Lecture-07

Control Structures: if, if-else, if-elseif-else, switch-case-default, for, while, do-while, goto-label, break and continue

Control structures

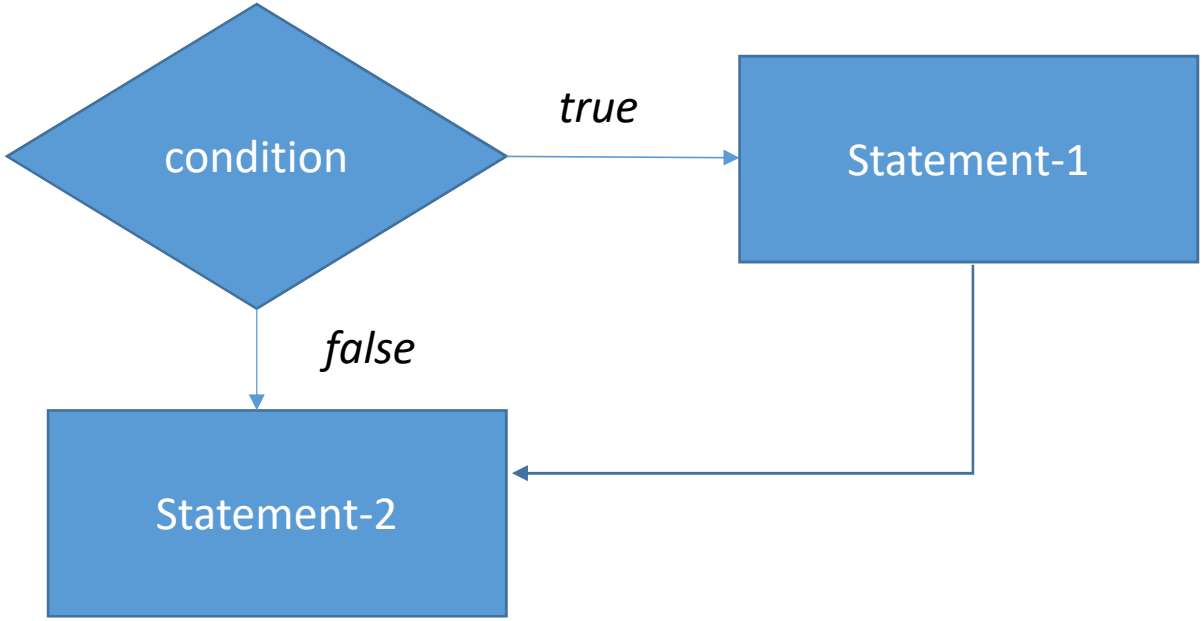
- Sequential: control passes from one to the next statement in sequence
- Selection: control passes from one to next based on whether a condition is true or false or its value
- Loop: control rotates amongst a set of statements until the condition is true
- Jump: control can abruptly jump from one point in program to another

if statement

if statements

```
if (condition) // this condition evaluates to true or false
        statement-1;    // this statement will be executed if condition is true
statement-2;


if (condition) // this condition evaluates to true or false
{
        statement-1;    // these statements will be executed if condition is true
        statement-2;
        statement-3;
        ....
}
statement-4;  // this statement will be executed next
```

if statement



if statement

```
1   #include <iostream>
2   using namespace std;
3
4   int main(){
5
6       int a, b = 9;
7
8       cout << "Enter a value for a: ";
9       cin >> a;
10
11      if (a > b && a < 100 )
12          cout << "a is a positive two digit number"<< endl;
13
14      cout << "Value of a entered is " << a << endl;
15
16  }
17
```

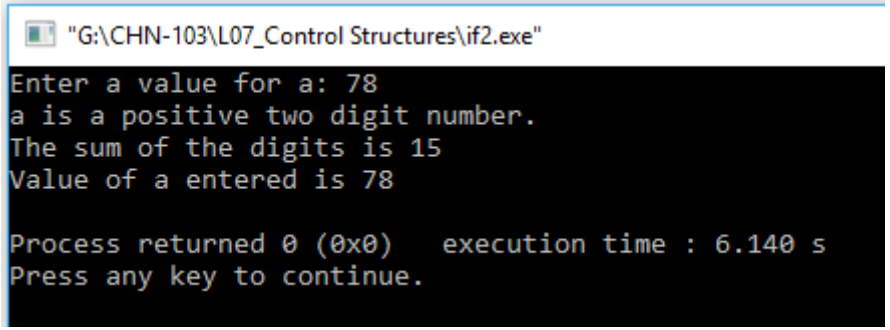
Outputs window from Codeblocks

```
"G:\CHN-103\L07_Control Structures\if.exe"
Enter a value for a: 23
a is a positive two digit number
Value of a entered is 23

Process returned 0 (0x0)   execution time : 4.781 s
Press any key to continue.
```

```
"G:\CHN-103\L07_Control Structures\if.exe"
Enter a value for a: -5
Value of a entered is -5

Process returned 0 (0x0)   execution time : 10.563 s
Press any key to continue.
```

