

Growing from C to C++

Lexical Conventions

- What is a C++ Program?
- C/C++ Preprocessor Differences
- Keywords
- Operators and Punctuation
- Comments
- Literals

Variables

- Fundamental Data Types
- Derived Types
- Standard Conversions and Arithmetic Conversions
- Declaration Scope
- Storage Classes
- Enumerations
- Declarations vs. Definitions

Addresses, Arrays, and Pointers

- Definitions
- Declarations
- String Declarations
- Accessing Array Elements
- Referencing and Dereferencing Pointers
- Dynamic Allocation
- Dynamic Deallocation

Program Structure

- The Preprocessor
 - Preprocessor Directives
 - Guarding Header Files
- Expressions and Statements
- Functions
- Program Start-Up
- Program Shut-Down
- Obtaining Command Line Arguments

Expressions

- Arithmetic Expressions
- Arithmetic Assignments
- Relational Expressions
- Logical Expressions
- Constant Expressions

Statements

- Simple and Block Statements
- if Statement

The Boolean Type
switch Statement
while Statement
do while Statement
for Statement

Functions

What is a Function?
Function Implementation
C++ Function Extensions
Using void to Simulate Procedures
Passing Parameters by Value
Passing Parameters by Reference
const Parameters, Return Value

Strings

Reintroducing Pointers
Arrays and Strings
Arrays of Strings
Operations on Strings
Student Problem: Understanding Casts and Pointers
Student Problem: Sorting String Tables

Operations on Strings

Computing String Length
Copying Strings
Concatenating Strings
Searching for Substrings
Comparing and Sorting Strings

Text Input and Output

Implementation Defined Libraries
C: Separate Data From Functions
C++: Overload Operators
Why use C for I/O in a C++ World?
The printf Statement
cout for Console Output
cin for Console Input

Object Oriented Concepts

What is Object Orientation?
Encapsulation
Information Hiding
Data Abstraction
Inheritance
Polymorphism
Classes vs. Objects

C++ Constructs Supporting OO

- Mapping OO to C++
- ANSI C struct Review
- Extensions to struct for C++
- What is a C++ class?
- Access Modifiers
- Dynamically Allocated Objects
- Memory Management Tips

Interfaces and Implementation

- Object Interface Defined
- Object Interfaces in C++
- Interfaces With Separate Implementations
- Linking Interface and Implementation
- Accessing Member Data and Functions
- Student Problem: Coding a Simple Object

Object Life Cycle

- Object Initialization
- State Changes During Cycle
- Constructors and Constructor Overloading
- Destructors
- Overloading Functions and Overloading Operators
- Student Problems: Extending an Existing Object and A String Object

Intermediate C++ Development

Building a Stack Object

- What is a Linked List?
- Searching a List
- Inserting Elements
- Deleting Elements
- Special Cases: Stacks and Queues
- Class Exercise: Stack Object Interface
- Student Problem: Coding the Stack From a High-Level Design

Intro to Software Components

- Class Exercise: What is a Software Component?
- One Possible Definition
- Examples: Is This a Component?
- Class Exercise: Software Component Characteristics
- Components and Process
- Software Component Summary

Extending Existing Components: Inheritance

- Class Exercise: Defining Inheritance
- Intersection vs. Union
- When is Inheritance Appropriate?
- C++ Inheritance Syntax
- Student Problem: Extending the Stack

Derived Classes

- C++ Inheritance Syntax
- Derived Members
- Additions and Overloads
- Derived Constructors
- Derived Destructors

Simplifying Interfaces: Data Abstraction

- Software Coupling Defined
- Software Coupling History
- Template Data Types & Classes
 - Template Syntax
 - Template Instantiation
- Pros and Cons of Using Templates
- Student Problem: Abstracting the Stack

Robust Components: Exception Handling

- Object Responsibilities
- Exception Concept and Definition
- Micro Level Exception Handling
- Impacts to Coding Style
- Exception Syntax and Sample Handled Output

Student Problem: That Damn Calc Again!

Promoting Reuse: Virtual Functions

Object Typed Systems

Polymorphism Concept

Impacts to Coding Style

Polymorphism Syntax and Use

Student Problem: Virtual VCR Controller

Advanced Topics

C++ Memory Management

Find the Errors

Building in Safeguards

Virtual Derivations

const and static in Object Scope

Constructors that are `private` or `protected`

Constructor Access Modifiers

protected Constructors

private Constructors