



The C++20 Masterclass (Full Syllabus Roadmap)

Section.1 : Welcome

- Welcome
- Getting the most out of the course
- Source code, Slides and Questions [Important]

Section.4 : Environment Setup - [Windows - Linux - Mac]

- The Tools

Section.3 : Environment setup - Window

- Window setup introduction
- Install and setup VS Code on Windows
- Microsoft Visual Studio Install - Windows
- VS Code setup with MSVC

Section.11 : Data Conversions: Overflow & Underflow

- Introduction
- Implicit Data Conversions
- Explicit Data Conversions
- Overflow and Underflow
- Quiz 9: So you think you know a bit more about C++? Let's find out!
- Summary

Section.12 : Bitwise Operators

- Introduction
- Printing Integers in Binary
- Shift Operators
- Logical Bitwise Operators
- Compound Bitwise and Assignment Operators
- Masks
- Mask Example
- Packing Color Information
- Quiz 10: So you think know more about C++? Let's find out!
- Summary

Section.13 : Variable Lifetime and Scope

- Variable Lifetime
- Variable Scope
- Quiz 11: So you think you know a little more about C++? Let's find out!

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Section.19 : Character manipulation and strings

- Introduction
- Character Manipulation
- Coding Exercise 18: How many of them are there?
- Coding Exercise 19: Hunt them down and replace them!
- C-String manipulation
- C-String concatenation and copy
- Coding Exercise 20: Making sense of the gibish
- Introduction std::string
- Declaring and using std::string
- Concatenating std::string
- Coding Exercise 21: Build from raw pieces!
- Accessing Characters in std::string
- std::string size and capacity
- Modifying std::string
- Comparing std::string's
- Coding Exercise 22: Who's the greatest?
- Comparing with std::string::compare()
- std::string : Replacing, copying, resizing and swapping
- Searching std::string
- Coding Exercise 23: Finding matches
- Transforming std::string to/from numbers
- Escape sequences
- Raw string literals
- Quiz 18: Escaping stuff
- Copied strings
- Quiz 19: Strings gone crazy!
- std::string_view
- Summary

- Install GCC & Clang - Windows
- Configure VS Code for GCC - Windows
- Configure VS Code for Clang - Windows
- Window template project: All compilers
- Windows Development Environment setup - Summary

Section.4 : Environment setup - Linux

- Linux environment setup - Introduction
- Install & setup VS Code on Linux
- Install GCC on Linux
- Configure VS Code for GCC - Linux
- Install Clang on Linux
- Configure VS Code for Clang - Linux
- Template Project - All compilers - Linux

Section.5 : Environment setup - Mac

- Introduction
- Install and Setup Visual Studio Code
- Install GCC and Clang
- Configure VS Code for gcc
- Configure VS Code for Clang
- Template Project - All compilers

Section.6 : Environments setup - Other Options

Section.14 : Control Flow

- Introduction
- If Statements
- Else If
- Switch
- Coding Exercise 4: Leap Years
- Short Circuit Evaluations
- Integral Logic Conditions
- Ternary Operators
- If constexpr
- If with Initializer
- Switch with Initializer
- Variable Scope Revised
- Switch Scope
- Assignment 4: Is it even? Or could it be odd?
- Assignment 5: Will you get the treatment
- Assignment 6: Is the day valid?
- Assignment 7: Hunt for a day in the past
- Assignment 8: Are you completely surrounded?
- Summary

Section.15 : Loops

- Introduction
- For Loop
- Quiz 12: So you think you have a better idea about loop in C++? Let's find out!
- Coding Exercise 5: Can you sum up to 99?
- For Loop: Multiple Declarations
- Coding Exercise 6: Print upper case characters
- Comma Operator
- Range Based For Loop
- Coding Exercise 7: Filter in multiples of 3
- While Loop
- Huge Loops with Output

