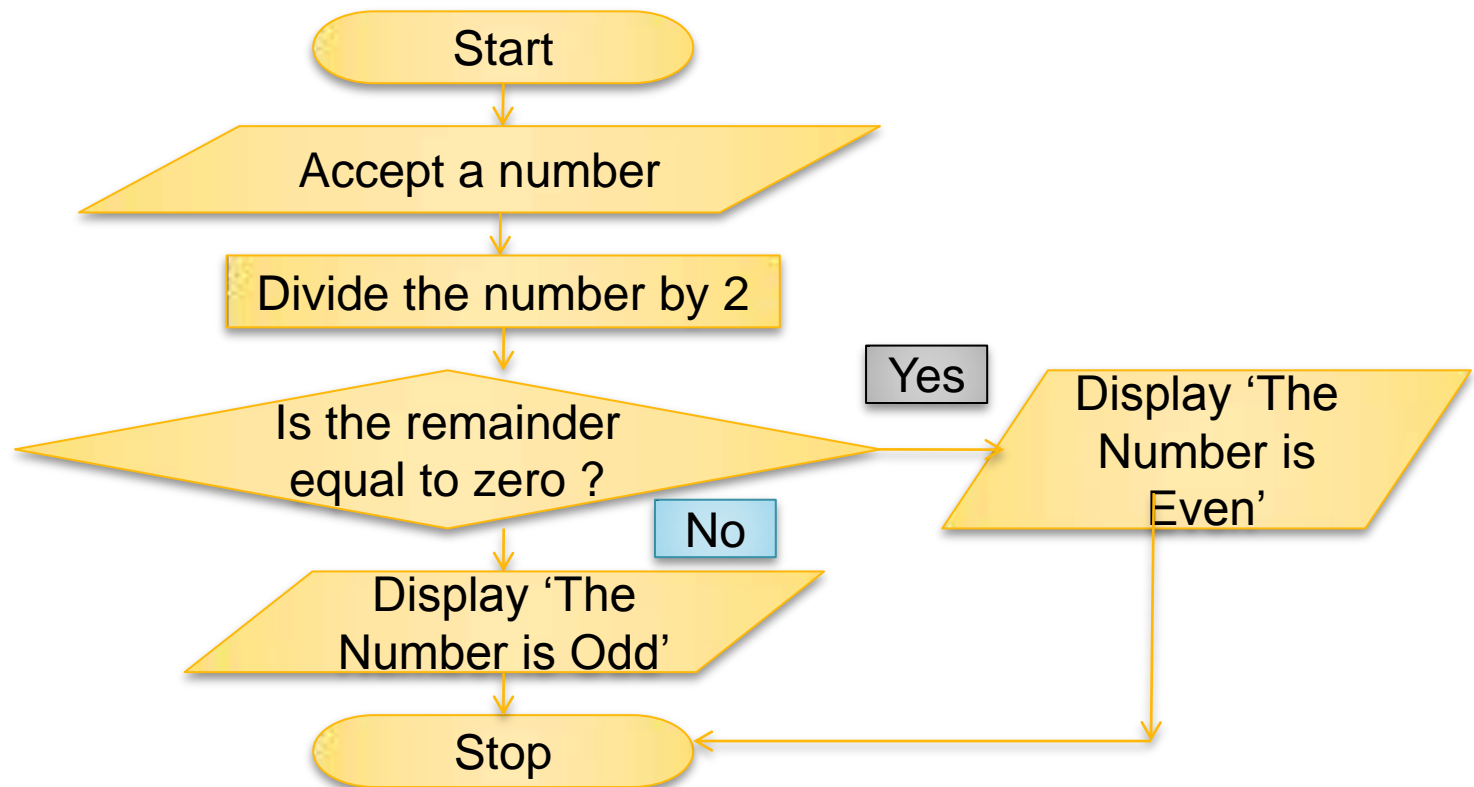
Flowchart – To withdraw money from ATM



Flowchart – To accept a number and increment by 1, and display the result



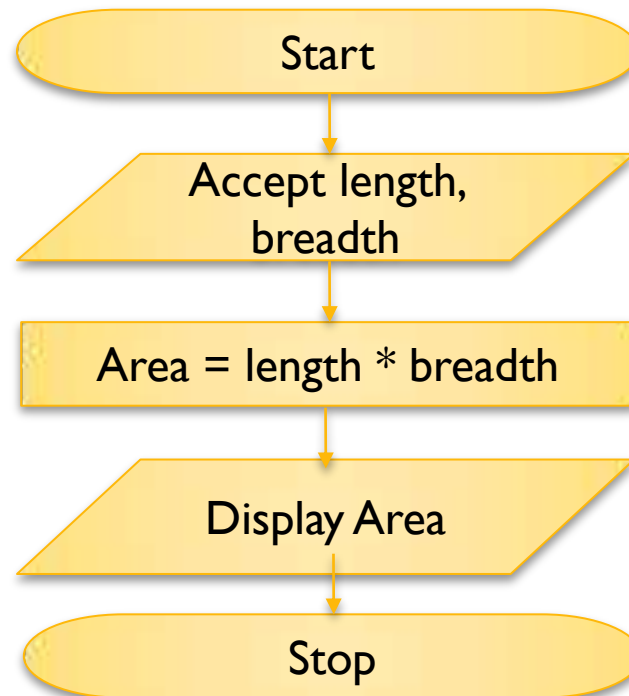
Consider an example where you need to determine whether a number is even or odd. This problem can be solved based on the condition that the number should be divisible by 2. If the number is divisible by 2, it should display the message, 'The Number is Even', otherwise 'The Number is Odd'.



