ALGORITHMS & FLOWCHARTS

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ALGORITHMS

- 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

ALGORITHMS

A sequence of activities to be processed for getting desired output from a given input.

Then we can say that:

1. Getting specified output is essential after algorithm is executed.
2. One will get output only if algorithm stops after finite time.
3. Activities in an algorithm to be clearly defined in other words for it to be unambiguous.

ALGORITHMS

- While writing algorithms we will use following symbol for different operations:
  - **+ for Addition**
  - **- for Subtraction**
  - *** for Multiplication**
  - **/ for Division and**
  - **← for assignment**
- For example A ← X*3 means A will have a value of X*3.

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

Type of Algorithms and Flowcharts

- The algorithm and flowchart, classification to the three types of ***control structures***.
- They are:

1. Sequence
2. Branching (Selection)
3. Loop (Repetition)

- These three control structures are sufficient for all purposes.

ALGORITHMS: Sequence

- The sequence is exemplified by sequence of statements place one after the other.
- The one above or before another gets executed first.
- In flowcharts, sequence of statements is usually contained in the **rectangular process box**.

ALGORITHMS

Example 2:

- Find the area of a Circle of radius r.

Algorithm:

Step1: Start
Step2: Read\input the Radius r of the Circle
Step3: Area ← PI*r*r // calculation of area
Step4: Print Area
Step5: End

ALGORITHMS

Example 3:

- Write an algorithm to read two numbers and find their sum.

Algorithm:

- Step1: Start
- Step2: Read\input the first num1.
- Step3: Read\input the second num2.
- Step4: Sum ← num1+num2 // calculation of sum
- Step5: Print Sum
- Step6: End

ALGORITHMS

Example 4:

- Convert temperature Fahrenheit to Celsius

Algorithm:

- Step1: Start
- Step 2: Read \Temperature in Fahrenheit F
- Step 3: C ←5/9*(F - 32)
- Step 4: Print Temperature in Celsius: C
- Step5: End

ALGORITHMS: Branching

- The branch refers to a **binary decision** based on some condition.
- If the condition is true, one of the two branches is explored; if the condition is false, the other alternative is taken.
- This is usually represented by the 'if-then' construct in pseudo-codes and programs.
- In flowcharts, this is represented by the **diamond-shaped decision box**. This structure is also known as the selection structure.

ALGORITHMS

Example 5:

- Find the greater number between two numbers

Algorithm:

- Step1: Start
- Step2: Read/input A and B
- Step3: If A greater than B then C=A
- Step4: if B greater than A then C=B
- Step5: Print C
- Step6: End

ALGORITHMS

Example 6:

- Find the result of equation $f(x)=\begin{cases}-x, & x<0\\ x, & x\geq 0\end{cases}$

Algorithm:

- Step1: Start
- Step2: Read/input X
- Step3: If X Less than zero then F=-X
- Step4: if X greater than or equal zero then F=X
- Step5: Print F
- Step6: End

ALGORITHMS

Example 7:

- Find the largest value of any three numbers.

Algorithm:

- Step1: Start
- Step2: Read/input A,B and C
- Step3: If (A>=B) and (A>=C) then Max=A
- Step4: If (B>=A) and (B>=C) then Max=B
- Step5:If (C>=A) and (C>=B) then Max=C
- Step6: Print Max
- Step7: End

ALGORITHMS: Loop

- The loop allows a statement or a sequence of statements to be repeatedly executed based on some loop condition.
- It is represented by the 'while', 'if' and 'for' constructs in most programming languages, for unbounded loops and bounded loops respectively.
- In the flowcharts, a back arrow hints the presence of a loop. A trip around the loop is known as **iteration**.

ALGORITHMS

Example 8:

- Calculate even numbers between 0 and 99

Algorithm:

- Step1. Start
- Step2. I ← 0
- Step3. Write I
- Step4. I ← I+2
- Step5. If (I <=98) then go to line 3
- Step6. End

ALGORITHMS

Example 9:

- Get a natural value n as its input and calculate odd numbers equal or less than n.

Algorithm:

- Step1. Start
- Step2. Read n
- Step3. I ← 1
- Step4. Write I
- Step5. I ← I + 2
- Step6. If (I <= n) then go to line 4
- Step7. End

ALGORITHMS

Example 10:

- Print even numbers between 1000 and 2000 and its sum.