Section.20 : Functions

- Introduction
- First hand on C++ Functions
- Coding Exercise 24: Sum up the digits
- Functions declaration and definitions
- Coding Exercise 25: Showing the odds!
- Multiple Files : Revision the Linker stage
- Coding Exercise 26: Palindromes!
- Pass by value
- Pass by const value
- Pass by pointer
- Pass by pointer to const
- Pass by const pointer to pointer
- Quiz 20: Zooming in on function parameters
- Pass by reference
- Pass by const reference
- Quiz 21: Pointers, references and const: Throwing you off!
- Passing function parameters : Summary
- Coding Exercise 27: Who has character?
- Array function parameters
- Coding Exercise 28: Insertion sort - Challenging
- Sized array function parameters
- Passing sized arrays by reference
- Quiz 22: Array function parameters : Throwing you off!
- Multi dimensional array function parameter
- Default function arguments
- Implicit Conversions
- Implicit conversions with references
- Implicit conversions with pointers
- Quiz 23: Implicit conversions with function parameters : Throwing you off!
- string_view Parameters
- Implicit conversions from std::string_view to std::string
- constexpr functions
- constexpr functions
- Quiz 24: constexpr functions : Throwing you off!

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- Introduction
- Trying out function templates
- Coding Exercise 37: Hunt them down!
- Template type deduction and explicit arguments
- Quiz 33: Template type deductions : Throwing you off!
- Template parameters by reference
- Coding Exercise 38: Swap'em'up!
- Template Specialization
- Coding Exercise 39: Find'em const char*'s
- Quiz 34: Where do specializations go : Throwing you off!
- Function templates with overloading
- Coding Exercise 40: const char* function template overloads
- Function templates specialization Vs Overloads : Some additional reading
- Function templates with multiple parameters
- Coding Exercise 41: Put'em numbers together!
- Templates return type deduction with auto
- Quiz 35: Function templates in multiple files : Throwing you off!
- Dectype and trailing return types
- Dectype and trailing return types : Throwing you off
- Dectype auto
- Default arguments
- Non type template parameters
- Coding Exercise 42: Find'em values!
- Auto Function Templates
- Quiz 37: Auto Function Templates : Throwing you off!
- Named Template Parameters for Lambdas

- Online compilers
- About other IDEs
- Quiz 1: So you think you know more about C++, let's find out!

Section.7 : Diving In

- Project Template
- Your First C++ Program
- Comments
- Errors
- Statements and Functions
- Data input and output
- Coding Exercise 1: Data Output
- C++ Program Execution Model
- C++ core language Vs Standard library Vs STL
- Quiz 2: Program Structure
- Assignment 1: The programs want to know where you live
- Summary

Section 8 : Variables and Data Types

- Introduction
- Number Systems
- Decimals and Integers
- Integer Modifiers
- Fractional Number
- Coding Exercise 2: Declare and initialize variables
- Booleans
- Characters And Text
- Auto
- Assignment
- Quiz 3: Data Representation in memory
- Quiz 4: Number systems

- Quiz 5: Auto
- Quiz 6: Let's how you'd use your data types
- Summary

Section.9 : Operations on Data

- Introduction
- Basic Operations
- Precedence and Associativity
- Prefix/Postfix Increment & Decrement
- Compound Assignment Operators
- Relational Operators
- Logical Operators
- Output formatting
- Numerics Limits
- Math Functions
- Coding Exercise 3: Area of hexagon
- Weird Integral Types
- Assignment 2: Celcius to Fahrenheit
- Assignment 3: Area and Volume of a Box
- Quiz 7: So you think you know more about C++. Let's find out!
- Summary

Section.10 : Literals and Constants

- Introduction
- Literals
- Constants
- Constant Expression
- constinit
- Quiz 13: So you think know more about C++? Let's find out!
- Summary

- Pointer to char
- Quiz 14: So you think you know more about pointers now? Let's find out!

- Arrays of pointer to char

- const pointer and pointer to const

- Array of const pointer to const char

- Pointers and arrays

- Coding Exercise 13: Where does the big guy live?