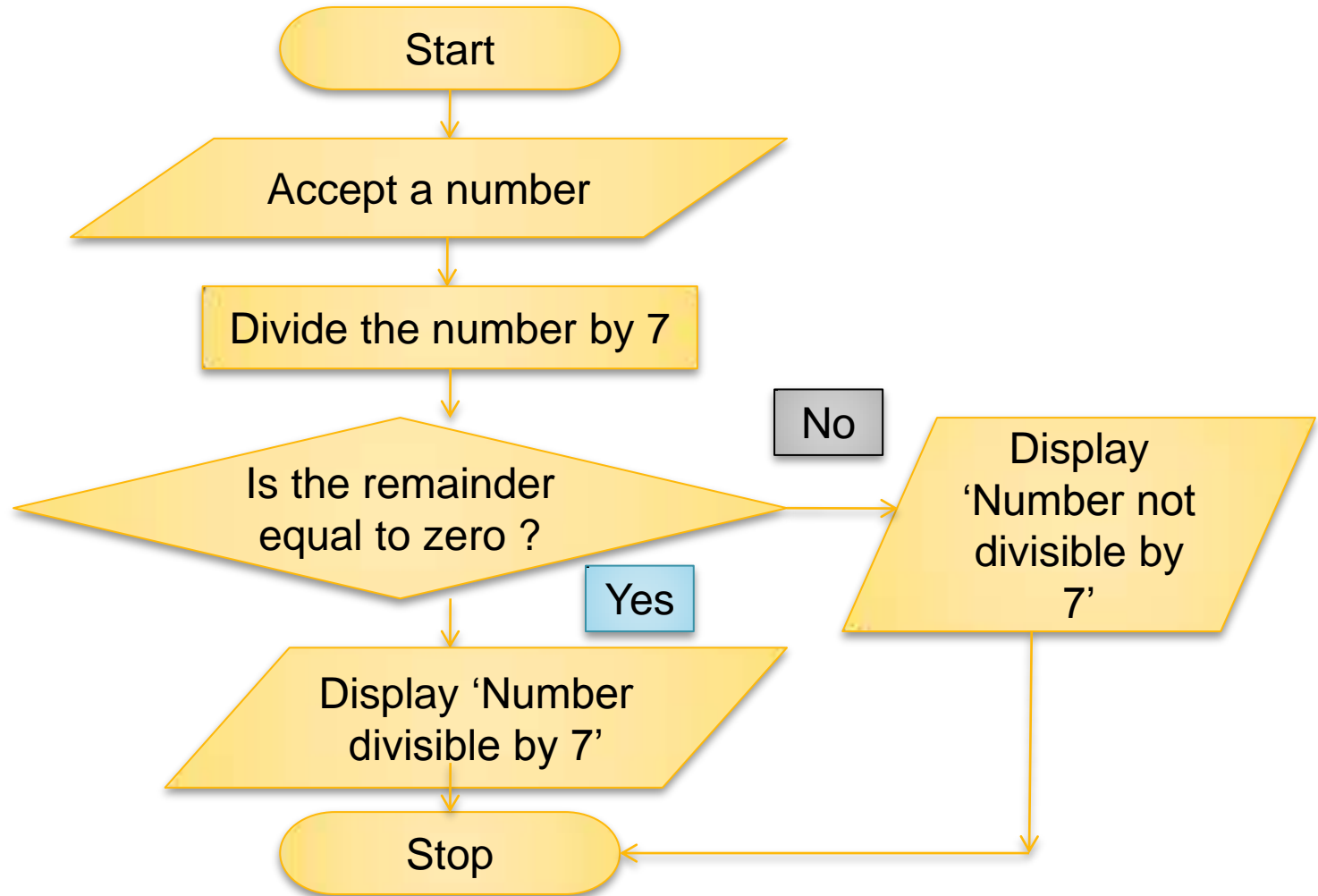
Just a Minute...

