

NAME : _____
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LESSON 1: INTRODUCTION

Many programs may require a repetition capability in which the same calculation or sequence of instructions is **repeated** over and over, using different sets of data.

Each repetition is referred to as **iteration** or a **loop** because of its cyclic nature.

1.1 Iteration Structure

Iteration is the repetition of a statement or block of statements in a program. Statements in a repetitive structure are **executed repeatedly while certain conditions remain true**.

C++ has three (3) iteration statements:

- (i) while statement
- (ii) do_while statement
- (iii) for statement

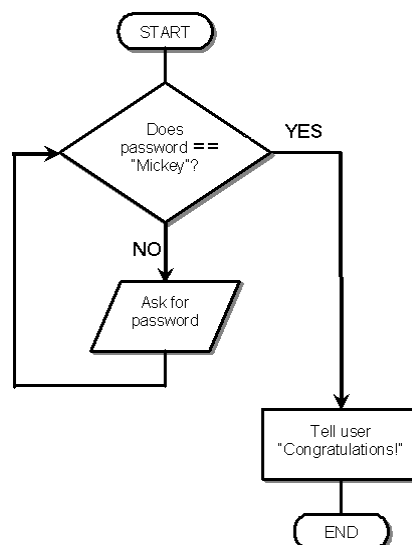


Figure 1: Flowchart of a loop

1.2 Requirements of a Repetition Structure

An iteration structure requires:

- (i) Loop control variable (LCV)
- (ii) Loop condition
- (iii) Loop body

Execution of the loop body is controlled by 3 operations:

- (i) Initialization of the LCV
- (ii) Evaluation of LCV in the loop condition
- (iii) Update of the LCV by incrementing or decrementing

===== **Increment and Decrement Operator** =====

Operator is placed after a variable to indicate the increment or decrement of one value from the variable.

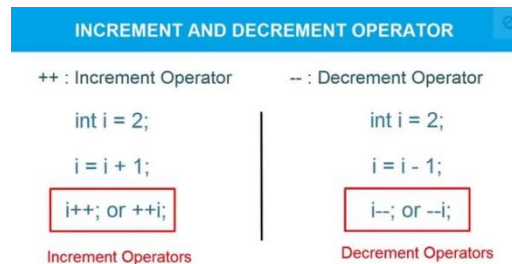


Figure 2: Increment and decrement operator

1.3 Types of repetition structure

	Counter-controlled Loop	Sentinel-controlled Loop
Description	Counter-controlled loop is used when the number of times a segment of code needs to be repeated is known in advance.	Sentinel-controlled loop is used when the number of repetitions depends on a certain condition. It uses a special end-of-data value called sentinel value that serves as a signal for loop termination . It is also called event-controlled loops . The number of repetitions is not known.
Example	Repeat a process for 10 times	Repeat a process if user input command is not 999.
Requirements	<ul style="list-style-type: none"> • The name of a control variable • The initial value of the control variable • The condition the tests for the final value of the control variable • The increment or decrement of the control variable each time the loop is executed 	

===== **Sentinel Value** =====

Sentinel value is a special end-of-data value that serves as a signal for loop termination. The sentinel value is chosen so it cannot be confused with regular input.

Sentinel-controlled loop is used with `while` and `do-while` statements.

LESSON 2: COUNTER CONTROLLED LOOP

```
#include<iostream>
using namespace std;

int main()
{
    int number;
    int total = 0;
    float average;

    for(int counter = 0; counter < 3; counter++)
    {
        cout<<"Enter a number: ";
        cin>>number;

        total = total + number;
    }
    average = total / 3.0;

    cout<<"\nTotal = "<<total<<endl;
    cout<<"Average = "<<average<<endl;

    system("pause");
    return 0;
}
```

Code 1: Using for loop to find total and average of three integer numbers.

```
#include<iostream>
using namespace std;

int main()
{
    int number;
    int counter = 0;
    int total = 0;
    float average;

    while (counter < 3)
    {
        cout<<"Enter a number: ";
        cin>>number;

        total = total + number;
        counter++;
    }
    average = total / 3.0;

    cout<<"\nTotal = "<<total<<endl;
    cout<<"Average = "<<average<<endl;

    system("pause");
    return 0;
}
```

Code 2: Using while loop to find total and average of three integer

numbers.

```
#include<iostream>
using namespace std;

int main()
{
    int number;
    int counter = 0;
    int total = 0;
    float average;

    do
    {
        cout<<"Enter a number: ";
        cin>>number;

        total = total + number;
        counter++;

    }while (counter < 3);
    average = total / 3.0;

    cout<<"\nTotal = "<<total<<endl;
    cout<<"Average = "<<average<<endl;

    system("pause");
    return 0;
}
```

Code 3: Using do_while loop to find total and average of three integer numbers

EXERCISE

Question 1

Based on the program segment given below:

```
int n = 1; //initial value
while (n <= 5) //terminal value
{
    n = n + 1; //step size
    cout<<n<<" ";
}
```

- (a) Write the statement/expression that corresponds to the loop operation.

Initialization:

Evaluation:

Update:

- (b) What is the output for the given while statement? (Use the tracing table provided.)

n	n <= 5	n++	cout<<n

Output:

- (c) State whether this loop is counter-controlled or sentinel-controlled loop.

Question 2

- (a) Using a `for` loop, write a program in C++ to display numbers from 1 to 25.
- (b) Using a `while` loop, display all the even numbers from 50 to 100 inclusively.
- (c) Using a `do_while` loop, write a program in C++ that can display all the odd numbers from 25 to 10 inclusively. The program should be able to display the sum of the numbers as well.

Question 3

Write a program in C++ that can determine and display the largest and the smallest number among any number of integers entered by the user.

Question 4

Write a program in C++ that can display how many numbers from 0 to 100 that is divisible by 2 and 5.