Algorithm and Flowchart

Dear teacher,
What do the terms Algorithm and Flowchart mean? What is their significance in programming?

Dear students,
In this chapter we shall learn about algorithms and flowcharts.

Computer solves the problems by following the instructions given to it. Every time we need the same task to be done by the computer, we have to feed it the same instructions again. To avoid this, we can save those instructions in the computer. Such set of instructions is called program. The programs are written using various programming language such as C, C++, Java, Python, VB, C# etc.

Amazing Fact

You can add 2 + 2 quickly and give the answer 4, but a computer can give the answer only if it has proper instructions to add the numbers i.e, how to add the numbers. And the instructions should be in a computer language.

Algorithm

The logical sequence of steps for a program is called algorithm. It is written in simple English.

Algorithm helps in understanding the flow of the intended program easily. Another advantage of algorithm is to use it to develop its graphical form called *Flowchart*.

Advantages of Algorithm

- It is the set of steps arranged in a logical sequence as a solution to a given problem.
- It makes it easier to create the graphical representation of the program flow called flowchart.
- It is in human language (English in our case) hence easy to understand.
- It is easy to find logical errors since every step has its own logical sequence.

Example 1: To calculate the sum of three numbers.

1. Start.
2. Input three numbers; x, y and z.
3. Calculate the sum of three numbers (x + y + z).
4. Print the sum.
5. Stop.

Example 2: To find the greater of two numbers.

1. Start.
2. Input two numbers, X and Y.
3. Compare X and Y. If both are equal, go to step 5, else go to step 4.
4. Compare if X is greater, go to step 6, else go to step 7.
5. Print "Both are equal" and go to step 8.
6. Print "X is greater" and go to step 8.
7. Print "Y is greater" and go to step 8.
8. Stop.

Do it Yourself

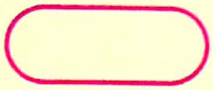
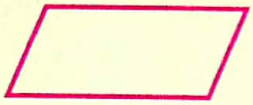
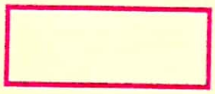
Write an algorithm to find the greater of three numbers.

Amazing Fact

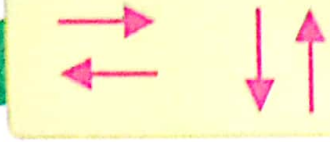
A flow chart generally flows in the direction from top to bottom or left to right.

Flowchart

A flowchart is a graphical representation of steps of an algorithm. It is a set of different types of boxes and symbols that are connected with arrows/flow lines.
Some common blocks and symbols used to create a flowchart are given here.

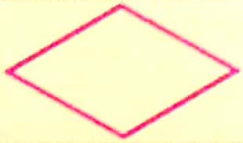
Start/Stop Box		An oval represents the start or end point.
Input/Output Box		A parallelogram represents input or output.
Process Box		A rectangle represents a process.

Flow lines



The flow lines determine the flow through the chart i.e, they show the direction in which the program moves.

Decision Box



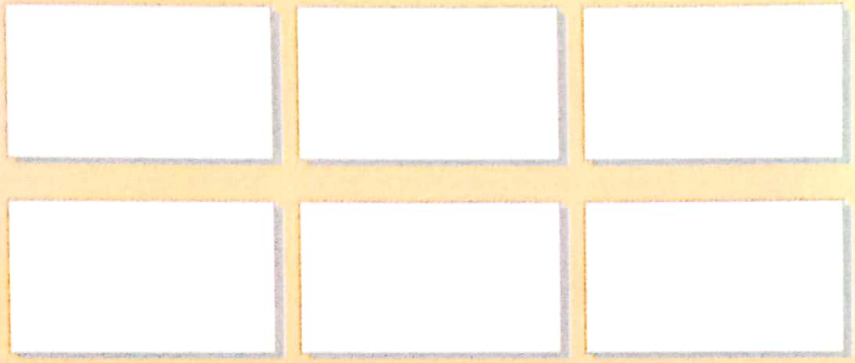
A decision/diamond box checks any condition in the program.

