

COMP2012H Honors Object-Oriented Programming and Data Structures

Syntax Comparison between Python and C++: Basics and Program Flow Control

The purpose of this set of notes is to help you quickly transfer your basic knowledge of Python to that of C++. Please note that it is not a complete summary of our lecture notes. For all the C++ features discussed in COMP2012H, you have to carefully study the lecture notes on our course website.

In Python	In C++
Hello World Program	
<pre>""" File: hello_world.py A common program used to demo a new language """ print("Hello World!")</pre>	<pre>/* * File: hello_world.cpp * A common program used to demo a new language */ #include <iostream> using namespace std; int main() { cout << "Hello world" << endl; return 0; }</pre> <p>Note: Every C++ program must have exactly one main() function which is the entry point of the program.</p>
Executing a Python program	Executing a C++ program
1. execute the program: python hello_world.py	1. compile the program: g++ -o hello_world.out hello_world.cpp 2. execute the program: hello_world.out

Basic Output	
To print the word “abc” with a newline character: <pre>print("abc")</pre> Or, <pre>print("abc", end = "\n")</pre>	To print the word “abc” with a newline character: <pre>cout << "abc" << endl;</pre> where <code>endl</code> means “end of the line”. Or , <pre>cout << "abc\n";</pre>

Comments	
<ul style="list-style-type: none">for one or more lines of comments: <pre>""" ... """</pre>for one line of comment only: <pre># ...</pre>	<ul style="list-style-type: none">for one or more lines of comments: <pre>/* ... */</pre>for one line of comment only: <pre>// ...</pre>

Including a module/library	
<pre>import random</pre>	<pre>#include <iostream></pre>

Statements	
<ul style="list-style-type: none">A statement is a line of code.Only extra blanks and tabs are ignored.If the line of the statement is too long, one may break it into several lines using “\”. <p>For example:</p> <pre>print("Hello", \ " world") print("!")</pre>	<ul style="list-style-type: none">Each statement ends in a semicolon “;”Extra blanks, tabs, lines are ignored.More than one statement can be on one line.A statement may be spread over several lines. <p>For example:</p> <pre>cout << "Hello" << " world"; cout << "!" << endl;</pre>
Variables	
<ul style="list-style-type: none">Basic Data Types:<ul style="list-style-type: none">Integer: Examples of values: 0, 1, 100, -101, ...Floating point: Examples of values: 0.5, -123.908232String: Examples of values: "A", 'abc', "comp 2012H", ...Boolean: Examples of values: True, FalseVariables need not be declared and their data types are inferred from the assignments. For examples: <pre>num1 = 100 # integer data type num2 = 0.05 # float data type</pre>	<ul style="list-style-type: none">Basic Data Types:<ul style="list-style-type: none">Integer: <code>short</code>, <code>int</code>, <code>long</code>, <code>long long</code>, etc. Examples of values: 0, 1, 100, -101, ...Floating point: <code>float</code>, <code>double</code>, <code>long double</code>, etc. Examples of values: 0.5, -123.908232Character: <code>char</code> Examples of values: 'A', 'a', 'B', 'b', ...Boolean: <code>bool</code> Examples of values: <code>true</code>, <code>false</code>Variables have to be declared and defined. For examples: <pre>int num1; num1 = 100; double num2 = 0.05;</pre>

if Statement	
<pre>if (<bool-expr>) : <stmt></pre>	<pre>if (<bool-expr>) <stmt></pre>
<pre>if (<bool-expr>) : <stmt(s)></pre>	<pre>if (<bool-expr>) { <stmt(s)> }</pre>
<pre>if (<bool-expr>) : <stmt> else : <stmt></pre>	<pre>if (<bool-expr>) <stmt> else <stmt></pre>
<pre>if (<bool-expr>) : <stmt(s)> else if (<bool-expr>) : <stmt(s)></pre>	<pre>if (<bool-expr>) { <stmt(s)> } else { <stmt(s)> }</pre>
<pre>if (<bool-expr>) : <stmt(s)> elif (<bool-expr>) : <stmt(s)></pre>	<pre>if (<bool-expr>) { <stmt(s)> } else if (<bool-expr>) { <stmt(s)> }</pre>
<pre>if (<bool-expr>) : <stmt(s)> elif (<bool-expr>) : <stmt(s)> else : <stmt(s)></pre>	<pre>if (<bool-expr>) { <stmt(s)> } else if (<bool-expr>) { <stmt(s)> } else { <stmt(s)> }</pre>

