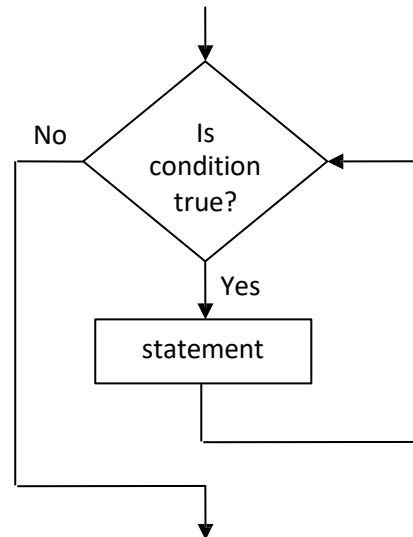


Iteration (Repetition) statements

- 1) `while` statement
- 2) `do/while` statement
- 3) `for` statement

while statement

`while (condition)
statement;`



The statement within the loop must modify variables in the condition; otherwise, the value of the condition will never change, and will never be able to exit the loop (i.e. **infinite loop**). Infinite loop is generated if the condition in a loop is always true.

Example: Write a C++ program that computes the sum of consecutive integer numbers $1 + 2 + 3 + \dots + n$.

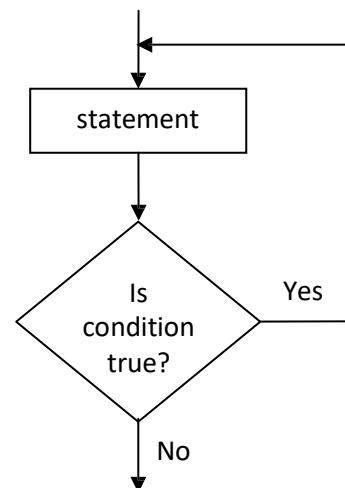
```
#include <iostream>
using namespace std;
int main(){
    int n , i = 1;
    long sum = 0;
    cout << "Enter a positive integer number:
"; cin >> n;
    while (i <= n)
        sum += i++;
    cout << "The sum of the first " << n
        << " integers is " << sum;
    return 0;
}
```

Example: Write a C++ program that computes the sum of ten numbers input by the user. Use while loop.

```
#include <iostream>
using namespace std;
int main()
{
    int number , sum = 0 , i = 1 ;
    while( i <= 10 )
    {
        cout << "Enter an integer number: ";
        cin >> number;
        sum += number;
        i++;
    }
    cout<<"Sum = " << sum << endl;
    return 0;
}
```

do/while statement

```
do
    statement;
while (condition);
```



Example: Consecutive integer numbers $1 + 2 + 3 + \dots + n$. Use do/while loop.

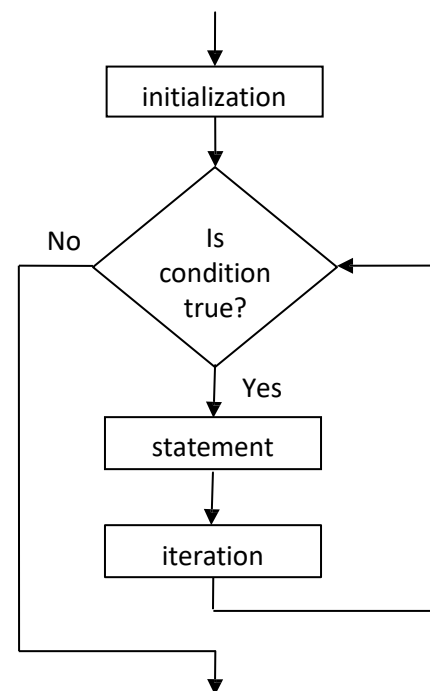
```
#include <iostream>
using namespace std;
int main()
{
    int n , i = 1;
    long sum = 0;
    cout << "Enter a positive integer: ";
    cin >> n;
    do
        sum += i++;
    while (i <= n);
    cout << "The sum of the first " << n
        << " integers is " << sum;
    return 0; }
```