- Swapping array data: A demo

- Pointer arithmetic : Introduction

- Pointer Arithmetic : Navigation

- Coding Exercise 14: Shoot forward

- Pointer arithmetic : Distance between elements

- Coding Exercise 15: Finding Nemo : The little guy!

- Pointer Arithmetic : Comparing Pointers

- Swapping array data : Pointer Arithmetic

- Program Memory Map Revised

- Dynamic Memory Allocation

- Dangling Pointers

- Quiz 15: So you think you know a bit more about dangling pointers? Let's find out!

- When new fails

- Null pointer safety

- Memory Leaks

- Dynamically allocated arrays

- Coding Exercise 16: Merge them!

- Summary

Section.18 : References

- Introduction
- Declaring and using references
- Coding Exercise 17: Declare your own reference
- Comparing pointers and references
- Quiz 16: What's your pick : pointers? References?
- References and const
- Quiz 17: Going through references to do stuff
- References with Range based for loops

Section.21 Enums and Type aliases

- Introduction
- Enumerated type (Enum Class)
- Coding Exercise 30: Day of the week
- Quiz 25: Enum classes : Throwing you off
- using enum
- Legacy enumerated types
- Quiz 26: Enums : Throwing you off!
- Type aliases
- Summary

Section.22 : Arguments to main

- Introduction
- Grab and use the arguments
- Calculator V1
- Calculator V2
- Summary

Section.23 : Getting things out of functions

- Quiz 42: Pointers to objects : Throwing you off!

- Destructors

- Order of Constructor Destructor Calls

- The this Pointer

- Coding Exercise 49: Setter Chains for Points with pointers

- Coding Exercise 50: Setter Chain for Points with references

- struct

- Quiz 43: struct Vs class : Throwing you off!

- Size of objects

- Summary

Section.31 Classes, objects and const

- Introduction
- const objects
- Quiz 44: Const objects : Throwing you off!
- Const objects as function arguments
- Quiz 45: Tricky arguments : Throwing you off
- const member functions
- Coding Exercise 51: Fixing up your Point
- Getter that work as setters
- Coding Exercise 52: Kill two birds with one stone
- Dangling pointers and references in objects
- Tricky return values : Throwing you off!
- Zooming in on const
- Mutable Member variables
- Structured Bindings
- Summary

Section.32 : Diving deep into constructors and initialization

1. Introduction
2. Default parameters for constructors
3. Coding Exercise 53: Default Points
4. Quiz 47: Several paths leading to Rome!
5. Initializer lists for constructors
6. Coding Exercise 54: Build Boxes like a gentleman!
7. Initializer lists Vs Member wise copy initialization
8. Explicit constructors
9. Constructor delegation
10. Coding Exercise 55: Delegated constructor for Box
11. Quiz 48: Tricky constructor delegation
12. Copy constructors
13. Quiz 49: Copy Constructors : Throwing you off!
14. Coding Exercise 56: You're a Point fixer!
15. Objects stored in arrays are copies
16. Quiz 50: You're a shape observer!
17. Shallow Vs Deep copy
18. Move constructors
19. Quiz 51: The need for move constructors
20. Deleted constructors
21. Quiz 52: Delete your constructor?
22. Initializer list constructor
23. Coding Exercise 57: Reverser
24. Aggregate initialization
25. Designated Initializers (C++20)
26. Uniform initializatioin for aggregates
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Section.33 : Freinds

1. Introduction
2. Freind functions
3. Coding Exercise 58: Measuring distances
4. Freind classes
5. Coding Exercise 59: You're a ShapeFactory maker!
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Section.34 : Static Members

