

# COMP2011 Programming with C++

## Syntax Comparison between VBA and C++: Basics and Program Flow Control

The purpose of this set of notes is to help you quickly transfer your basic knowledge of VBA to that of C++. Please note that it is not a complete summary of our lecture notes. For all the C++ features discussed in COMP2011, you have to carefully study the lecture notes on our course website.

In VBA	In C++
<b>Hello Word Program</b>	
<pre>Private Sub Workbook_Open()     MsgBox "Hello World!" ' Showing a message End Sub</pre>	<pre>/*  * File: hello_world.cpp  * A common program used to demo a new language  */ #include &lt;iostream&gt; using namespace std; int main() {     cout &lt;&lt; "Hello World!" &lt;&lt; endl;     return 0; }</pre>
<b>Executing a VBA code</b> <ul style="list-style-type: none"><li>• The event handler will be executed automatically when an event occurs.</li><li>• Or, run (apply) a macro</li></ul>	<b>Executing a C++ program</b> <ol style="list-style-type: none"><li>1. compile the program: g++ -o hello_world.out hello_world.cpp</li><li>2. execute the program: hello_world.out</li></ol>
<b>Basic Output</b>	
To show a message “abc” with a newline character:  <pre>MsgBox "abc"</pre>	To show a message “abc” with a newline character:  <pre>cout &lt;&lt; "abc" &lt;&lt; endl;</pre> <p>where <code>endl</code> means “end of the line”.</p> <p>Or,</p> <pre>cout &lt;&lt; "abc\n";</pre>
<b>Comments</b>	
<ul style="list-style-type: none"><li>• for one line of comment only: <pre>' ...</pre></li></ul>	<ul style="list-style-type: none"><li>• for one or more lines of comments: <pre>/* ... */</pre></li><li>• for one line of comment only: <pre>// ...</pre></li></ul>
<b>Statements</b>	
<ul style="list-style-type: none"><li>• A statement is a line of code.</li><li>• Only those extra blanks and tabs are ignored.</li><li>• If the line of the statement is too long, one may break it into several lines using “_”.</li></ul> <p>For example:</p> <pre>MsgBox "Hello" &amp; _ " world" MsgBox "!"</pre>	<ul style="list-style-type: none"><li>• Each statement ends in a semicolon “;”</li><li>• Extra blanks, tabs, lines are ignored.</li><li>• More than one statement can be on one line.</li><li>• A statement may be spread over several lines.</li></ul> <p>For example:</p> <pre>cout &lt;&lt; "Hello" &lt;&lt; " world" &lt;&lt; endl; cout &lt;&lt; "!" &lt;&lt; endl;</pre>

## Variables

- Basic Data Types:
  - Integer: `Integer`, `Long`  
Examples of values: 0, 1, 100, -101, ...
  - Floating point: `Single`, `Double`  
Examples of values: 0.5, -123.908232
  - String: `String`  
Examples of values: `"A"`, `"abc"`, `"comp 2011"`, ...
  - Boolean: `Boolean`  
Examples of values: `True`, `False`
  - Variant: `Variant`
- Variables can be created for different types by using the keyword `Dim`.  
For examples:
 

```
Dim num1 As Integer
num1 = 100 ' Integer data type
Dim num2 As Double
num2 = 0.05 ' Double data type
```

- Basic Data Types:
  - Integer: `short`, `int`, `long`, `long long`, etc.  
Examples of values: 0, 1, 100, -101, ...
  - Floating point: `float`, `double`, `long double`, etc.  
Examples of values: 0.5, -123.908232
  - Character: `char`  
Examples of values: `'A'`, `'a'`, `'B'`, `'b'`, ...
  - Boolean: `bool`  
Examples of values: `true`, `false`
- Variables have to be declared and defined.  
For examples:
 

```
int num1;
num1 = 100;
double num2 = 0.05;
```

## if Statement

```
If (<bool-expr>) Then
    <stmt>
End If
```

```
if (<bool-expr>) <stmt>
```

```
If (<bool-expr>) Then
    <stmt(s)>
End If
```

```
if (<bool-expr>) { <stmt(s)> }
```

```
If (<bool-expr>) Then
    <stmt>
Else
    <stmt>
End If
```

```
if (<bool-expr>) <stmt> else <stmt>
```

```
If (<bool-expr>) Then
    <stmt(s)>
Else
    <stmt(s)>
End If
```

```
if (<bool-expr>) { <stmt(s)> } else { <stmt(s)> }
```

```
if (<bool-expr>) Then
    <stmt(s)>
ElseIf (<bool-expr>) Then
    <stmt(s)>
Else
    <stmt(s)>
End If
```

```
if (<bool-expr>)
{
    <stmt(s)>
} else if (<bool-expr>) {
    <stmt(s)>
} else {
    <stmt(s)>
}
```

Note: Blocks are identified by **End If**, **ElseIf**, **Else**.  
For example:

```
Dim x As Integer
x = -5
Dim Result As String
If x > 0 Then
    Result = "x is positive"
    If x Mod 2 Then
        Result = Result + " and odd."
    Else
        Result = Result + " and even."
    End If
ElseIf (x < 0) And (x Mod 2) Then
    Result = "x is negative and odd."
ElseIf (x < 0) And (Not (x Mod 2)) Then
    Result = "x is negative and even."
Else
    Result = "x is zero."
End If
MsgBox Result
```

Note: Blocks are identified by pairs of braces ({}).  
For example:

```
int x = -5;
if (x > 0)
{
    cout << "x is positive";
    if (x % 2)
        cout << " and odd." << endl;
    else
        cout << " and even." << endl;
} else if ((x < 0) && (x % 2)) {
    cout << "x is negative and odd." << endl;
} else if ((x < 0) && !(x % 2)) {
    cout << "x is negative and even." << endl;
} else {
    cout << "x is zero." << endl;
}
```

### if-else Operator

In C++, there are the if-else expressions. The syntax is:

**<condition> ? <result1> : <result2>**

It means that if **<condition>** is true, the expression's value will be **<result1>**, otherwise it will be **<result2>**.