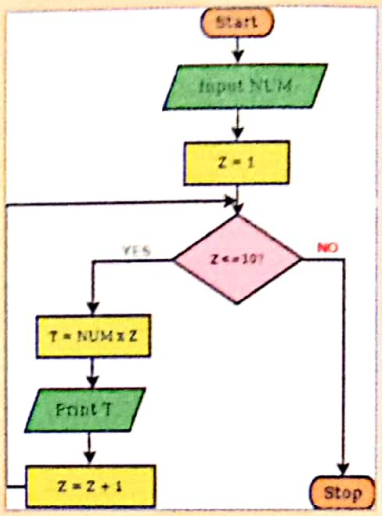
Connector

It connects one part of flow chart to another.

Do it Yourself

Identify the various parts of the given flowchart.





Advantages of flowchart

1. Flowcharts are an easier way to depict the logic of the program.
2. Flowcharts, being graphical, help greatly in problem analysis.
3. Flowcharts of any program are good for documentation and later reference.
4. A flowchart helps in debugging process (to remove errors).

Limitations of flowchart

1. For complex, large programs flowchart becomes complex and difficult to follow.
2. If alterations are required the flowchart may require re-drawing completely.

Drawing Flowcharts using Dia

Dia is an easy-to-use, free Flowchart designer. Dia comes as an .exe file so to ensure its clean and latest version, it is recommended to download it directly from http://dia-installer.de/. After downloading the .exe file, double click on it to launch it and follow the simple instructions on the installer screen to install it.

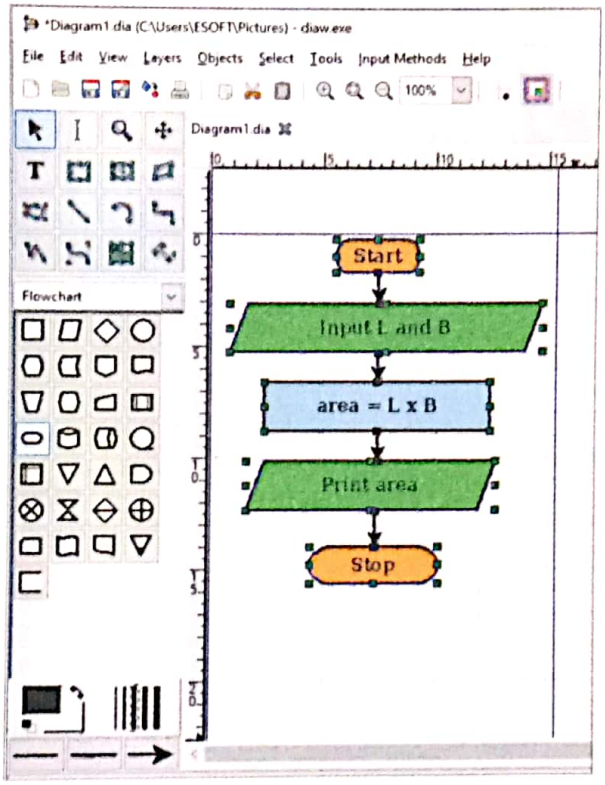
Dia Interface

Menu bar: A standard menu bar with various menus.

Standard toolbar: It provides quick tools like new, open, save, print and export diagram etc.

Diagram Canvas: It is the largest blank area where you can draw the desired diagrams.

Toolbox: All the blocks and connecters you need are available in the Toolbox. It also provides options for line widths and arrow styles.