1. Introduction (theory)
2. Static Members
3. Static member variables
4. Quiz 53: Static Members : Throwing you off!
5. Coding Exercise 60: Count'em Points
6. Inline static member variables (C++17)
7. Static constant
8. Static constants pre C++17
9. Coding Exercise 61: Counts Points like a gentleman
10. Coding Exercise 62: Cool Utility
11. Member variables of self type
12. Member variables of other types
13. Static member funtions
14. Quiz 54: Static member functions : Throwing you off!
15. Nested classes
16. In class member initialization revisited
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Section.35 : Namespaces

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2. Creating Namespaces
3. Coding Exercise 63: Use Points like a gentleman
4. Namespaces Across Multiple Files
5. Coding Exercise 64: Split your point across
6. Default Global Namespace
7. Coding Exercise 65: Make it global
8. Built In Namespaces
9. Using Declarations
10. Quiz 55: Using declaration : Throwing you off!
11. Anonymous Namespaces
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13. Nested Namespaces
14. Namespaces Aliases

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Section.36 : Programs with multiple files : A closer look

1. Introduction
2. Declarations and definitions
3. Quiz 57: Compiling and Linking : Throwing you off!
4. Declarations and definitions
5. Quiz 58: Declarations or Definition : Throwing you off!
6. One Definition Rule
7. Linkage
8. Global external variables
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10. Flipping linkage
11. Inline variables and functions
12. Inline Vs static (anonymous namespaces)
13. Forward declarations
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Section.37 : Smart Pointers

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2. Unique pointers
3. Quiz 60: Smart Pointers : Throwing you off!
4. Coding Exercise 66: Release memory like a gentleman!
5. Coding Exercise 67: You can do better!
6. Unique pointers as function parameters and return values
7. Quiz 61: Tricky parameters : Throwing you off!
8. Unique pointers and arrays
9. Shared pointers
10. Coding Exercise 68: Shared pointers: You can do better!
11. Creating shared pointers from unique pointers
12. Shared pointers with arrays

13. Shared pointers as function parameters and return values
14. Quiz 62: Smart Pointers : Throwing you off!
15. Weak pointers
16. Smart pointer members : Recommended reading
17. Quiz 63: Smart Pointers conventional wisdom
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Section.38 : Operator Overloading

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2. Addition Operator as Member
3. Coding Exercise 69: operator+ for Multi-dimensional Points
4. Addition Operator as Non-Member
5. Coding Exercise 70: Adding up strings
6. Coding Exercise 71: Multi-dimensional Points : Non member operator+
7. Subscript Operator for Reading
8. Coding Exercise 72: Read data like a gentleman
9. Subscript Operator for Reading and Writing
10. Subscript Operator for Collections Types
11. Stream Insertion Operation Operator
12. Coding Exercise 73: You'll prints Points!
13. Coding Exercise 74: You'll print own strings!
14. Stream Extraction Operator
15. Other Arithmetic Operator
16. Compound Operator && Resusing Other Operators
17. Quiz 64: Compound operators : Throwing you off!
18. Coding Exercise 75: operator += for CU::string
19. Custom Type Conversions
20. Implicit Conversions with Overriden Binary Operators
21. Coding Exercise 76: Use CU::strings left and right, like a gentleman.
22. Unary Prefix Increment Operator As Member
23. Unary Prefix Increment Operator as Non-Member
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25. Prefix-Postfix Decrement Operator (Exercise)
26. Copy Assignment Operator
27. Quiz 65 Copies : Throwing you off!
28. Coding Exercise 77: CU::string copy assignment operator
29. Copy Assignment Operator for Other Types
30. Type Conversions Recap
31. Functors
32. Coding Exercise 78: Distance function object
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34. Assignment 13: [Optional] Your very own string class

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1. Introduction
2. All Logical Operators
3. Coding Exercise 79: You'll compare CU::string's
4. Rel Ops going forward
5. Quiz 66: Rel Ops going forward
6. Logical Operators with Implicit Conversions
7. Coding Exercise 80: Compare like a gentleman
8. Three way comparison operator
9. Quiz 67: operator <=> : Throwing you off!
10. Defaulted Equality Operator
11. Assignment 14: Are points equal? Or not equal?
12. Custom equality operator
13. Assignment 15: Are CU::string's equal? : C++20 Mode!
14. Default ordering with spaceship operator
15. Assignment 16: Default Ordered Points
16. Members without the spaceship operator
17. Custom spaceship operator for ordering
18. Assignment 17: Equality and ordering for CU::string
19. Logical Operators Simplified