if statement

Output window from Codeblocks



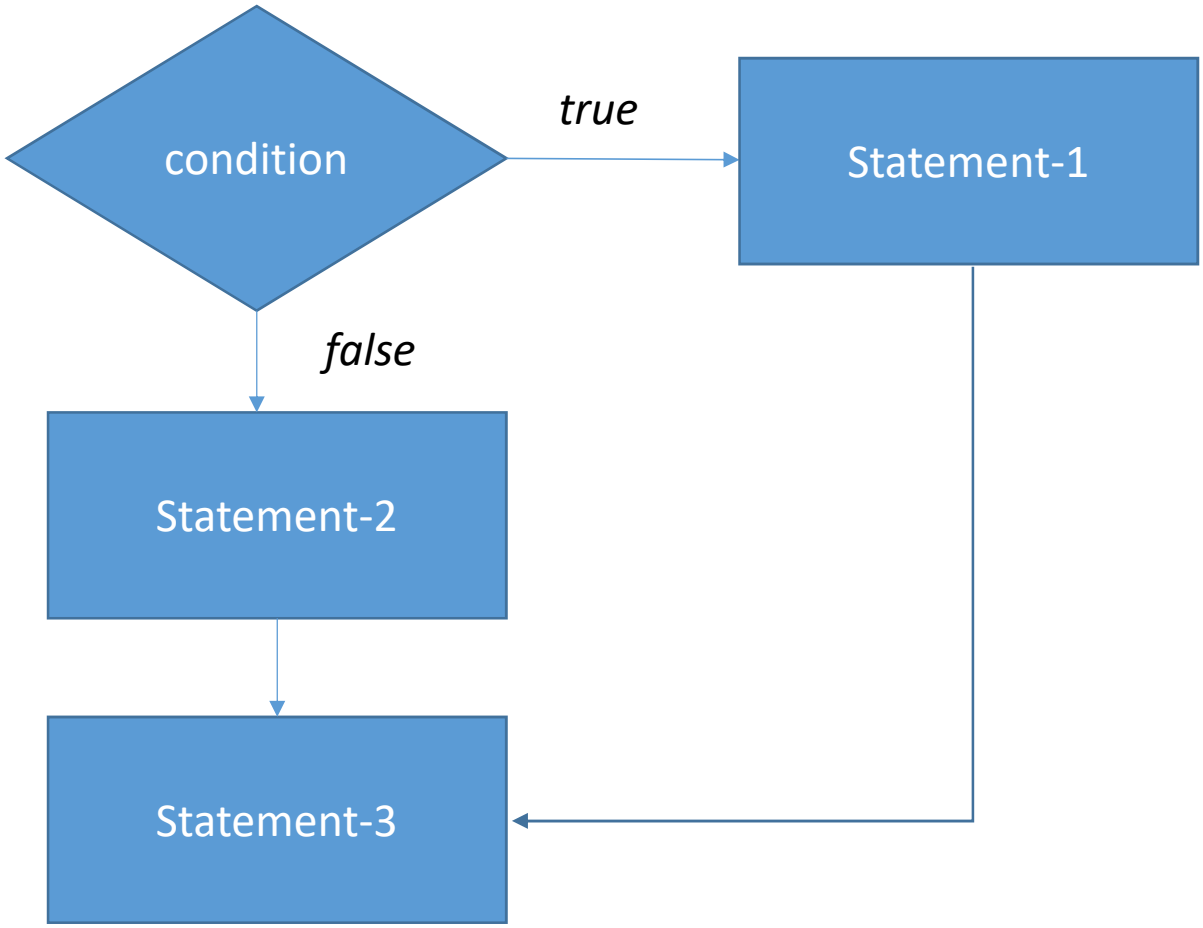

```
1  #include <iostream>
2  using namespace std;
3
4  int main(){
5
6      int a, b = 9;
7
8      cout << "Enter a value for a: ";
9      cin >> a;
10
11     if (a > b && a < 100 ){
12         cout << "a is a positive two digit number."<< endl;
13         int sum = 0;
14         sum += a%10;
15         sum += (a/10)%10;
16         cout << "The sum of the digits is " << sum << endl;
17     }
18
19     cout << "Value of a entered is " << a << endl;
20
21 }
22
```

If-else statement

if-else statements

```
if (condition)  // this condition evaluates to true or false
        statement-1;    // this statement will be executed if condition is true
else
        statement-2;    // this statement will be executed if condition is false
statement-3;    // will be executed next

if (condition)// this condition evaluates to true or false
{
        statement-1;    // these statements will be executed if condition is true
        statement-2;
        statement-3;
        ....
}
else{
        statement-1;    // these statements will be executed if condition is false
        statement-2;
        statement-3;
        ....
}
```

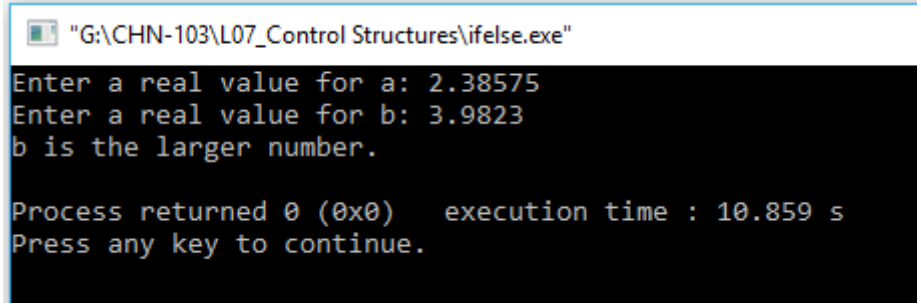
if-else statement



If-else statement

```
1  #include <iostream>
2  using namespace std;
3
4  int main(){
5
6      float a, b;
7
8      cout << "Enter a real value for a: ";
9      cin >> a;
10
11     cout << "Enter a real value for b: ";
12     cin >> b;
13
14     if (a > b )
15         cout << "a is the larger number."<< endl;
16     else
17         cout << "b is the larger number."<< endl;
18
19 }
```

