	SVKM's NMIMS Mukesh Patel School of Technology Management & Engineering / School of Technology Management & Engineering	
B. Tech/MBA Tech	**Workbook**	**Academic Year- 2024-25**
Year:-First	**Subject:-** Programming for Problem Solving	**Semester: - First**

Experiment: 4

PART A

(PART A: TO BE REFERRED BY STUDENTS)

Aim: Programming using looping and unconditional statements

Learning Outcomes: The learner would be able to

1. Understand the syntax of looping statements
2. Use looping to solve problems by writing programs
3. Work with unconditional (break/continue) statements

Theory:

C++ Control Constructs/Structure/Statements

- Control statements are used to alter the flow of program execution.
- Control statements evaluate the condition (uses relational and/or logical operators) & control the flow of execution.
- C++ control constructs/statements are as follows.

Decision Making Statements or Conditional Statements Or Selection Statements	**Loop Control Statements or Iterative Statements**	**Jump Control Instructions or Branching Statement**
• if • if-else • Nested if-else • else if Ladder • switch-case	• for • while • do-while	• break • continue • return

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Loop Control Statements Or Iterative Statements

Loop???

Statements in a block are repeatedly executed for a certain number of times or periods.

What are the steps used in the loop?

1. Initialization
2. Condition or Test Expression
3. Update expression.

Initialization: -

- Initial value, i.e., starting value, is assigned to loop variable
- Executed only ones in the lifetime of the loop.

Condition: -

- Every time the condition is evaluated, if it is evaluated as true, control will get entry in the loop; otherwise, the loop will be terminated.
- Condition is true or false as we use relational and/or logical operators to write condition.

Update Expression: -

- Any expression to update the loop variable, after updating the loop variable control will recheck the condition & this will be iterative till the condition becomes false.

Loops are categorized into

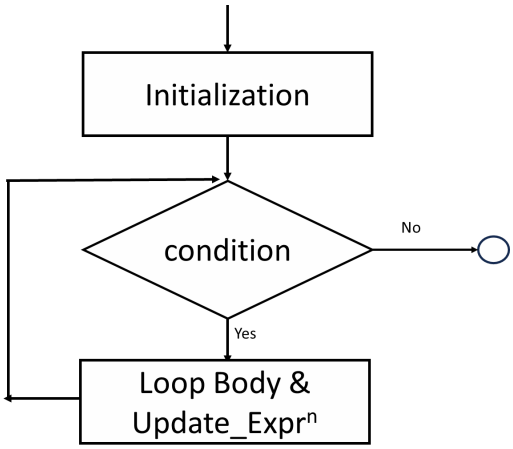
1. Entry Controlled Loop
   i. for
   ii. while
2. Exit Controlled Loop
   i. do while

for loop

- it is iterative or loop controlled statement.
- **for** is keyword used as loop control statement.
- **Syntax:-**

```
for( initialization ; condition ;  update_expression ){
        // Loop Body;          //body of for
}
```

- **Flowchart:-**



Example:- Programming examples to show use of for loop.

Write a program to print first 5 numbers (using for loop)

```
int main( ){
        int i,n=5;
        for( i=1; i<=5; i++ ){
                cout<<i<<" ";
        }
        return 0;
}
```

Write a program to print first N numbers (using for loop)

```
int main( ){
        int i,n;
        cout<<"Enter value of N:";
        cin>>n;
        for( i=1; i<=n; i++){
                cout<<i<<" ";
        }
        return 0;
}
```

/* Write a program to print sum of first N numbers. */
// i. e. sum=1+2+3+……+N */

```
int main( ){
        int i,n,sum=0;
        cout<< "Enter value of n:";
        cin>>n;
        for(i=1;i<=n;i++){
                sum = sum + i;
        }
        cout<< " Sum of numbers is "<<sum;
        return 0;
    }
```

/* Write a program to print factorial of N */
// i. e. fact=1*2*3……*N

```
int main( ){
        int i,n,fact=1;
        cout<< "Enter value of n:";
        cin>>n;
        for(i=1;i<=n;i++){
                fact = fact * i;
        }
        cout<< " Factorial is "<<fact;
        return 0;
    }
```

While loop

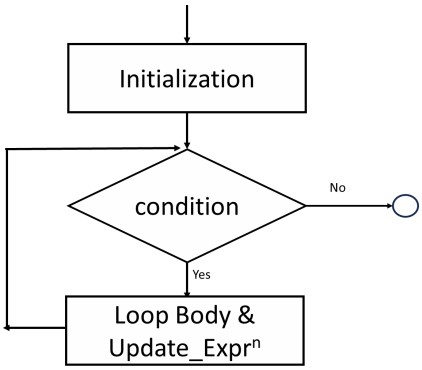
- it is loop control statement or iterative statement.
- while is keyword & used as loop control statement.

Syntax:-

```
initlialization;
while(condition){
        //loop body
        update_expression;
}
```

- In the above syntax, the condition is evaluated first; if it is true, then the loop's body is executed along with update_expression. Again, the condition will be checked & if it is true, then the body of the loop is executed again. Otherwise, execution will be terminated.