<p>Note: Blocks are identified by having the same indentation.</p> <p>For example:</p> <pre>x = -5 if x > 0 : print("x is positive", end="") if x % 2 : print(" and odd.") else : print(" and even.") elif (x < 0) and (x % 2) : print("x is negative and odd.") elif (x < 0) and (not (x % 2)) : print("x is negative and even.") else : print("x is zero.")</pre>	<p>Note: Blocks are identified by pairs of braces ({}).</p> <p>For example:</p> <pre>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; }</pre> <p>if-else Operator</p> <p>In C++, there are if-else expressions. The syntax is:</p> <pre><condition> ? <result1> : <result2></pre> <p>It means that if <condition> is true, the expression's value will be <result1>, otherwise it will be <result2>.</p> <p>For example:</p> <pre>int x = 2, y = 3; int z = (x > y) ? x : y; cout << z << endl; // the output will be 3</pre>
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while Loop

<pre>while (<bool-expr>) : <stmt(s)></pre> <p>Note: Blocks are identified by having the same indentation.</p> <p>For example:</p> <pre>i = 10 while i > 0: i = i - 2 print(i)</pre>	<pre>while (<bool-expr>) <stmt></pre> <pre>while (<bool-expr>) { <stmt(s)> }</pre> <pre>do (<bool-expr>) <stmt></pre> <pre>do { <stmt(s)> } while (<bool-expr>);</pre> <p>Note: Blocks are identified by pairs of braces ({}).</p> <p>For example:</p> <pre>int i = 10; while (i > 0) { i -= 2; cout << i << endl; }</pre>
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<p>for Loop</p> <pre>for <item> in <a list of item> : <stmt(s)></pre> <p>For example:</p> <pre>for i in range(10): print(i)</pre>	
<p>break and continue</p> <p>In a for loop, break means to stop the whole loop; while continue means to skip the current execution.</p>	
<p>Functions</p> <p>A Python function need not specify the parameter types and return types.</p> <p>For example,</p> <pre>""" File: function_example.py A Python Program with two functions: PrintNum() and AddOne() """ def PrintNum(num): print("The number is", num) def AddOne(num): return (num + 1) PrintNum(10) PrintNum(AddOne(10))</pre>	
<p>A C++ function has to specify the parameter types and return types.</p> <p>For example,</p> <pre>/* File: function_example.cpp A C++ Program with two functions: PrintNum() and AddOne() */ #include <iostream> using namespace std; void PrintNum(int num) { cout << "The number is " << num << endl; } int AddOne(int num) { return (num + 1); } int main() { PrintNum(10); PrintNum(AddOne(10)); return 0; }</pre>	

Some Operators in Python and C++

		Python			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
	Integer Division	//	1 // 2	0	/	1 / 2	0
	Modulus (Remainder)	%	9 % 4	1	Same		
	Power	**	2 ** 3	8	Nil		
Assignment Operators	Assignment	=	x = y		Same		
	Addition Assignment	+=	x += y		Same		
	Subtraction Assignment	-=	x -= y		Same		
	Multiplication Assignment	*=	x *= y		Same		
	Division Assignment	/=	x /= y		Same		
	Assignment						
Relational Operators	And	and	True and False	False	&&	true && false	false
	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	Same		
	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. Cay Horstmann. (2012). C++ For Everyone. Second Edition. Wiley.