Output window from Codeblocks

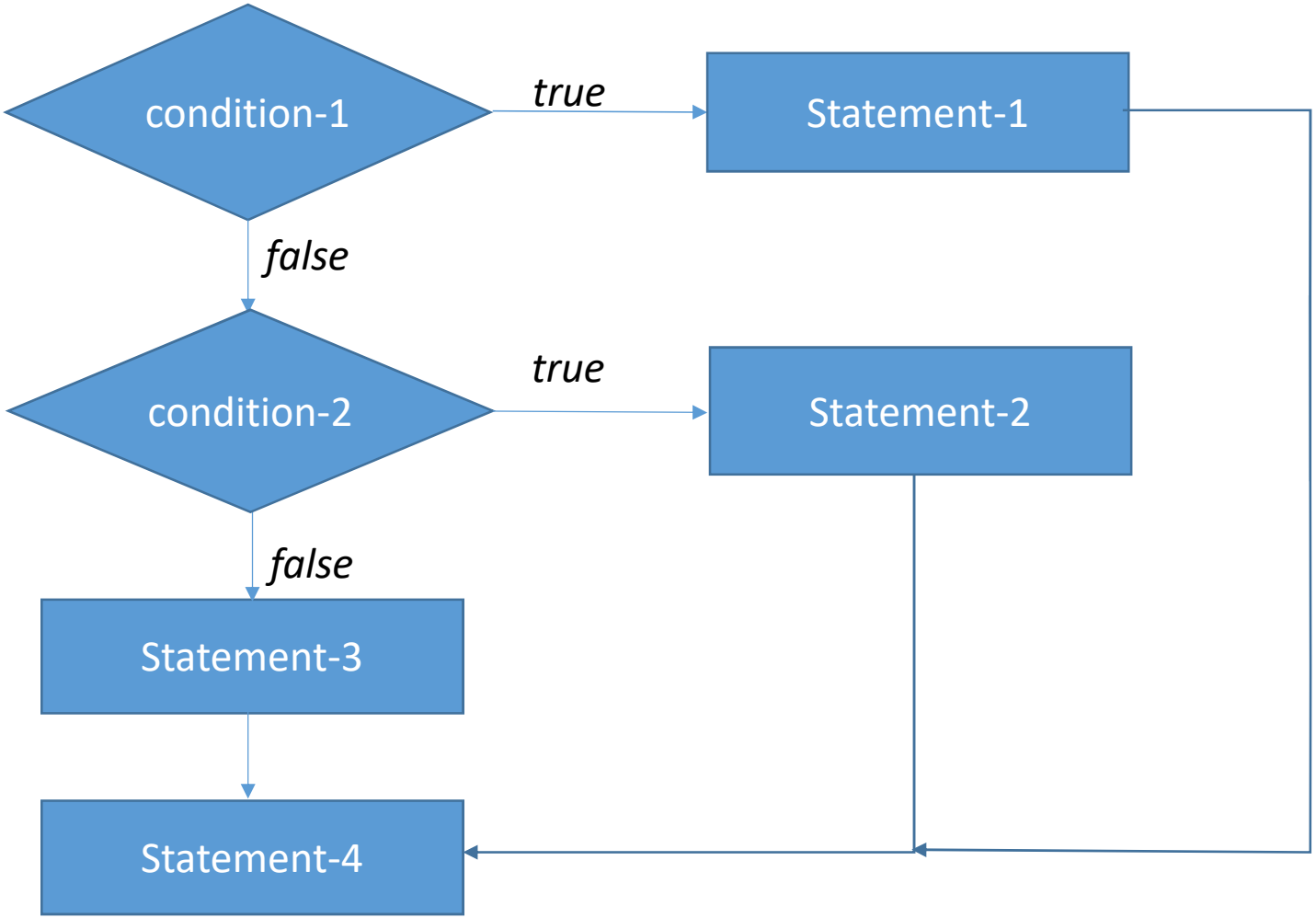


If-else if-else statement

if-else if -else statement

```
if (condition-1)
        statement-1;            // this will be executed when condition-1 is true
else if (condition-2)
        statement-2;            // this will be executed when condition-2 is true and
                                // condition-1 is false
else
        statement-3;            // this will be executed when both the above conditions are
                                // false

statement-4;
```

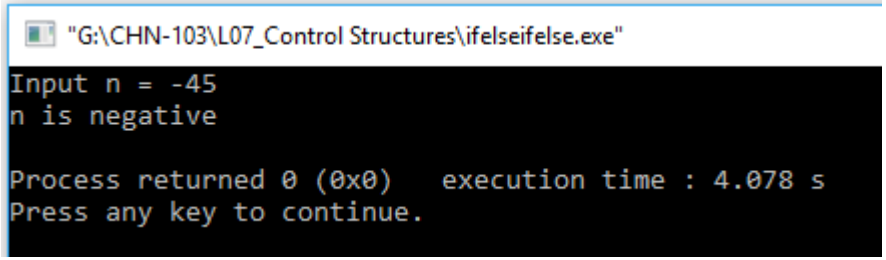
if-else if-else statement



If-else if-else statement

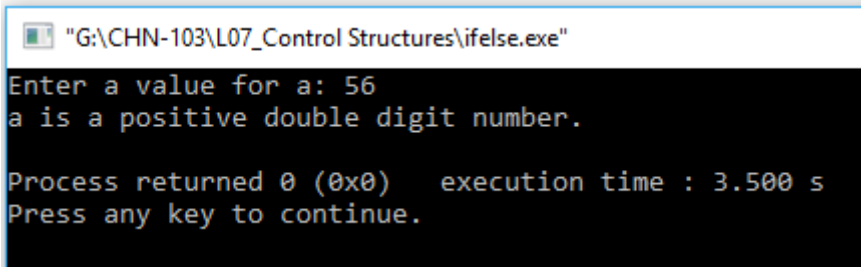
```
1   #include <iostream>
2
3   using namespace std;
4
5   int main(){
6
7       int n;
8
9       cout << "Input n = ";
10      cin >> n;
11
12      if (n > 0)
13          cout << "n is positive\n";
14      else if (n < 0)
15          cout << "n is negative\n";
16      else
17          cout << "n is zero\n";
18
19      return 0;
20  }
21
```

Output window from Codeblocks



If-else if-else statement

Output window from Codeblocks




```
1   #include <iostream>
2   using namespace std;
3
4   int main(){
5
6       int a, b = 9, c = 99, d = 999;
7
8       cout << "Enter a value for a: ";
9       cin >> a;
10
11      if (a >= 0 && a <= b )
12          cout << "a is a positive single digit number."<< endl;
13      else if (a > b && a <= c)
14          cout << "a is a positive double digit number."<< endl;
15      else if (a > c && a <= d)
16          cout << "a is a positive triple digit number."<< endl;
17      else
18          cout << "This program cannot say anything about a."<< endl;
19
20  }
21
```