While Flowchart: -



Example:- Programming example to show use of while loop.

Write a program to print first 5 numbers (using for loop)

```
int main( ){
        int i,n=5;
        for( i=1; i<=5; i++ ){
                cout<<i<<" ";
        }
        return 0;
}
```

(for loop can also be written as)

```
int main( ){
        int i,n=5;
        i=1;
        for( ; i<=5; ){
                cout<<i<<" ";
                i++;
        }
        return 0;
}
```

Write a program to print first N numbers (using while)

```
int main( ){
        int i,n=5;
        i=1;
        while (i<=5){
                cout<<i<<" ";
                i++;
        }
        return 0;
}
```

/* Write a c++ program to print reverse of a given number. */

```
int main( ){
int n,d,rev=0;
cout<<"Enter one number\n";
cin>>n;
while(n!=0){
        d=n%10;
        rev=rev*10+d;
        n/=10;  // Update expression.
}
cout<< "Reverse number is  "<<rev;
return 0;
}
```

Output

```
Enter one number
2357
Reverse number is 7532
```

do-while

- it is exit controlled loop
- it is loop control statement or iterative statement.
- do & while are keywords & used as loop control statement.

Syntax:-

```
Initlialization;
do{
    //loop body
    update_expression;
} while(condition);
```

- In the above syntax, the loop is executed the first time before checking the condition; after that, the condition is evaluated for every iteration; if it is evaluated as true, then the body of the loop is executed along with update_expression. Otherwise, execution will be terminated.

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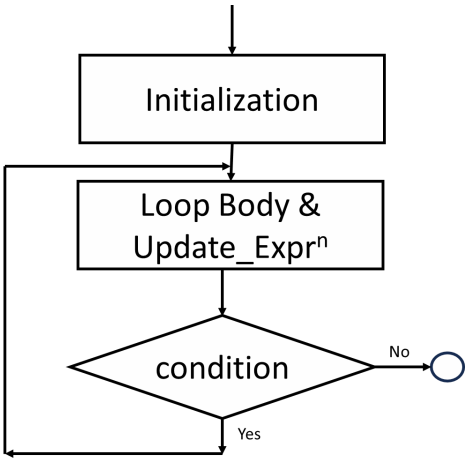
Do-while Flowchart:-



Example of Do-while-

Write a program to print first 5 numbers (using do-while)

Using For Loop

```
int main( ){
        int i,n=5;
        i=1;
        for( ; i<=5; ){
            cout<<i<<" ";
            i++;
        }
        return 0;
}
```

Using while loop

```
int main( ){
        int i,n=5;
        i=1;
        while (i<=5){
            cout<<i<<" ";
            i++;
        }
        return 0;
}
```

Using do - while loop

```
int main( ){
        int i,n=5;
        i=1;
        do{
            cout<<i<<" ";
            i++;
        } while (i<=5);
        return 0;
}
```

Write a program that will calculate the sum of every third integer beginning with i=2 and for all values of i that are less than 100 using i. for ii while iii. Do while loop.

Using For

```
int main( ){
    int i , sum=0;
    for(i=2; i<100; i=i+3){
        sum = sum + i;
    }
    cout<<"Sum is"<<sum;
    return 0;
}
```

Using While

```
int main( ){
    int i=2 , sum=0;
    while(i<100){
        sum = sum + i;
        i = i + 3;
    }
  cout<<"Sum is"<<sum;
    return 0;
}
```

Using Do While

```
int main( ){
    int i=2 , sum=0;
    do{
        sum = sum + i;
        i = i + 3;
     } while(i<100);
cout<<"Sum is"<<sum;
    return 0;
}
```

Jump Control Instructions or Branching Statement

- The following are the jump control or branching statements supported by C++.
  - break
  - continue
- Jump control statement transfers the control from one position to another in the program during execution.

break:-

- 'break' is used to exit the execution of any loop.
- 'break' is used to stop the execution of remaining *cases* in *the switch*.

Syntax:-

```
break;
```

- In the above syntax, we have only break keywords followed by semicolon, and we can write this in switch and any loops.

Example:- Programming example to show use break.

```
#include<stdio.h>

main(){

        int i,n;

                i=1;

                while(n=4){

                        if(i==4) break;

                        cout<<"\t"<<i;

                        i++;

                }

}
```

In this example, we have used the 'break' keyword to break the while loop… and execution of the while loop will be terminated whenever condition *if(i==4)* is evaluated as true, as the break will get executed.

Output

```
1       2       3       4
```

Continue:-

- 'continue' is used to continue the execution of the next iteration by skipping the current iteration of any loop.
- **Note:- continue can not be used in switch-case.**

- **Syntax:-**

```
continue;
```

  - In the above syntax, we have only the 'continue' keyword followed by a semicolon and we can write this in any loop.

Example:- Programming example to show use continue.

```
#include<stdio.h>

main( ){

    int i;

        for(i=1;i<=5;i++){

            if(i==4) continue;

            cout<<"\t"<<i;

        }

}
```

In this example, we have used the 'continue' keyword to continue the iteration of the loop. Whenever condition *if(i==4)* is evaluated as true, then the next iteration will be continued.

