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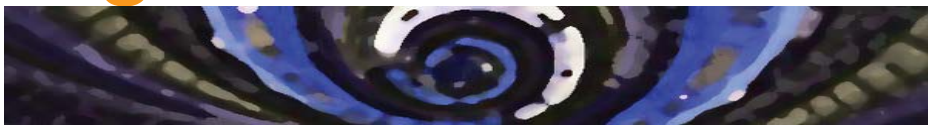
Shilpa64.lk

AlgoHack aims to teach Computer Science and Programing to young people, initiated by Shilpa Sayura Foundation, supported by GOOGLE RISE and Computer Society of Sri Lanka.

AlgoHack #5



PROGRAMING LOOPS

AlgoHack #5

PROGRAMING LOOPS

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Loops

Everyday, sun rises from east, it goes over our sky and sets in the east. The sun process repeated once a day, throughout time since beginning.

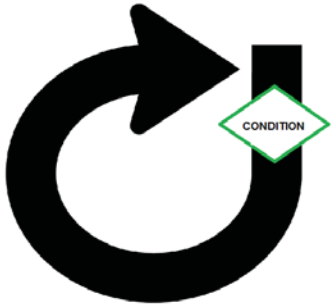
World is rotating around the Sun. is a loop?
Earth rotating around self. Is it another loop?
Does both loops happen at the same time?
Are there other loops within these loops.

Name 5 loops in our life.
Do they have any sub loops?

Think of your day loop. Get up, get dressed, eat breakfast, go to school, come home, play, wash, eat dinner,go to bed, dream. We repeat this every school day. Holiday loop can be different. We repeat foot loops.

Is life a Loop of Loops ?

How about trees? Roads, Vehicles, Engines, Planes?



Loops help repeating some action over and over while certain condition is true.. The Loops exit when condition become false.
We can play before 5PM.
Loops are very important for problem solving.


```
*
* * *
* * * * *
```

Write a program to print the following output:

```
    *
  * * *
 * * * * *
* * * * * * *
```

Modify this program to print a christmas tree,

Output odd numbers from 0 to 50.
Print summation of even numbers from 20 to 50.

Output running summation and average from 10 number inputs.

Output multiplication table from 1 to 10, using two loops.

A Rabbit runs along a loop, with one door to the caret farm, the door always closed, and generate a random number between 0 to 10. With every loop rabbit enter a number between 0 to 10. If the numbers match door opens. **Design a game, and write code in python.**

path to reach a location.

Can you **design an algorithm** to operate a robot in a grid? Robot has has to avoid all blocked squares..

X			X	
	X			
		X		X
		X		

Your robot need to travel from square to square using Forward, turnLeft, turnRight commands. It checks if next square is open with isOpen condition. isOpen will return true if your robot can move forward.

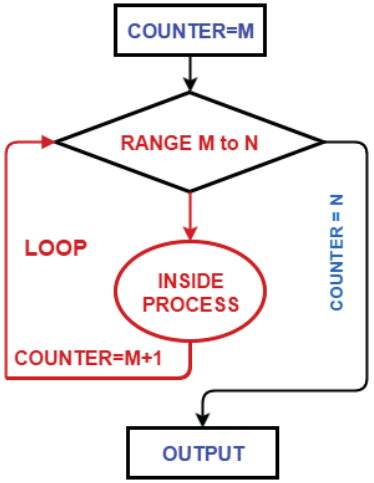
Hint: *The robot checks if a square is free? Then move forward. If not turn left or right and re-try to move forward.*

Is there a possibility of Robot getting stuck? **Why?**
What if you have two robots? The robots has to check if the square is occupied with occupied condition.
Present your algorithm to the class.

Write a program to print the following output:

Sort a 10 cards. Are you repeating same process for all cards? It is a loop. You end when all cards sorted.

Some loops **repeat number of times**. *3 meals a day.*
Some loops **repeat continuously**. *Breathing*



A Loop will **check the condition** in every cycle it runs.
if the condition is true, the **entry is allowed** to loop.

When inside, program **execute loop code** block
As a result **data for condition** may change.

The **process repeats** while **condition is true**.
if the **condition become false**, the l**oop ends**.
Program then continues to next code block.

Discuss loops in human life

Loop	Type	Condition
Breathing	Continues	
Eating	3 times a day	
Walking		
Sleeping		

Loops are important in programming to **repeat actions.**

Sweep Robot sweeps floor on all weekdays at 6.00 AM.
Sweep Robot repeats sweeping while room not clean.