For example:

```
int x = 2, y = 3;
int z = (x > y) ? x : y;
cout << z << endl;
// the output will be 3
```

### while Loop

```
While (<bool-expr>)
    <stmt(s)>
Wend
```

Note: Blocks are identified by the closest **Wend**.

```
Do While (<bool-expr>)
    <stmt(s)>
Loop
```

Note: Blocks are identified by the closest **Loop**.

```
while (<bool-expr>)
    <stmt>
```

```
while (<bool-expr>)
{
    <stmt(s)>
}
```

Note: Blocks are identified by pairs of braces ({}).

```
Do
    <stmt(s)>
while (<bool-expr>)
```

Note: Blocks are identified by having the same indentation.

```
do
    <stmt>
while (<bool-expr>);

do
{
    <stmt(s)>
} while (<bool-expr>);
```

Note: Blocks are identified by pairs of braces ({}).

For example:

```
Dim i As Integer
i = 10
Do While i > 0
    i = i - 2
    MsgBox i
Loop
```

For example:

```
int i = 10;
while (i > 0)
{
    i -= 2;
    cout << i << endl;
}
```

### for Loop

```
For <counter> = <start> To <end> Step <step>
    <stmt(s)>
Next
```

For example:

```
Dim i As Integer
For i = 0 To 9 Step 1
    MsgBox i
Next
```

```
for (<for-initialization>; <bool-exp>;
    <post-processing>) { <stmt(s)> }
```

For example:

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

### Finishing a Loop Early

In a **For** loop, the statement

**Exit For**

means to stop the whole **For** loop.

In a **Do While ... Loop** and **Do ... Loop While** loop, the statement

**Exit Do**

means to stop the whole loop.

In a **for** loop or a **while** loop, **break** means to stop the whole loop; while **continue** means to skip the current execution.

### Functions and Subroutines

- A VBA function runs some code and returns something after the code is finished.
- A VBA subroutine runs some code, but does not return anything.

For example,

```
' A subroutine with no return value
Sub PrintNum(ByVal num As Integer)
    MsgBox "The number is" + Str(num)
End Sub

' A function with return value
Function AddOne(ByVal num As Integer)
    AddOne = num + 1
End Function

' An event handler in calling
' the subroutine PrintNum() and
' the function AddOne()
Private Sub Workbook_Open()
    PrintNum 10
    PrintNum AddOne(10)
End Sub
```

- A C++ function may or may not return a value.

For example,

```
/* File: function_example.cpp
   A C++ program with two functions:
   PrintNum() and AddOne()
*/
#include <iostream>
using namespace std;
// A function with no return value
void PrintNum(int num)
{
    cout << "The number is " << num << endl;
}
// A function with return value of integer type
int AddOne(int num)
{
    return (num + 1);
}
// A main function in calling
// the two functions PrintNum() and AddOne()
int main()
{
    PrintNum(10);
    PrintNum(AddOne(10));
    return 0;
}
```

### Some Operators in VBA and C++

		VBA			C++		
		Symbol	Example	Output	Symbol	Example	Output
Arithmetic Operators	Addition	+	1 + 2	3	Same		
	Subtraction	-	1 - 2	-1	Same		
	Multiplication	*	1 * 2	2	Same		
	Division	/	1 / 2	0.5	/	1.0 / 2	0.5
					/	1 / 2	0
	Modulus (Remainder)	Mod	9 Mod 4	1	Same		
Assignment Operators	Power	^	2 ^ 3	8	Nil		
	Assignment	=	x = y		Same		
	Addition Assignment	+=	x += y		Same		
	Subtraction Assignment	-=	x -= y		Same		
	Multiplication Assignment	*=	x *= y		Same		
	Division Assignment	/=	x /= y		Same		
Relational Operators	And	And	x And y		&&	x && y	
	Or	Or	True Or False	True		true    false	true
	Not	Not	Not False	True	!	!false	true
Comparison Operators	Larger than	>	20 > 10	True	Same		
	Larger than or equal to	>=	20 >= 10	True	Same		
	Smaller than	<	20 < 10	False	Same		
	Smaller than or equal to	<=	20 <= 10	False	Same		
	Equal to	=	20 = 10	False	==	20 == 10	false
	Not equal to	<>	20 <> 10	True	!=	20 != 10	true
Increment Operators	Post-increment	Nil			++	x = 1; y = 2; y = x++; cout << x << " " << y;	2 1
	Pre-increment	Nil			++	x = 1; y = 2; y = ++x; cout << x << " " << y;	2 2
Decrement Operators	Post-decrement	Nil			--	x = 1; y = 2; y = x--; cout << x << " " << y;	0 1
	Pre-decrement	Nil			--	x = 1; y = 2; y = --x; cout << x << " " << y;	0 0

#### References:

1. David Rossiter and Gibson Lam. (2015). Excel and Excel VBA Programming for Beginners. Third Edition. McGraw Hill Education.
2. Cay Horstmann. (2012). C++ For Everyone. Second Edition. Wiley.