Nested *if* statement

```
if (condition){
        statement;
        if (condition-2)        // this is a nested-if statement
                statement;
        else                    // associates with the immediately preceding 'if'
                statement;      // this will be executed when condition-2 is false
}
```

```
"G:\CHN-103\L07_Control Structures\nestedIf.exe"
Enter an integer value for a: 23
a is a positive number.
It is also an odd number.

Process returned 0 (0x0)   execution time : 4.109 s
Press any key to continue.
```

```
1   #include <iostream>
2   using namespace std;
3
4   int main(){
5
6       int a;
7       cout << "Enter an integer value for a: "; cin >> a;
8
9       if (a > 0 ){
10          cout << "a is a positive number."<< endl;
11          if (a % 2)
12              cout << "It is also an odd number." << endl;
13          else
14              cout << "It is also an even number."<< endl;
15      }
16  }
```

switch-case-default statement

switch-case-default

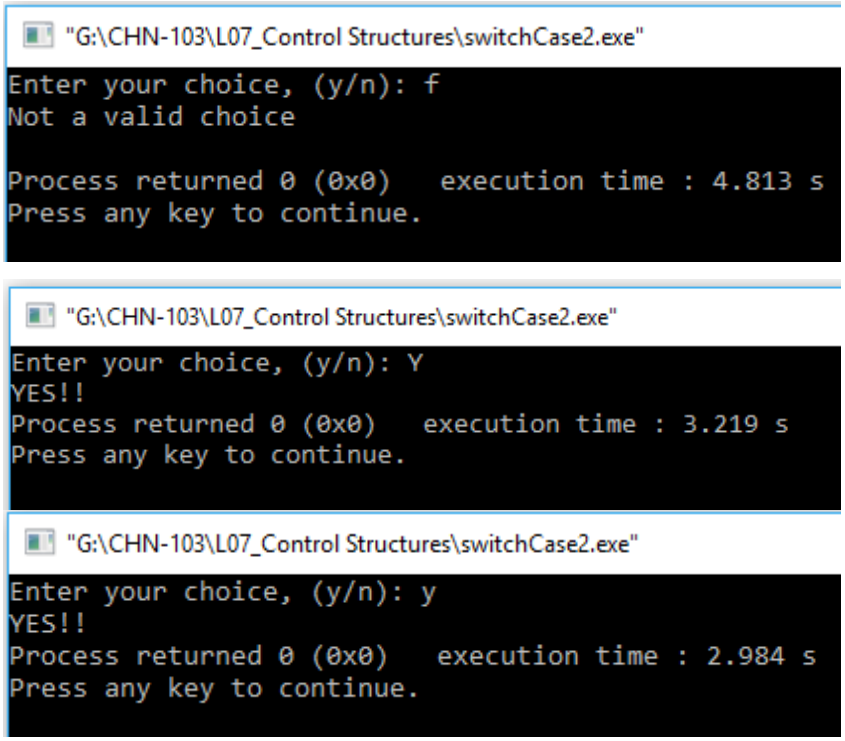
```
switch (expression){
        case <value of expression>:
                statement – 1;
                statement – 2;
                break;

        case <value of expression>:
                statement – 1;
                statement – 2;
                break;

        ....
        default:
                statement – 1;

}//end of switch case
```

```
#include <iostream>

using namespace std;

int main(){

    int choice;

    cout << "Enter your choice: ";
    cin >> choice;

    switch (choice){
        case 0:
            cout << "You have entered 0\n";
            break;

        case 1:
            cout << "You have entered 1\n";
            break;

        default:
            cout << "You have entered non-binary no.\n";
    }

}
```

```
"G:\CHN-103\L07_Control Structures\switchCase.exe"
Enter your choice: 1
You have entered 1

Process returned 0 (0x0)   execution time : 7.875 s
Press any key to continue.
```

switch-case-default statement

```
1   #include <iostream>
2
3   using namespace std;
4
5   int main(){
6
7       char ch;
8       cout << "Enter your choice, (y/n): ";
9       cin >> ch;
10
11      switch(ch){
12          case 'y':
13          case 'Y':
14              cout << "YES!!";
15              break;
16          case 'n':
17          case 'N':
18              cout << "NO??";
19              break;
20          default:
21              cout << "Not a valid choice\n";
22      }
23  }
24
```