20. Spaceship operator as a non member
21. Zooming in on weak ordering - Example 1
22. Zooming on weak ordering - Example 2
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24. Summing up on comparisons in C++20
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Section.40 : Inheritance

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2. First try on Inheritance
3. Coding Exercise 81: You'll fix the hierarchy
4. Protected members
5. Quiz 68: Member access specifiers : Throwing you off!
6. Coding Exercise 82: Get it to work
7. Quiz 69: Base and Derived : Throwing you off balance!
8. Base class access specifiers : Zooming in
9. Base class access specifiers : A demo
10. Quiz 70: Base class access specifiers : Throwing you off!
11. Closing in on Private Inheritance
12. Resurrecting Members Back in Context
13. Coding Exercise 83: You'll bring them back!
14. Default Constructors with Inheritance
15. Coding Exercise 84: Mix'em up!
16. Custom Constructors With Inheritance
17. Coding Exercise 85: Chain'em Constructors
18. Copy Constructors with Inheritance
19. Coding Exercise 86: Copy construct'em with Inheritance
20. Inheriting Base Constructors
21. Quiz 71: Inherited base constructors : Throwing you off
22. Inheritance and Destructors
23. Reused Symbols in Inheritance
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2. Static Binding with Inheritance
3. Quiz 72: Static binding : Throwing you off!
4. Dynamic binding with virtual functions
5. Coding Exercise 87: Build a dynamic inheritance tree
6. Coding Exercise 88: Help! Help! Weird references here!
7. Size of polymorphic objects and slicing
8. Quiz 73: Sliced off ? : Throwing you off!
9. Polymorphic objects stored in collections (array)
10. Override
11. Overloading, overriding and function hiding
12. Coding Exercise 89: Tricky Overloads
13. Quiz 74: Tricky Hierarchies : Throwing you off!
14. Inheritance and polymorphism at different levels
15. Inheritance and polymorphism with static members
16. Coding Exercise 90: Static members with inheritance
17. Final
18. Final and Override are not keywords
19. Polymorphic functions and access specifiers
20. Non polymorphic functions and access specifiers
21. Virtual functions with default arguments
22. Virtual Destructors
23. Dynamic casts
24. Polymorphic Functions and Destructors
25. typeid() operator
26. Pure virtual functions and abstract classes
27. Abstract Classes as Interfaces
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Section.42 : Exception Handling

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2. Try and Catch Blocks and scope
3. Coding Exercise 91: Divide like a boss!
4. The need for exceptions

5. Handling Exceptions At Different Levels
6. Quiz 75: Lots of Level : Throwing you off!
7. Multiple Handlers for an Exception
8. Nested Try Blocks
9. Quiz 76: Nest Your errors : Throwing you off!
10. Throwing Class Objects
11. Coding Exercise 92: Build you own
12. Exceptions as Class Objects with Inheritance Hierarchies
13. Quiz 77: Relatives : Throwing you off!
14. Polymorphic Exceptions
15. Quiz 78: Relatives, again! : Throwing you off!
16. Rethrown Exceptions
17. Program custom termination
18. Ellipsis catch all block
19. noexcept Specifier
20. Exceptions in Destructors
21. Standard Exceptions
22. Catching Standard Exceptions
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24. Assignment 18: Read files like a gentleman!
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Section.43 : Box Container class : Practicing what we know

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2. Constructing and destructing
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4. Removing Items
5. Other operators (=, +, +=)
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7. Storing In Different Types