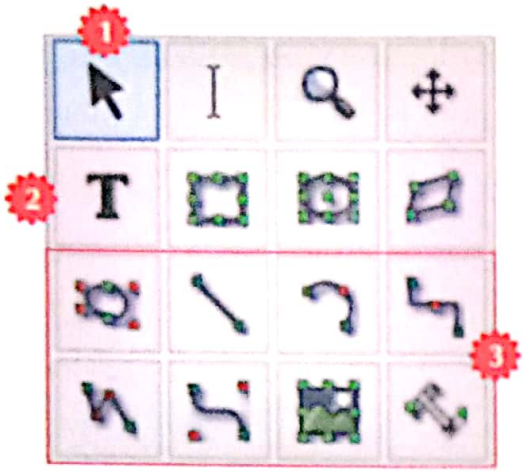
Drawing Flowcharts in Dia

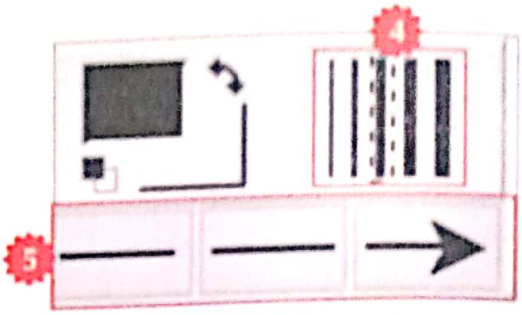
Click on the desired block in the Toolbox and drag with mouse on the Canvas. The block will be drawn.

Editing Tools

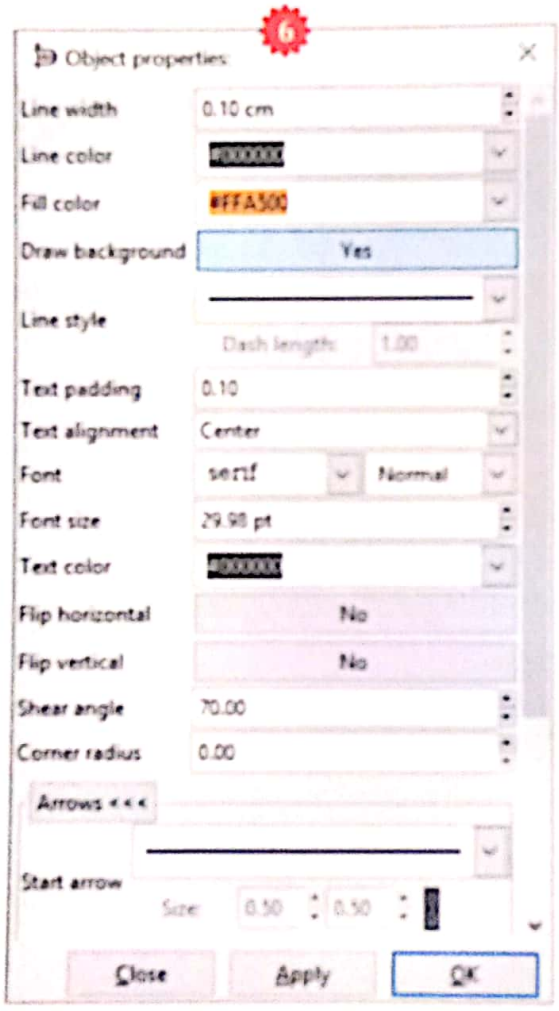
1. Use Arrow tool to move the shape around on the canvas.
2. Use Text edit tool to type text inside the block or press **F2** key on the keyboard.
3. Use Connecters to connect the blocks with lines and arrows.
4. Use Line widths to set the line thickness.
5. Use Arrow styles to set desired arrow style.
6. For font, lines and colour settings, double click on the desired block to edit its properties.

You can use File menu > Export option to export your chart as an image.





Line width and Arrow Styles



Converting an Algorithm into a Flowchart

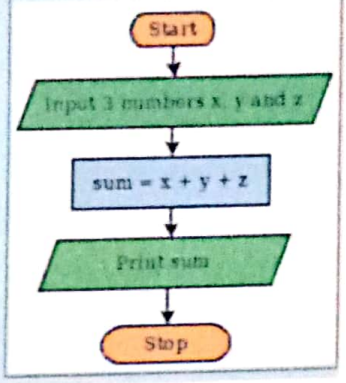
Flowcharts are usually drawn from top to bottom. To convert an algorithm into a flow chart, pick up each statement in the algorithm and find the suitable, matching block of flowchart. Then connect them from top to bottom or left to right as the space on the paper allows. Let us see some examples now.

Example 1: To calculate the sum of three numbers.