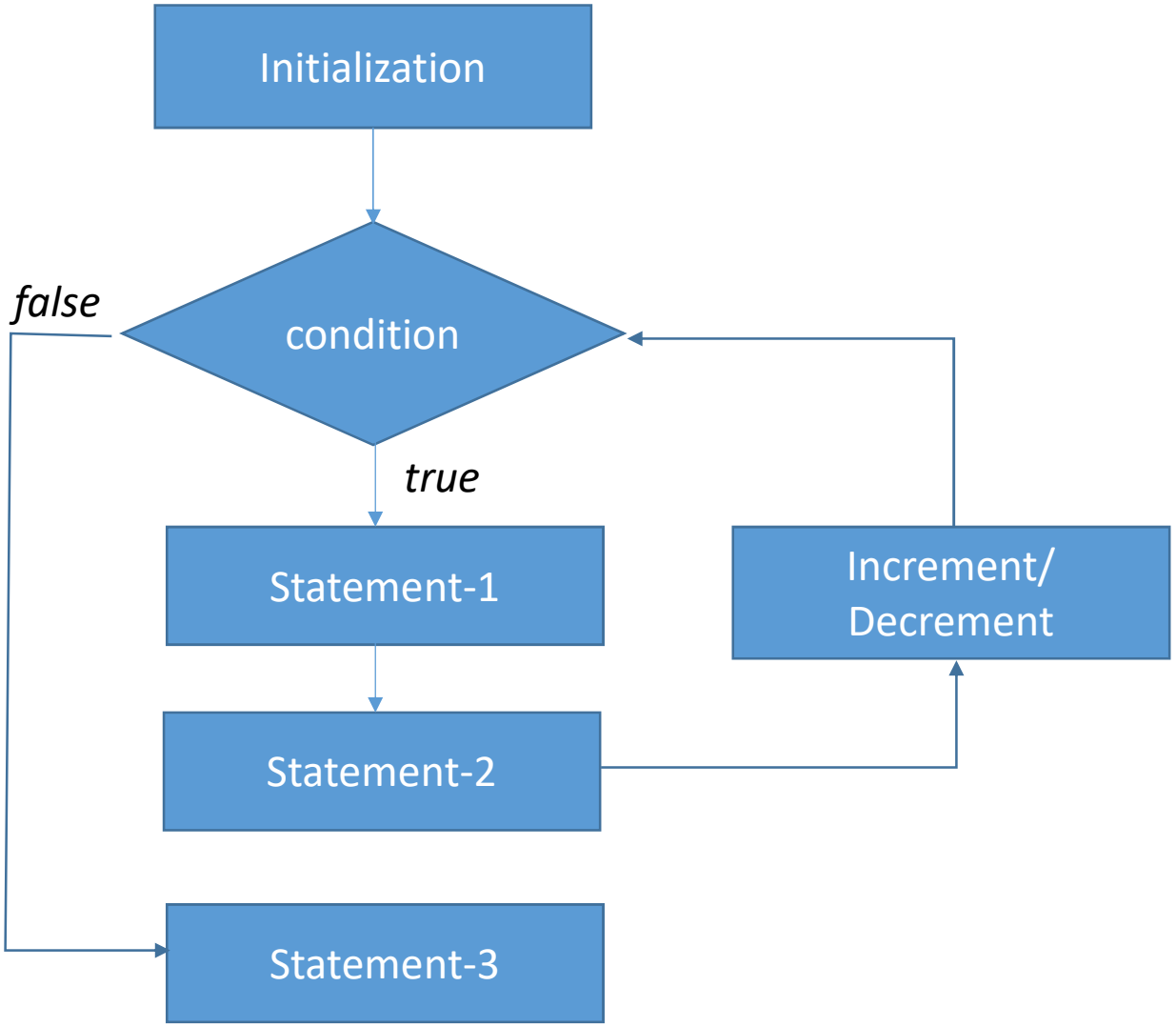
for loop statement

For loop

```
for (<initialization>;<condition>;<increment/decrement>){
        statement – 1;
        statement – 2;
        ...
}

for (int i = 0; i < 10; i++){

        cout << “loop variable i “ << i << endl;

}
```

all three fields of initialization, condition checking and increment/decrement are optional.

for statement



for loop statement

```
"G:\CHN-103\L07_Control Structures\forLoop.exe"
How many numbers you want to sum? 10
Summed 0 numbers          Current sum = 0
Summed 1 numbers          Current sum = 1
Summed 2 numbers          Current sum = 3
Summed 3 numbers          Current sum = 6
Summed 4 numbers          Current sum = 10
Summed 5 numbers          Current sum = 15
Summed 6 numbers          Current sum = 21
Summed 7 numbers          Current sum = 28
Summed 8 numbers          Current sum = 36
Summed 9 numbers          Current sum = 45
Summed 10 numbers         Current sum = 55
Sum of first 10 numbers is 55

Process returned 0 (0x0)   execution time : 4.656 s
Press any key to continue.
```

```cpp
#include <iostream>

using namespace std;

int main(){

    int n, sum = 0;
    cout << "How many numbers you want to sum? ";
    cin >> n;

    for (int i = 0;i <= n; i++){
        sum += i;
        cout << "Summed " << i << " numbers"
             << "\t Current sum = " << sum << '\n';

    }
    //cout << "After the loop i = " << i << endl;
    cout << "Sum of first " << n << " numbers is " << sum << '\n';

}
```

Variable ‘i’ is defined in the scope of the *for* loop only

All the fields for initialization, condition and increment/decrement are optional

```cpp
#include <iostream>

using namespace std;

int main(){

    int n, sum = 0;
    cout << "How many numbers you want to sum? ";
    cin >> n;

    for (int i = 0;i <= n; i++){
        sum += i;
        cout << "Summed " << i << " numbers"
             << "\t Current sum = " << sum << '\n';

    }
    cout << "After the loop i = " << i << endl;
    cout << "Sum of first " << n << " numbers is " << sum << '\n';

}
```

ogs & others

Code::Blocks | Search results | Cccc | Build log | **Build messages** | CppCheck/Vera++ | CppCheck/Vera

File	Line	Message
		=== Build file: "no target" in "no project" (compiler: unknown) ===
G:\CHN-103\L07...		In function 'int main()':
G:\CHN-103\L07...	17	error: 'i' was not declared in this scope
		=== Build failed: 1 error(s), 0 warning(s) (0 minute(s), 0 second(s)) ===

Nested *for loop* statement

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

int main(){

    int n;
    cout << "Enter the value of n for which sum is required:";
    cin >> n;

    int sum = 0;

    for (int i = 0; i < n; i++){

        sum += i+1;

        for (int j = 0; j < i; j++){

            cout << j + 1 << '+';

        }

        cout << i+1 << '=' << sum << '\n';

    }
}
```

```
"G:\CHN-103\L07_Control Structures\forLoops.exe"
Enter the value of n for which sum is required:10
1=1
1+2=3
1+2+3=6
1+2+3+4=10
1+2+3+4+5=15
1+2+3+4+5+6=21
1+2+3+4+5+6+7=28
1+2+3+4+5+6+7+8=36
1+2+3+4+5+6+7+8+9=45
1+2+3+4+5+6+7+8+9+10=55