While the switch is on, the buib give light.
While temperature < 100 , heat the water

How does a automatic electric kettle works?
How does it get heat?
How does it automatically switch off?
Can there be temperature sensing loop?
How does whistle blowing glass kettle works?
Explain their loops. Discuss with a friend.
Identify 5 machines with loops in your environment.

Pseudocode for loop

The problem is
A program takes an input from keyboard and print it.
If 0 is entered program exits. Write the code.

```
while (true):
    x=input(x)
    If (x=="0") :
        break
    print (x)
print ("End")
```

We can modify this program using **continue**

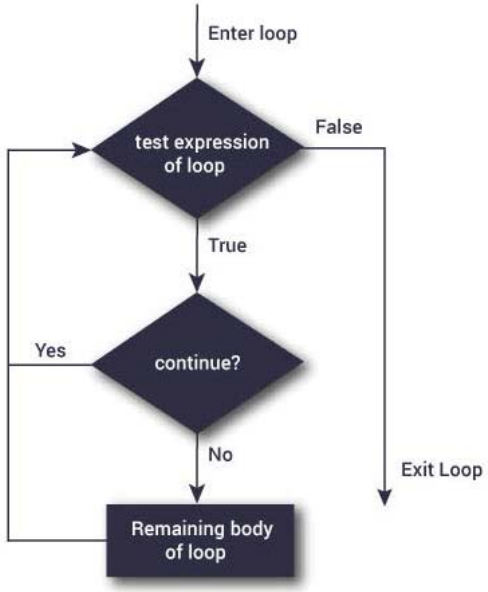
```
while (true):
    x=input(x)
    If (x != "0") :
        print (x)
        continue
    break
print ("End")
```

Draw flowcharts for above two problems.
Explain code execution step by step.

Loop Programming Challenges
print numbers 0 to 100.
print sum of numbers 0 to 100.
print sum of odd numbers from 0 to 100.
Print sum of all numbers 0 to 100 divisible from 5

Walking Robot
Imagine a robot which uses sensors in a loops to find a

The ***continue*** statement is used to skip the rest of the code inside a loop. The loop does not terminate but continues on with the next iteration.




```
s="Vishva"
for val in s # process all chars in s
    if val == "j":
        continue
    print(val)

print ("The end")
```

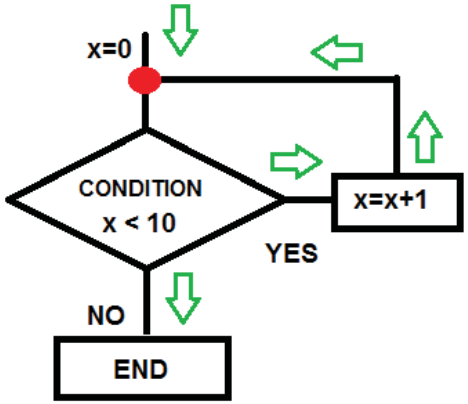
What will be the output ?
Did you notice that "j" is not printed? **Why?**


```
Loop While (Condition)
       [Loop Code block1]
 End Loop
After Loop Code here
```

Saman did not do his homework, so his teacher asked him to write "i will do my homework" 100 times.
If saman is a computer programmer how can he use a loop to do the task faster?

```
x=0
Loop while (x < 100)
    Print "I will do my homework"
    x=x+1
```

Flow chart for running 10 cycles in a loop.



Python code to print numbers 1 to 10

```
x=0
```

```
while (x < 10):
    print(x)
    x=x+1
```

What do you learn from above program?
How does the x < 10 condition help branching of the program to repeat some actions or exit the loop.

In python programing we can force a loop to break using **break** statement. The break statement exits current loop.

Design a program to calculate the sum of numbers 1 to 10 using a while loop. Draw a flowchart and write pseudo code before coding in python.

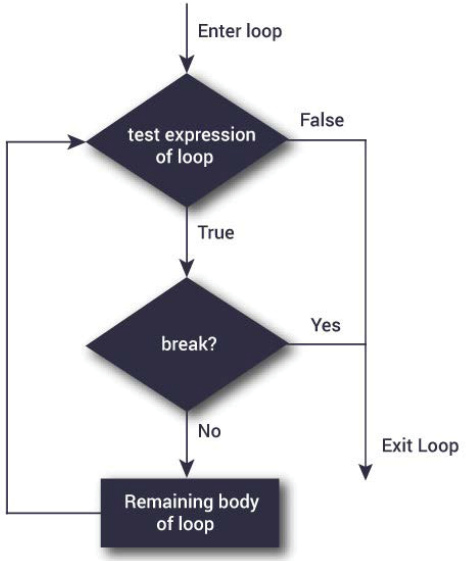
Modify the program to break loop if the number is 7

Design a program to print all even numbers upto 20.