8. Associative Containers : Intro
9. Associative Containers : Pair
10. Associative Containers : Set
11. Associative Containers : Map
12. Associative Containers : Multiset & multimap
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14. Container Adaptors : Intro
15. Container Adaptors : Stack
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17. Container Adaptors : Priority queue
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1. Introduction
2. All of
3. for_each
4. max_element and min_elements
5. find
6. copy
7. sort
8. transform
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10. Coding Exercise 106: MovableStack

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2. Range Algorithms
3. C++20 Ranges Library Iterator Pair Algorithms
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6. Vie composition and Pipe operator

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2. Your First Class Template
3. Coding Exercise 93: Building your maps
4. Instances Of Class templates
5. Quiz 79: Keeping track of your instances : Throwing you off!
6. Non type template parameters
7. Coding Exercise 94: Multi dimensional points : The swissarmy knife class
8. Quiz 80: Compatible points? : Throwing you off!
9. Default Values for template parameters
10. Coding Exercise 95: Sane Defaults
11. Explicit Template Instantiations
12. Template Specialization
13. Coding Exercise 96: Compare your maps!
14. Quiz 81: Specialized maps : Throwing you off!
15. Template Specialization with select methods
16. Coding Exercise 97: Comparing Maps? Not Again!!
17. Quiz 82 Comparing Maps. Yes. Again! : Throwing you off!
18. Freinds of class templates[Theory intro]
19. Freind functions for class templates
20. Stream insertion operator for class templates
21. Assignment 19: Stream insert'em Points!
22. Assignment 20: Stream insert'em Maps!
23. Class templates with type traits and static asserts
24. Assignment 21: Type traits constrained Maps!
25. Class templates with C++20 concepts
26. Built In Concepts
27. Assignment 22: Concept constrain your maps!
28. Concepts Example #1
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1. Introduction
2. Quiz 83: Move Semantics : What they're all about
3. Lvalues and Rvalues
4. Quiz 84: Lvalues and Rvalues : Throwing you off!
5. Rvalue references
6. Quiz 85: Rvalue references : Throwing you off!
7. Moving temporaries around
8. Move constructors and assignment operators
9. Coding Exercise 98: Moving from CU::string's
10. Moving Lvalues with std::move
11. Invalidating pointers after std::move
12. Move only types
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Section.46 : Functions Like Entities

1. Introduction
2. Function Pointers
3. Coding Exercise 99: Collection Sums
4. Callback Functions
5. Coding Exercise 100: Modifying scores
6. Function Pointer Type Aliases
7. Function Pointer Type Aliases with Templates
8. Function
9. Coding Exercise 101: Function score modifiers
10. Standard Function (in the <functional> header)
11. Function with parameters
12. Coding Exercise 102: Color Printer
13. Function and lambda functions
14. Lambda functions as callbacks

15. Capturing by value under the hood
16. Capturing by value reference under the hood
17. Mixin capturing
18. Capturing the this pointer
19. std::function
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2. std::vector
3. std::array
4. Iterators
5. Traversing container subsets with iterators
6. Reverse iterators
7. Constant iterators
8. Iterator types
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2. Sequence Containers : Deque
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6. Sequence containers : std::vector revisited
7. Sequence Containers : std::array revisited

7. Range Factories
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2. Iterator Powers
3. Custom Iterator Theory
4. Building Custom Input Iterators
5. Building Custom Output Iterators
6. Building Custom Forward Iterators
7. Building Custom Bidirectional Iterators
8. Building Custom Random Access Iterators
9. Custom Iterators with C++20 Ranges and Views
10. Constant Iterators
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12. Wrapping Iterators From Other Containers
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3. Block Export
4. Separating the Module Interface from the Implementation (Same File)
5. Separating the Module Interface from the Implementation (Different Files)
6. Multiple Implementation Files
7. Multiple Interface Files
8. Export Import
9. Sub-Modules
10. Module Interface Partitions
11. Custom Class Templates as Module (BoxContainer)
12. Modules with Namespaces
13. Visibility and Reachability
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