Process returned 0 (0x0)   execution time : 4.687 s
Press any key to continue.
```

while and *do-while* loops

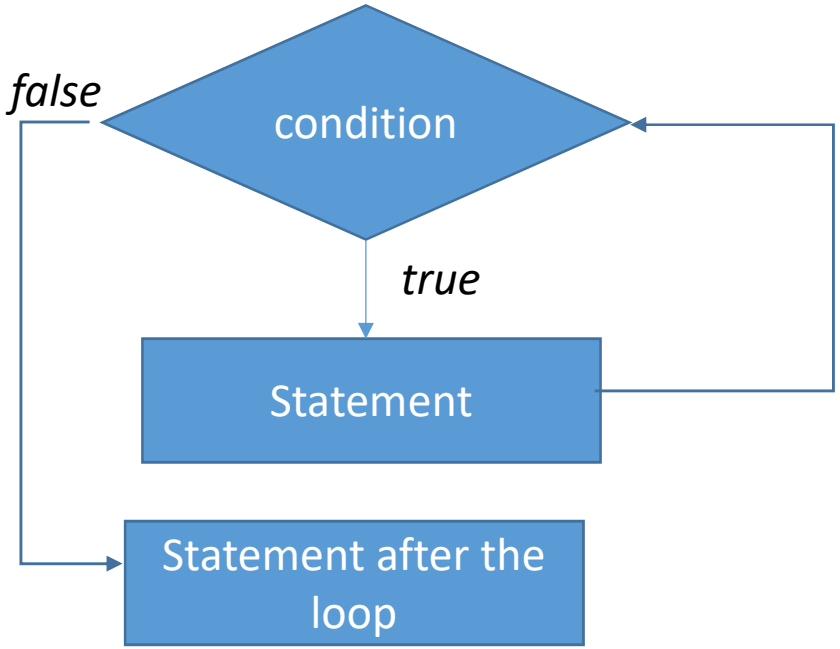
while loop – this is an entry controlled loop

```
while (condition) {
        statement-01;          // will execute when condition is true
        ....                   // there must be some way to update the condition
}
```

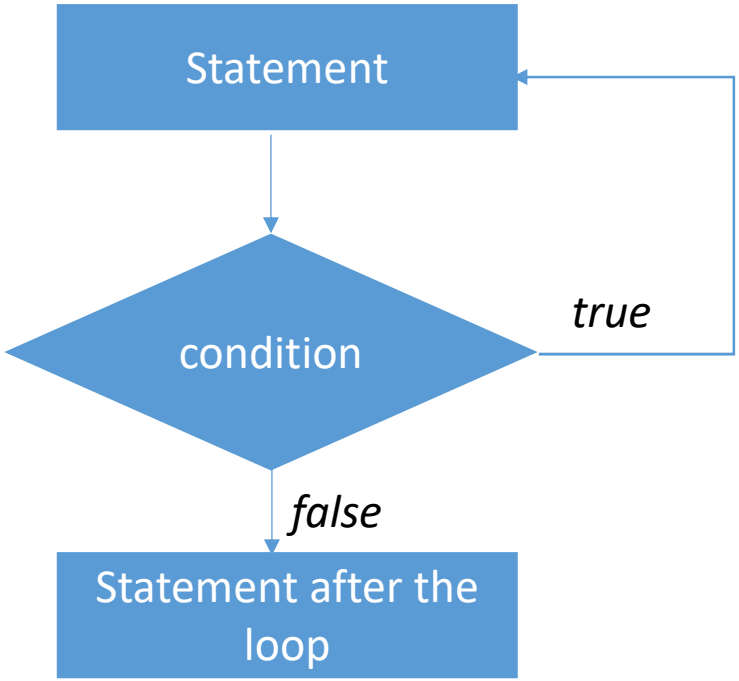
do while – this is a exit controlled loop

```
do {
        statements;    // will execute at least once
                       // will execute again until condition is true
        ...            // there must be some update to the condition
}while(condition);
```

while and *do-while* loops



while loop



do-while loop

while loop

```
1  #include <iostream>
2  using namespace std;
3
4  int main(){
5
6      float num, sum = 0.0;
7      bool flag = true;
8
9      while(flag){
10         cout << "Enter a number to add to the sum ";
11         cin >> num;
12
13         if (num > 0)
14             sum += num;
15
16         // Some way to update the flag
17         cout << "Do you want to add more numbers?(0/1)";
18         cin >> flag;
19     }
20     cout << "The sum of numbers entered is = " << sum << endl;
21 }
22
```

```
"G:\CHN-103\L07_Control Structures\whileLoop.exe"
Enter a number to add to the sum 12
Do you want to add more numbers?(0/1)1
Enter a number to add to the sum 90
Do you want to add more numbers?(0/1)1
Enter a number to add to the sum -34
Do you want to add more numbers?(0/1)0
The sum of numbers entered is = 102

Process returned 0 (0x0)   execution time : 17.735 s
Press any key to continue.
```

do-while loop

```
"G:\CHN-103\L07_Control Structures\doWhileLoop.exe"
Enter a number to add to the sum 12
Do you want to add more numbers?(0/1)1
Enter a number to add to the sum 67
Do you want to add more numbers?(0/1)0
The sum of numbers entered is = 79

Process returned 0 (0x0)   execution time : 15.922 s
Press any key to continue.
```

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

int main(){

    float num, sum = 0.0;
    bool flag = true;

    do{
        cout << "Enter a number to add to the sum ";
        cin >> num;

        if (num > 0)
            sum += num;

        // Some way to update the flag
        cout << "Do you want to add more numbers?(0/1)";
        cin >> flag;
    }while(flag);

    cout << "The sum of numbers entered is = " << sum << endl;
}
```

Don’t forget the semicolon after while

break and *continue* statements

break;