Algorithm

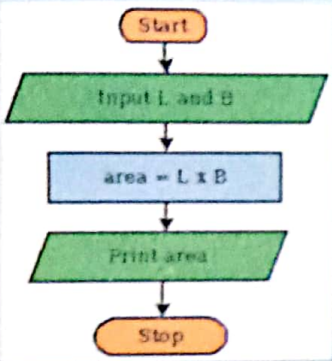
1. Start.
2. Input three numbers; x, y and z.
3. Calculate the sum of three numbers; Sum = x + y + z.
4. Print the sum.
5. Stop.

Flowchart



Example 2: To find the area of a rectangle.

Flowchart



Algorithm

1. Start.
2. Input the length and breadth of the rectangle; L, B.
3. Calculate the area; Area = L x B.
4. Print the Area.
5. Stop.

Do it Yourself

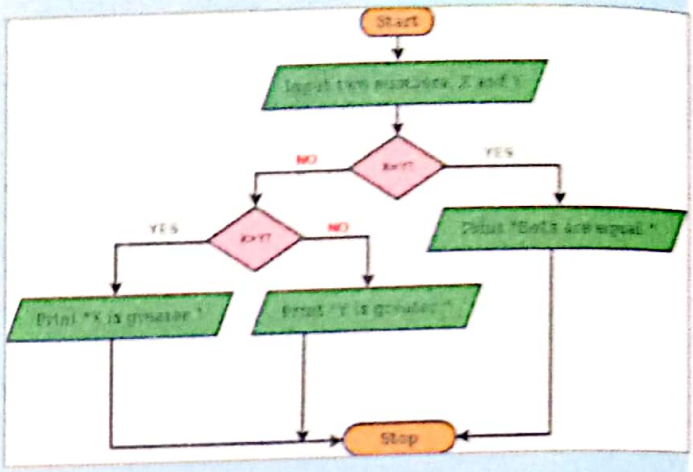
1. Write an algorithm to find the average of five numbers and draw the flowchart also.
2. Write an algorithm to find the perimeter of a rectangle and draw the flowchart also.
3. Draw the Flowchart on paper for the following algorithm:
   1. Start.
   2. Input the radius of circle; R.
   3. Calculate the area; Area = π R x R.
   4. Print the Area.
   5. Stop.

Example 3: To convert an algorithm into a flowchart to find the greater of two numbers.

Algorithm

1. Start.
2. Input two numbers, X and Y.
3. Compare X and Y. If both are equal, go to step 5, else go to step 4.
4. Compare if X is greater, go to step 6, else go to step 7.
5. Print "Both are equal" and go to step 8.
6. Print "X is greater" and go to step 8.
7. Print "Y is greater" and go to step 8.
8. Stop.

Flowchart



Do it Yourself

Write an algorithm to convert feet into inches. Draw the flowchart also.

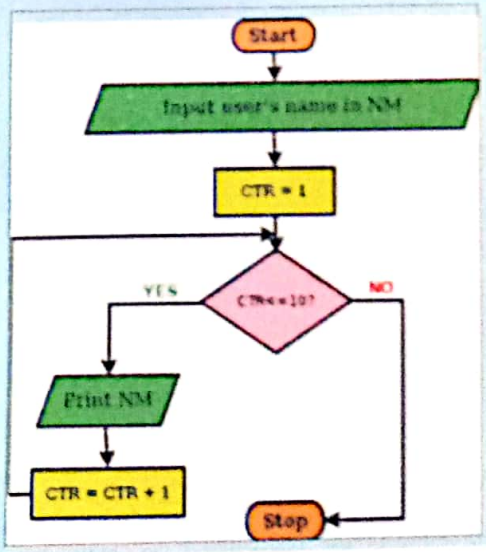
Loop

A loop has a purpose to repeat one or more statements a certain number of times or until a condition is fulfilled. While using a loop, you need a counter. A counter is a variable that is used to count the number of times a procedure is being repeated. Its name could be anything like x, counter, ctr etc.