Write a python program to input a number output the sum of all numbers from 0 to the input number.

Modify the output all odd numbers and their sum.

Breaking a Loop




```
s=”Algo”
for val in s # process all chars in s
    if val == "j":
        break
    else
         print(val)

print (“The end”)
```

What will be the output ?

The same can be achieved using **for … range** structure

```
n=0
for n in range(0,10):# iterate 0 to 10
   print ( n)
   i=0
   for i in range(0,10): #iterate 0 to 10
        print ( i)
```

Run these algorithms in python
Are there a **difference** of output ?
If so **why** ?

In computer science looping is called **iteration**.
Iteration means repeating a process.

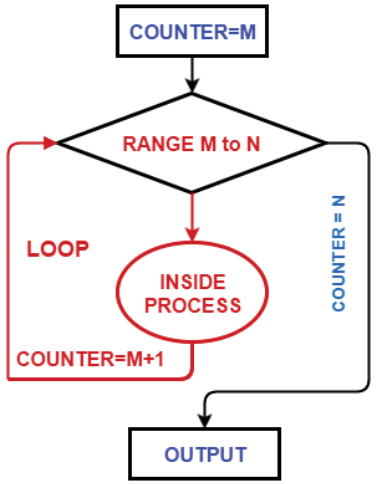
If you are searching your room for a misplaced book, you will continue searching until all places are checked.

What will you do if the book is found?

If you want stop searching, we need a condition to stop.
In python we use break command to break from a loop

Python has another type of loop.

The loop increments a counter starting from M to N values. It is called a for … next loop. The loop runs (N-M) times incrementing M by 1 in each loop.



#This code prints numbers between 10 to 19

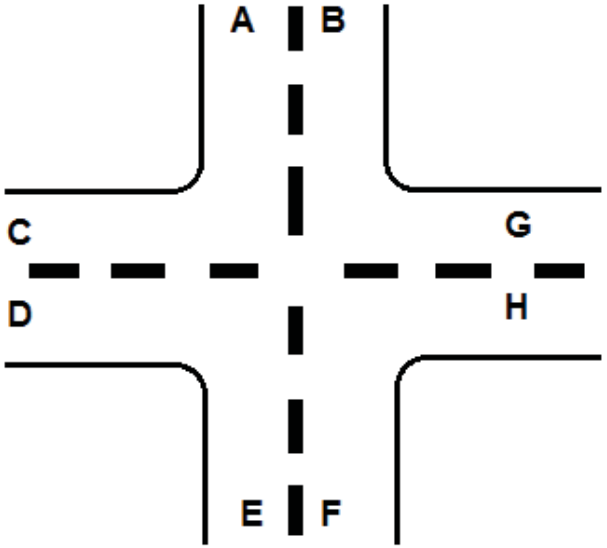
```
for x in range(10,20):
     print (x)
```

This code does the same.

```
while (true)
     x=x+1
     print (x)
     If (x > 10) :
         break
print ("out of loop")
```

Explain above programs. Which one do you like?

Think of a traffic light signal post on a junction.
The vehicles are driven on the left side.



Draw how cars from A, B, C, D, E, F, G, H can drive?
How many directions are there in total?
What directions can you allow safely same time?
Describe loops in this system.
Suggest a time based control system for this?
What do you think of a sensor based system?

Design a traffic signal loop solution with a flow chart.
Can you write **pseudocode** for a program?

Sensor Based Escalator
When escalator sense a person, it automatically starts and runs a loop. If there is no person it automatically stops. The loop begins when another person is sensed.

What other loops you find around you like above?
Your school van loops through a route on school days.
List 5 loops and describe their **condition of looping**.

Think of a group of 5 children standing in a circle
1. one student goes to the center
2. performs a dance with 7 steps
3. Next student repeat 1 and 2
4. The loop exists when all 5 children perform.

Each student taking a dance is the main loop.
The sub loop is 7 steps. **Flow chart this process.**

What will print from following python code ?

```
number= 0
while (number < 10):
   print ( number)
   i=0
   while (i < 10):
      i=i+1
      Print (i)

   number= number+ 1
```