Example: Write a C++ program that computes the sum of integer numbers input by the user. The program should stop when the user enters zero.

```
#include <iostream>
using namespace std;
int main()
{
    int number;
    long sum = 0;
    do
    {
        cout<<"Enter an integer number: ";
        cin >> number;
        sum += number;
    }while(number);    // or while(number != 0);
    cout << "Sum = " << sum;
    return 0;
}
```

for statement

```
for ( initialization ; condition ; iteration )
    statement ;
```



Examples:

1. increasing

```
for ( int i = 1 ; i <= 100 ; i++ )
```

2. decreasing

```
for ( int i = 100 ; i >= 1 ; --i )
```

3. increasing by 7

```
for ( int i = 7 ; i <= 77 ; i += 7 )
```

4. decreasing by 5

```
for ( int i = 20 ; i >= 2 ; i -= 5 )
```

Example: Write a C++ program that prints the numbers from 1 to 20.

```
#include <iostream>
using namespace std;
int main()
{
for ( int i = 1 ; i <= 20 ; i++ )
    cout << i << " ";
    cout << endl;
    return 0;
}
```

Example: Write a C++ program that computes the sum of ten integer numbers input by the user. Use for loop.

```
#include <iostream>
using namespace std;
int main()
{
    int number;
    long sum = 0;
    for ( int i = 1 ; i <= 10 ; i++ )
        {
            cout << "Enter an integer number: ";
            cin >> number;
            sum += number;
        }
    cout << "Sum = " << sum << endl;
    return 0;
}
```

Example: Write a C++ program that computes the factorial of an integer number.

```
#include <iostream>
using namespace std;
int main()
{
    int number;
    long fact = 1;
    cout << "Enter a positive integer number: ";
    cin >> number;
    for ( int i = number ; i > 1 ; i-- )
        fact *= i;
    cout << "The factorial is " << fact << endl;
    return 0;
}
```

Exercise:

1. Write a C++ program that computes the sum of integer numbers divisible by 6 that are from 20 to 100.
2. Write a C++ program that computes the power of an integer number.

3. What is the output of the following C++ program?

```
#include <iostream>
using namespace std;
int main()
{
    for(int c = 7 ; c <= 16 ; c++)
        switch(c % 10)
        {
            case 0: cout<<" , "; break;
            case 1: cout<<"OFTEN "; break;
            case 2:
            case 8: cout<<"IS "; break;
            case 3: cout<<"NOT "; break;
            case 4:
            case 9: cout<<"DONE "; break;
            case 5: cout<<"WELL "; break;
            case 6: cout<<" . "; break;
            case 7: cout<<"WHAT "; break;
            default: cout<<" bad number. ";
        }
        cout<<endl;
    return 0;
}
```

4. Write a program that calculates the value of (pi) from the following series. Stop calculation when the value of (pi) exceeds 8.7235.

$$Pi = 4 + 4/3 + 4/5 + 4/7 + 4/9 + \dots\dots\dots$$

5. Write a C++ program that reads several integer numbers input by the user and finds the smallest number. The user should first enter a value that specifies the number of integer values.

Ex: n=9

10, 8, 4 ,33, 6, 91, 44, 22, 89

Smallest is 4

6. Assume $j=0$, what is the new value of j at the end of each of the following loops?

- ```
for(int i = 8 ; i >= 0 ; i = i - 3)
 j = j + 1;
```
- ```
for(int i = 0 ; i <= 8 ; i = i + 2 )
    j = j + 1;
    i = i + 1;
```

7. If $(i=0)$ and $(g=5)$, what are the new values of i and g after the following program segment?

```
while ((i <= 4) && (g > 0))
{
    i = i + 1;
    g = g - 1;
}
```

8. What is the output of each of the following C++ code segments:

- a)

```
int x = 0;
while (x < 10)
    cout << x++ << endl;
cout <<"Done\n";
```
- b)

```
char ch;
for (ch = 'A' ; ch <= 'F' ; ch = ch +
    1) cout << ch;
cout << endl;
```

9. Write a C++ program that reads a positive integer number and computes the sum of its decimal digits.

Ex: 7354

Sum is 19