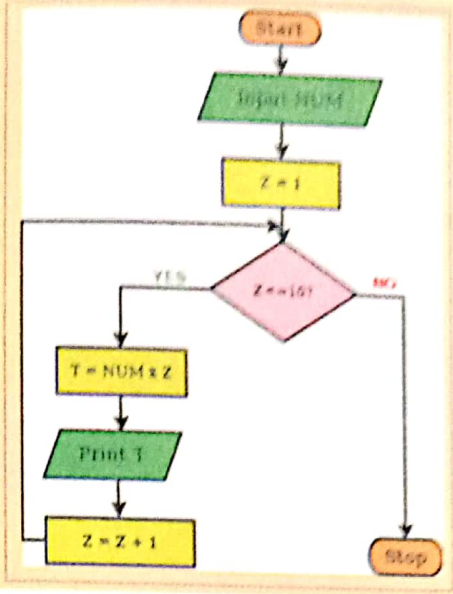
A variable is the name of data. It keeps on changing its value during execution of a program. Its value can be incremented or decremented as per your requirement.

Example 1: To print the name 10 times.

CTR	CTR<=10	OUTPUT
1	YES	RAVI
2	YES	RAVI
3	YES	RAVI
4	YES	RAVI
5	YES	RAVI
6	YES	RAVI
7	YES	RAVI
8	YES	RAVI
9	YES	RAVI
10	YES	RAVI
11	NO	program stops



Example 2: To enter any number and print its table.



NUM	Z	Z<=10	T = NUM x Z	OUTPUT
5	1	YES	5 x 1	5
5	2	YES	5 x 2	10
5	3	YES	5 x 3	15
5	4	YES	5 x 4	20
5	5	YES	5 x 5	25
5	6	YES	5 x 6	30
5	7	YES	5 x 7	35
5	8	YES	5 x 8	40
5	9	YES	5 x 9	45
5	10	YES	5 x 10	50
5	11	NO		program stops

Glossary

Algorithm : An algorithm is a sequence of steps to solve a problem.

Flowchart : A flowchart is a graphical representation of steps of an algorithm.

Quick Review

- *A set of instructions, written in a computer language, is called a program.*
- *Different types of boxes and symbols are used in a flowchart.*
- *A loop has a purpose to repeat a statement a certain number of times or until a condition is fulfilled.*

Exercise

A. Choose the correct answer.

1. A/ An _____ is used to solve a specific problem..

a) Algorithm ○ b) Program ○

c) Both a) and b) ○ d) None of these ○

2. A flowchart symbol cannot be typed. This is a _____ of flowcharts.

a) feature ○ b) limitation ○

c) Both a) and b) ○ d) None of these ○

3. A _____ is used to repeat one or more statements a certain number of times.

a) Loop ○ b) Algorithm ○

c) Flowchart ○ d) Program ○

4. A _____ may have its value changed during program execution.

a) Flowchart ○ b) Algorithm ○

c) Counter ○ d) None of them ○

B. Answer the following questions.

1. What do you mean by the terms: *Program, Algorithm* and *Flowchart*?

2. What is the advantage of a flowchart?

2. List advantages of algorithm.

Ch-1

C. Match the following.

Column-I	Column-II
1. Flow lines	a. 
2. Process box	b. 
3. Decision box	c. 
4. Input/output box	d. 
5. Start/stop box	e. 

Lab Activity

Create algorithms to solve the following problems and then create Flowcharts using Dia or PowerPoint shapes or OpenOffice Draw or any other software provided in lab.

1. Accept the age of the user and check, if user is eligible to cast vote (age 18 or above). If not then display the number of years user should wait to be eligible for voting. If yes then display the message "You can vote."
2. Accept numbers from the user and keep them adding until user inputs zero. When a zero is input, program should display the sum of all the numbers entered and end.
3. Modify the algorithm and flowchart of Problem #2 to not to add any negative numbers input by the user.
4. A laser printer is printing one page at a time. Computer should display the message "Paper out!" if paper runs out in the printer and program should end. This should be checked before printing every page until all the pages are printed.

Teacher's Signature : _____ *Teacher's Remark :* ☆☆☆☆☆

https://en.wikiversity.org/wiki/Programming_Logic
https://kids.kiddle.co/Flow_chart

Teacher's Corner...

Teachers are advised to cite real life examples around students' daily life to explain the concepts in an easier fashion.