

# Introduction to Modern C++ Course Outline

Ryan Baker

January 2, 2025

## Week 1: Introduction to C++

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2.2 The C++ Methodology . . . . .	2
2.3 C++ vs. Other Languages . . . . .	2
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3.1 Tools Required . . . . .	2
3.1.1 Text Editor . . . . .	2
3.1.2 Compiler . . . . .	2
3.2 “Hello, World!” Example . . . . .	2
<b>4 Basic Syntax and Structure</b>	<b>2</b>
4.1 Basic Structure of a C++ Program . . . . .	2
4.1.1 <code>int</code> <code>main()</code> . . . . .	2
4.2 Foundational Concepts . . . . .	2
4.2.1 Semicolons, <code>/* comments */</code> , and Whitespace . . . . .	2
4.2.2 Line-by-Line Execution . . . . .	2
4.3 Input and Output . . . . .	2
<b>5 Datatypes and Variables</b>	<b>2</b>
5.1 Primitive Types . . . . .	2
5.1.1 <code>int</code> , <code>char</code> , <code>bool</code> , <code>float</code> , <code>void</code> . . . . .	2
5.1.2 <code>sizeof</code> Operator . . . . .	2
5.2 Declaration and Definition . . . . .	2
5.2.1 Assignment Operator <code>=</code> . . . . .	2
5.2.2 Brace Initialization <code>{}</code> . . . . .	2
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<b>1</b>	<b>The Build Process</b>	<b>2</b>
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1.2.2	Conditional Compilation . . . . .	2
1.2.3	File Inclusion . . . . .	2
1.2.4	Preprocessor Output . . . . .	2
1.3	Compilation . . . . .	2
1.3.1	Compiler Output . . . . .	2
1.4	Linking . . . . .	2
<b>2</b>	<b>Introduction to Memory</b>	<b>2</b>
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2.2	Pointers . . . . .	2
2.2.1	NULL Pointers . . . . .	2
2.2.2	Pointer Arithmetic . . . . .	2
2.2.3	Pointers to Pointers . . . . .	2
<b>3</b>	<b>Memory Layout</b>	<b>2</b>
3.1	Text Segment . . . . .	2
3.2	Static Memory . . . . .	2
3.2.1	Variable Lifetime . . . . .	2
3.3	The Heap . . . . .	2
3.3.1	Operators <b>new</b> and <b>delete</b> . . . . .	2
3.3.2	Memory Leaks . . . . .	2
3.4	The Stack . . . . .	2
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<b>2</b>	<b>Scope</b>	<b>4</b>
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2.1.3	Anonymous Scope . . . . .	4
2.2	Namespaces . . . . .	4
2.2.1	Namespace Operator :: . . . . .	4
2.2.2	using Namespaces . . . . .	4
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3.2.1	The Overhead of if Statements . . . . .	4
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<b>4</b>	<b>Loops</b>	<b>4</b>
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<b>5</b>	<b>Control Flow Keywords</b>	<b>4</b>
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1.3	Array Initialization . . . . .	2
1.4	Dynamic Arrays . . . . .	2
<b>2</b>	<b>Structs</b>	<b>2</b>
2.1	Struct Initialization . . . . .	2
<b>3</b>	<b>Classes</b>	<b>2</b>
3.1	Constructors and Destructors . . . . .	2
3.1.1	Initializer Lists . . . . .	2
3.1.2	Default Initialization . . . . .	2
3.1.3	Copy Constructors . . . . .	2
3.2	Access Specifiers . . . . .	2
3.2.1	<code>private</code> Members . . . . .	2
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3.2.3	<code>public</code> Members . . . . .	2
3.2.4	Structs vs. Classes . . . . .	2
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1.2	Encapsulation . . . . .	2
1.3	Inheritance . . . . .	2
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1.3.2	Interfaces . . . . .	2
1.4	Polymorphism . . . . .	2
1.5	Composition <code>// not usually included</code> . . . . .	2
<b>2</b>	<b>Operator Overloading</b>	<b>2</b>
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2.2	<code>friend</code> Functions . . . . .	2

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<b>1</b>	<b>Standard Containers</b>	<b>2</b>
1.1	Sequence Containers . . . . .	2
1.1.1	std::array . . . . .	2
1.1.2	std::vector . . . . .	2
1.1.3	std::deque . . . . .	2
1.1.4	std::list . . . . .	2
1.2	Associative Containers . . . . .	2
1.2.1	std::set . . . . .	2
1.2.2	std::map . . . . .	2
1.3	Unordered Containers . . . . .	2
1.3.1	std::unordered_set . . . . .	2
1.3.2	std::unordered_map . . . . .	2
1.4	std::sort . . . . .	2
1.5	std::find . . . . .	2
1.6	std::accumulate . . . . .	2
1.7	Container Adapters . . . . .	2
<b>2</b>	<b>Iterators</b>	<b>2</b>
<b>3</b>	<b>Ranges</b>	<b>2</b>
<b>4</b>	<b>Views</b>	<b>2</b>

## Week 7: Safety in C++

1	Undefined Behavior	2
2	Memory Safety	2
3	Smart Pointers	2
4	Exception Safety	2



## Week 8: Templates

1	Function Templates	2
2	Class Templates	2
3	Template Specialization	2
4	Variadic Templates	2

## **Week 9: Compile-Time Programming**

<b>1</b>	<b>Lambdas</b>	<b>2</b>
<b>2</b>	<b>Compile-Time Programming</b>	<b>2</b>
<b>3</b>	<b>Template Metaprogramming</b>	<b>2</b>