Output

1 2 3 5

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Examples of Loops/Iterative Statements:

Write a program to find sum of following series… 1+2+3+4+5+6+...+N	Write a program to find sum of following series… 1*2*3*4*5*6*...*N Or Write a program to find factorial of a number	Write a program to find the entered number is perfect or not. Ex. 28 is perfect number as, sum of its positive divisor except that number. 1+2+4+7+14 =28

#include <iostream>
using namespace std;
int main() {
  int s=0,n,i;
  cout<<"Enter N"<<endl;
  cin>>n;
  for(i=1;i<=n;i++){
  s=s+i;
  }
  cout<<"Sum of series is "<<s<<endl;
  return 0;
}
	#include <iostream>
	using namespace std;
	int main() {
	  int f=1,n,i;
	  cout<<"Enter N"<<endl;
	  cin>>n;
	  for(i=1;i<=n;i++){
	  f=f*i;
	  }
	  cout<<"Result is "<<f<<endl;
	  return 0;
	}
		#include <iostream>
		using namespace std;
		int main() {
		  int s=0,n,i;
		  cout<<"Enter N"<<endl;
		  cin>>n;
		  for(i=1;i<n;i++){
		  if(n%i==0)
		  s=s+i;
		  }
		  if(n==s)
		  cout<<n<<" is perfect number"<<endl;
		  else
		  cout<<n<<" is not perfect number"<<endl;
		  return 0;}

Enter N 10 Sum of series is 55	Enter N 6 Result is 720	

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// program to count number of digits in a number.

```
#include <iostream>
using namespace std;
int main() {
  int n,c,t;
  cout<<"Enter no";
  cin>>n;
  t=n; // as n will become 0 after loop execution
  while(n!=0){
     c++;
     n=n/10;
  }
  cout<<"No of digits in "<<t<<" are: "<<c;

  return 0;
}
```

Output:-

Enter no34567

No of digits in 34567 are: 5

// program to find sum of digits in a number.

```
#include <iostream>
using namespace std;
int main() {
  int n,s=0,t,d;
  cout<<"Enter no";
  cin>>n;
  t=n; // as n will become 0 after loop execution
  while(n!=0){
     d = n%10;
     s = s+d;
     n=n/10;
  }
  cout<<"Sum of digits of "<<t<<" is: "<<s;
  return 0;
}
```

Output:-

Enter no45678

Sum of digits of 45678 is: 30

// Program to find revers of a number

```
#include <iostream>
using namespace std;
int main() {
  int n,r=0,t,d;
  cout<<"Enter no";
  cin>>n;
  t=n; // as n will become 0 after loop execution
  while(n!=0){
     d = n%10;
     r = r*10+d;
     n=n/10;
  }
  cout<<"Reverse of "<<t<<" is: "<<r;
  return 0;
}
```

Output:-

Enter no4321

Reverse of 4321 is: 1234

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Tasks:

Sr. No.	Problem Statement	Flow chart
1	Write program to find the sum of the following series using while loop $1^2 + 2^2 + 3^2 + \ldots N^2$	
2.	Write a program to find the sum of all numbers between M and N, where N>M, using for loop.	
3.	Write a program to accept a number from the user. Find and print the sum of digits of the number. (using do-while loop)	✓
4.	Write a program that prints the first n Fibonacci numbers using a for loop.	
5.	Write a program to accept a number from user and display if the number is Armstrong number. (Armstrong number is the number in any given number base, which forms the total of the same number, when each of its digits is raised to the power of the number of digits in the number.)	
6.	Write an algorithm to find a given number is palindrome or not. Example of Palindrome number: 12321 565 **Note:- Its number not string/character array…**	
7.	Write a program to check whether the entered number is prime or not. (make use of **break**)	✓
8.	Write a program to print the entire uppercase and lowercase letters using a loop (use continue). Hint: - ASCII values of A-65, a-97 there are not alphabets from 91 to 96, these values can be continued	
9.	Write a program using loop to find the Greatest Common Divisor (GCD) and Least Common Multiple (LCM) of two numbers.	

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Additional Programming Questions: -

1. Write a program to display the sum of N terms of even natural numbers.
   Hint:-Suppose value of N=6, then first N terms are 2+4+6+8+10+12
2. Write a program in C++ to find the number and sum of all integers between 100 and 200 which are divisible by 9.
3. Implement a program to print all Leap Years from 1 to N using C++ program.(Using - for)
4. Write a program to print the sum of the last and the first digit of a number the user gives. (Uisng-While)
5. Write a program to find the power of a number X^Y; here, X is base and Y is exponent (using for loop)
6. Write a program in C++ to check the perfect number using while loop
7. Write a program to count +ve number, -ve number and zeros until user want, make use of do while loop. (using do-while)
8. Write a C++ program that asks the user to enter positive integers in order to process count, maximum, minimum, and average or terminate the process with -1.

Nested Loop Question: -

1. Write a program to check whether a number is a strong number or not.
2. Write a program in C++ to calculate the series (1) + (1+2) + (1+2+3) + (1+2+3+4) + ... + (1+2+3+4+...+n).