Algorithm:

- Step1. Start
- Step2. I ← 1000 and S ← 0
- Step3. Write I
- Step4. S ← S + I
- Step5. I ← I + 2
- Step6. If (I <= 2000) then go to line 3
  else go to line 7
- Step7. Write S
- Step8. End

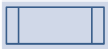
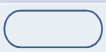
FLOWCHART

- The flowchart is a diagram which visually presents the flow of data through processing systems.
- A flow chart shows the operations performed and the sequence of these operations in a system.
- Algorithms are sequence of steps for solving problems. So a flow chart can be used for representing visually an algorithm.
- A flowchart, will describe the operations (and in what sequence) are required to solve a given problem.

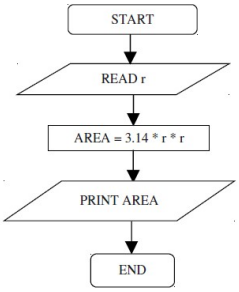
FLOWCHART

- A graphical representation of the sequence of operations in a program.
- Flowcharts show the sequence of instructions in a single program or subroutine.
- Different symbols are used to draw each type of flowchart.
- There are 6 basic symbols commonly used in flowcharting of Programs.
- Terminal, Process, input/output, Decision, Connector and Predefined Process.

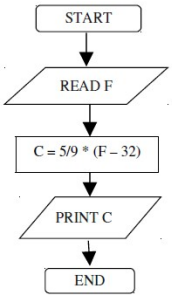
FLOWCHART

SYMBOL	NAME	FUNCTION
	**Process**	Indicates any type of internal operation inside the Processor or Memory.
	**Input / Output**	Used for any Input / Output (I/O) operation. Indicates that the computer is to obtain data or output results.
	**Decision**	Used to ask a question that can be answered in a binary format (Yes/No, True/False).
	**Connector**	Allows the flowchart to be drawn without intersecting lines or without a reverse flow.
	**Predefined Process**	Used to invoke a subroutine or an Interrupt program.
	**Terminal**	Indicates the starting or ending of the program, process, or interrupt program
	**Flow Lines**	Shows direction of flow.

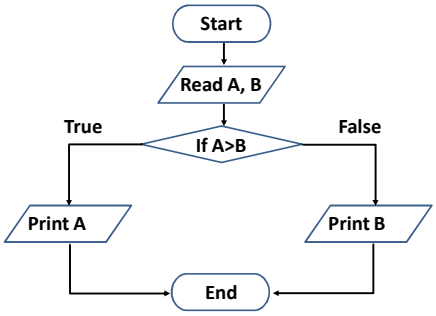
Problem1: Find the area of a circle of radius r.



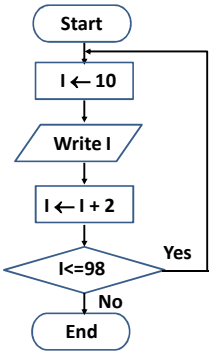
Problem 2: Convert temperature Fahrenheit to Celsius.



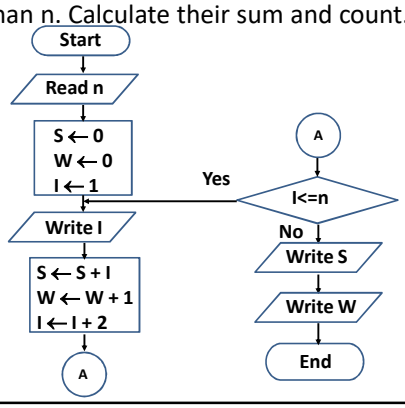
Problem 3: Find the greater number between two numbers.



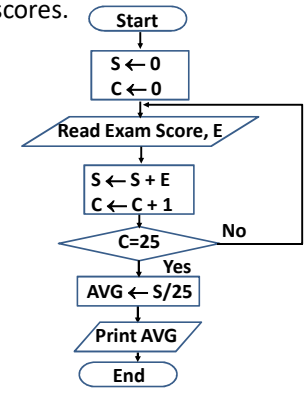
Problem 4: Flowchart for the problem of printing even numbers between 9 and 100:



Problem7: Flowchart for printing odd numbers less than n. Calculate their sum and count.



Problem8: Flowchart for the calculate the average from 25 exam scores.



FLOWCHART

Advantages of using Flowcharts

- Communication
- Effective analysis
- Documentation of Program/System
- Efficient Program Maintenance
- Coding of the Program

FLOWCHART

1. Draw flowchart to find average age of a group of 10 players?
2. Draw flowchart to find factorial of N?
3. Draw a flowchart to find the sum of first 100 natural numbers.
4. Draw a flowchart to find the largest of three numbers x, y and z.
5. Draw a flowchart which generates first 50 items of the Fibonacci series: 1, 1, 2, 3, 5, 8,…?
6. Draw a flowchart for the problem of determining prime number?