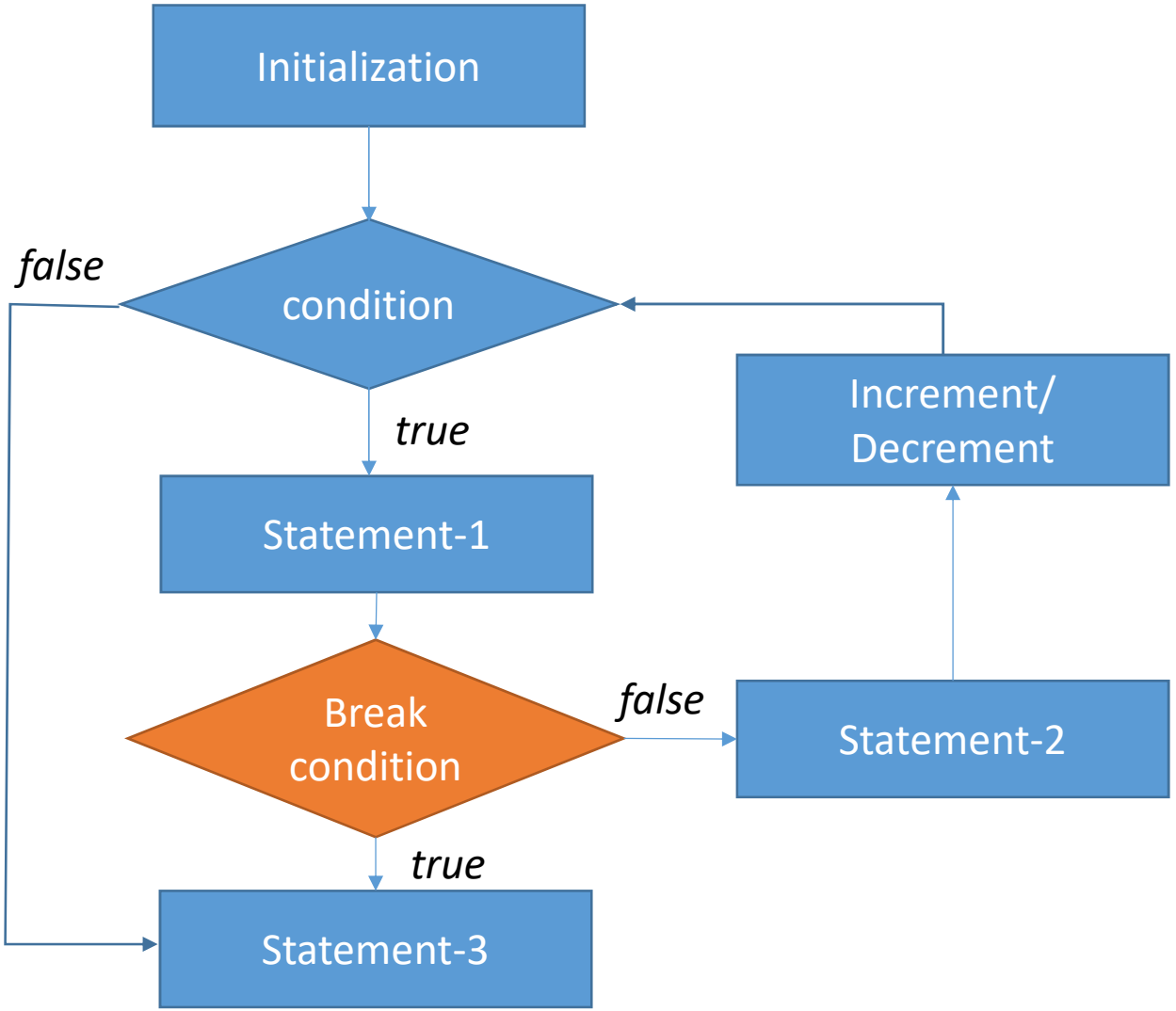
```
for (int i = 0;  i < 10; i++){

        if (i == 5)
                break;          // This will cause the control to go out of the loop
        cout << “Value of i is “ << i;
}
```

The break statement will break only the inner most loop in case of nested loops.

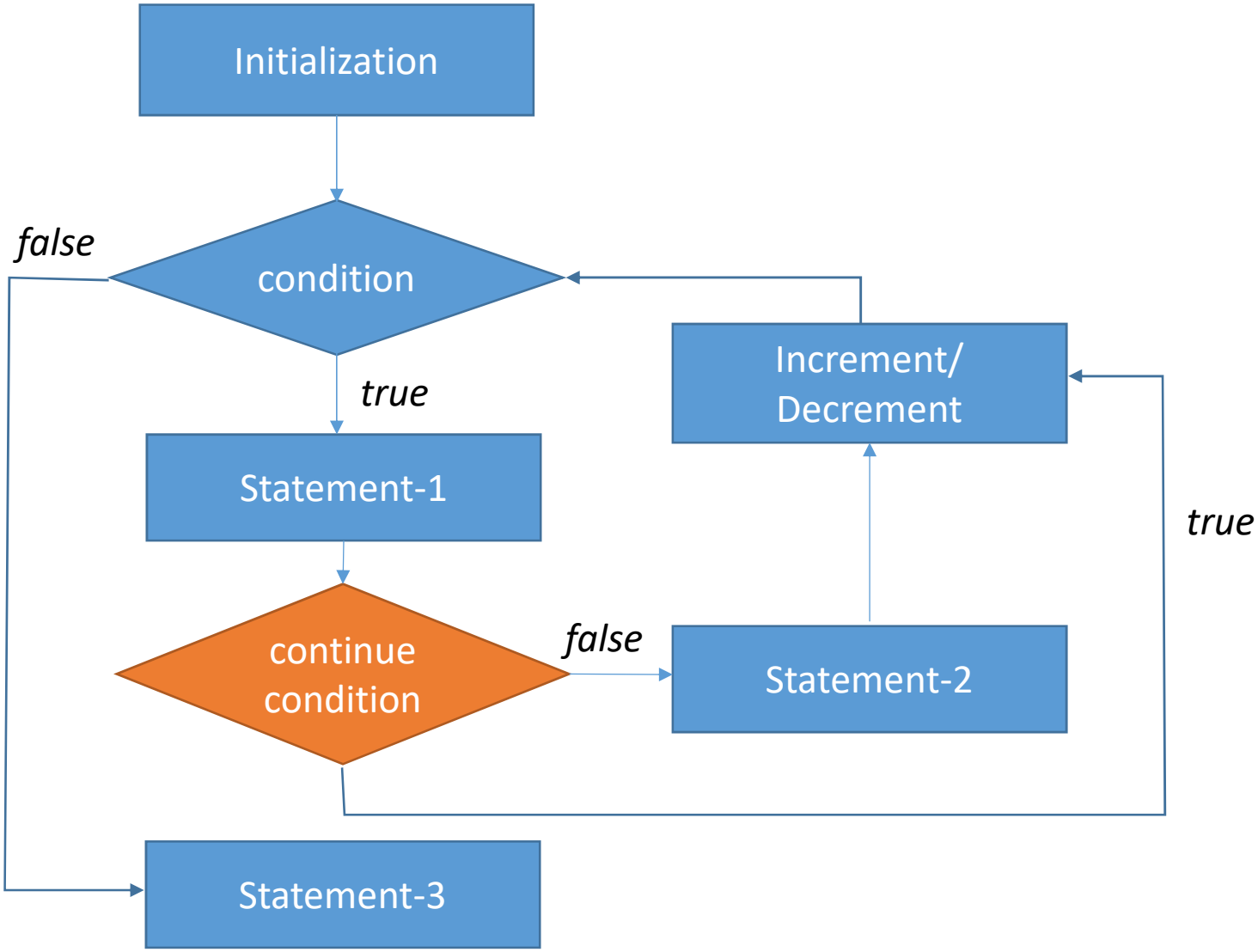
Continue;

```
for (int i = 0;  i < 10; i++){

        if (i == 5)
                continue;               // This will cause the control to skip rest of the statements and
                                        // continue with next iteration of loop
        cout << “Value of i is “ << i;
}
```