- Write a flow chart to calculate area of rectangle
 - *Allotted Time: 05 minutes*
- Write a flow chart to enter any number and check it is divisible by 7 or not
 - *Allotted Time: 05 minutes*

Solution - I



Solution - 2



Pseudocode

- It is a formal way of writing the program logic whereas algorithm is an informal way of writing program logic
- It is detailed yet easy description of what algorithm must do.
- It is written in formally styled-English language
- It is used as an initial step in the process of developing of program
- Provide detailed template to programmers.
- It is language independent i.e. it can be converted to program by using any programming language.

Pseudocode

- In Pseudocode we can use few special words for determining the actions like
 - Accept/input
 - Display/print
 - If / else
 - Repeat
 - Start
 - End
 - Goto

Example – to input 2 number and display the sum

1. START
2. INPUT A, B
3. $TOTAL = A + B$
4. PRINT TOTAL
5. END

Example – to enter a number and check it is even or odd

1. START
2. INPUT NUM
3. IF NUM MOD 2 = 0 THEN
4. PRINT “NUMBER IS EVEN”
5. ELSE
6. PRINT “NUMBER IS ODD”
7. END

MOD (%) is used to find out remainder by dividing 2

Types of Control program structure

- In computer program there are mainly 3 types of control statements:
 1. Sequential
 2. Selection
 3. Iteration

Sequential

- A series of steps or statements that are executed in a specific order.
- The beginning and end of a block of statements can be optionally marked with the keywords begin & end.
- Example:
 1. Statement 1
 2. Statement 2
 3. Statement 3
 4. .
 5. Statement n
- Here each statement will be executed one by one

Example – to swap 2 numbers

1. START
2. INPUT A, B
3. $C = A$
4. $A = B$
5. $B = C$
6. PRINT A,B
7. END

In this Pseudocode, each instruction will be executed one by one without any jump

Let us input $A=10$, $B = 20$
 $C = A$ ($C = 10$)
 $A = B$ ($A = 20$)
 $B = C$ ($B = 10$)

We can clearly observe the values of A and B are exchanged

Can you all think of another method for the same problem without using 'C'
Hint: use arithmetic operation

Selection

- It determine two course of action depending upon the condition.
- A condition is given here, which will result in either True(1) or False (0)
- The keyword either if and else (almost all programming language also support this keyword)
- It is also known as branching statement, because it provide two branch, one for True and another for False. Branching will be done depending upon the condition.

Example- to input age and check age is eligible for voting or not

1. START
2. INPUT AGE
3. IF AGE \geq 18 THEN:
4. PRINT "ELIGIBLE FOR VOTING"
5. ELSE
6. PRINT "NOT ELIGIBLE FOR VOTING"
7. END

LET US TAKE INPUT IN AGE IS 29, THEN

**IF AGE \geq 18 (TRUE) SO
OUTPUT WILL BE
"ELIGIBLE FOR VOTING"**

**NOW TAKE AGE=14
IF AGE \geq 18 (FALSE) SO
"NOT ELIGIBLE FOR
VOTING" WILL BE PRINTED**

Iteration

- It specifies block of one or more statement that are repeatedly executed till condition remains true.
- Keyword used are :
 - While (supported by almost all programming language also)
 - If with go to (in Pseudocode only)
- Iteration consists of 3 main parts:
 1. *Initial value (from where iteration begins)*
 2. *Condition (upto what condition iteration will continues)*
 3. *Stepping (Increment/Decrement from Initial value to reach to condition)*

Example: To print all number from 1 to 100 (While)

1. START
2. $A = 1$ [INITIAL VALUE]
3. WHILE $A \leq 100$ [CONDITION]
4. PRINT A
5. $A = A + 1$ [INCREMENT]
6. END

Initially **A = 1**, Now condition will be checked **$A \leq 100$, will be true**, then it will **print 1**, now the value of **A will be increment by 1** i.e. becomes 2, now again condition will be checked, **True**, and this process will be continued, **After printing 100**, value of A will become 101, condition will be evaluated to **False**, and loop will end

Example: To print all number from 1 to 100 (if with go to)

1. START
2. $A = 1$ [INITIAL VALUE]
3. PRINT A
4. $A = A + 1$
5. IF $A \leq 100$ THEN GO TO STEP 3
6. END

Initially **A = 1**, It will print 1, after this value of A will be incremented by 1 i.e. 2, Now the condition will be checked, $A \leq 100$ ($2 \leq 100$) will be true so execution will move to step 3 i.e. it will print 2 and again incremented by 1 i.e. 3 and condition be will checked and printed, this process will be condition, when value of A becomes 101, Pseudocode will end

Just a Minute....

1. Write a Pseudocode to convert temperature in Fahrenheit to Celsius
2. Write a Pseudocode to input age and check age is teenager or not
3. Write a Pseudocode to print all the even numbers from 2 to 100
4. Write a Pseudocode to print all the odd numbers from 100 to 1