break statement

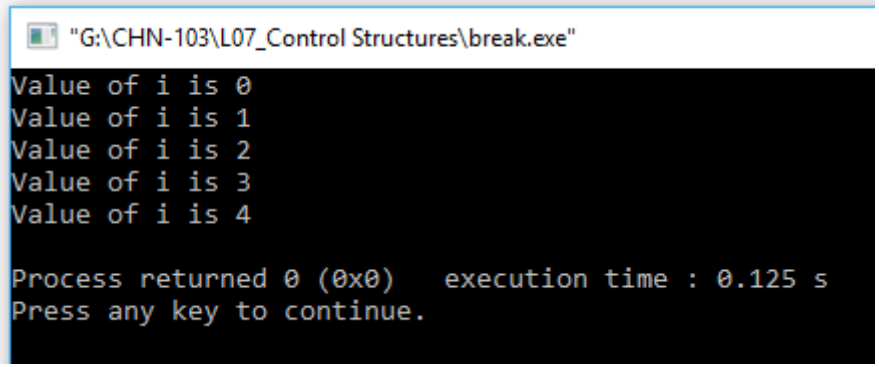


continue statement



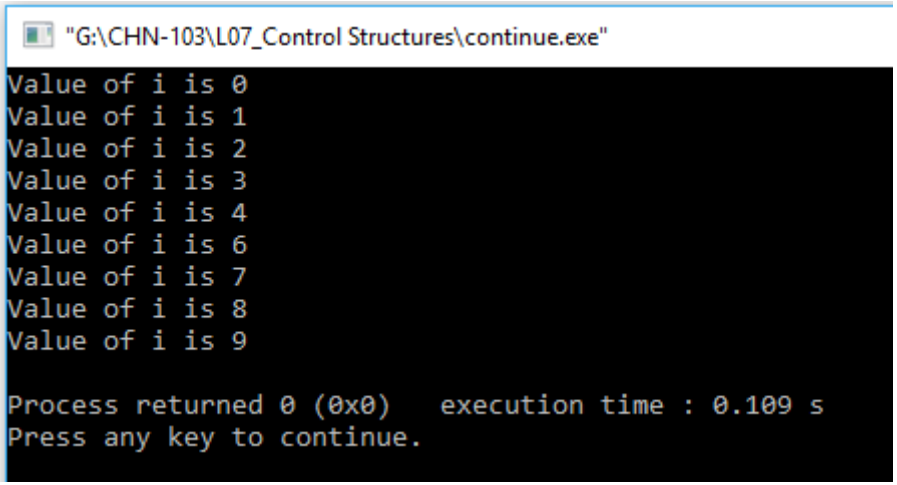
break statement

```
1   #include <iostream>
2
3   using namespace std;
4
5   int main(){
6
7       for (int i = 0;  i < 10; i++){
8
9           if (i == 5)
10              break;  // This will cause the control to go out of the loop
11          cout << "Value of i is " << i << endl;
12
13      }
14  }
15
```



continue statement

```
1   #include <iostream>
2
3   using namespace std;
4
5   int main(){
6
7       for (int i = 0;  i < 10; i++){
8
9           if (i == 5)
10              continue;    // This will cause the control to skip rest
11                           // of statements in this iteration
12          cout << "Value of i is " << i << endl;
13
14      }
15  }
16
```



goto label statement

goto <label>;.....label:

This is for jumping from one point to another point in the program. You can not jump into a loop or an if statement where the state of loop variable would be undefined.

```cpp
#include <iostream>

using namespace std;

int main(){

    int n, sum = 0;
    bool flag;

    start:      // this is a label
        cout << "Input a value for n: ";
        cin >> n;
        if (n > 0)
            sum += n;
        else
            cout << "No non-positive numbers allowed\n";

        cout << "Do you want to continue?(0/1)";
        cin >> flag;
        if (flag)
            goto start;
        else
            goto end;

    end:
    cout << "Sum is " << sum << endl;

}
```

```
"G:\CHN-103\L07_Control Structures\goto.exe"
Input a value for n: 12
Do you want to continue?(0/1)1
Input a value for n: 13
Do you want to continue?(0/1)1
Input a value for n: -34
No non-positive numbers allowed
Do you want to continue?(0/1)1
Input a value for n: 67
Do you want to continue?(0/1)0
Sum is 92

Process returned 0 (0x0)   execution time : 62.376 s
Press any key to continue.
```

Summary

Control Structures: how and when the statements are executed in a program

Sequential	**Selection**	**Looping**	**Jumping**
	If If else If elseif else switch-case-default	for while do while	break continue goto <label>