

# C++ Developer – 100+ Lab Exercises (Basic, Intermediate, Advanced)

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## ☐ Basic Level (30+ Exercises)

### ☐ C++ Fundamentals

- Lab 01: Setup C++ environment (Code::Blocks, VS Code, or GCC).
- Lab 02: Hello World program.
- Lab 03: Variables and Data Types – simple calculator.
- Lab 04: Input/Output using `cin` and `cout`.
- Lab 05: Constant and macro definitions.

### ☐ Control Structures

- Lab 06: If-else based grade calculator.
- Lab 07: Leap year checker.
- Lab 08: Switch-case menu-driven calculator.
- Lab 09: Print Fibonacci series using `while`.
- Lab 10: Multiplication table using `for`.

### ☐ Loops and Patterns

- Lab 11: Print numeric triangle using nested loops.
- Lab 12: Print pyramid and reverse pyramid.
- Lab 13: Prime number checker.
- Lab 14: Factorial of a number.

### ☐ Functions & Arrays

- Lab 15: Functions with and without return types.
  - Lab 16: Recursive factorial calculator.
  - Lab 17: Pass by value vs reference.
  - Lab 18: Linear search in array.
  - Lab 19: Bubble sort implementation.
  - Lab 20: Reverse array using pointers.
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## □ Intermediate Level (40+ Exercises)

### □ Pointers & Memory

- Lab 21: Pointer basics – swap using pointers.
- Lab 22: Pointer arithmetic demonstration.
- Lab 23: Dynamic memory allocation with `new/delete`.
- Lab 24: Arrays and pointers.
- Lab 25: Dangling pointer detection.

### □ Object-Oriented Programming

- Lab 26: Create a class `Student` with member functions.
- Lab 27: Constructor overloading.
- Lab 28: Class inheritance – `Person` and `Employee`.
- Lab 29: Polymorphism with virtual functions.
- Lab 30: Abstract class example.

### □ Operator Overloading

- Lab 31: Overload `+` and `-` operators for custom `Complex` class.
- Lab 32: Overload increment `++` operator.
- Lab 33: Overload assignment operator.

### □ File Handling

- Lab 34: Create and write to a text file.
- Lab 35: Read from a file and display content.
- Lab 36: Append data to an existing file.
- Lab 37: Copy content from one file to another.
- Lab 38: File handling with classes.

### □ Standard Template Library (STL)

- Lab 39: Use of `vector` with sorting.
  - Lab 40: `map` operations – dictionary creation.
  - Lab 41: `stack` implementation using STL.
  - Lab 42: `queue` operations and simulation.
  - Lab 43: `set` operations – removing duplicates.
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## ☐ **Advanced Level (30+ Exercises)**

### ☐ **Advanced OOP Concepts**

- Lab 44: Multiple inheritance example.
- Lab 45: Friend class and friend function.
- Lab 46: Static data and functions.
- Lab 47: Deep copy vs shallow copy.
- Lab 48: Pure virtual function and interface implementation.

### ☐ **Data Structures in C++**

- Lab 49: Singly Linked List – insertion/deletion.
- Lab 50: Doubly Linked List – operations.
- Lab 51: Stack implementation using arrays.
- Lab 52: Queue using circular array.
- Lab 53: Binary Search Tree – insertion/search.

### ☐ **Algorithms**

- Lab 54: Binary Search algorithm.
- Lab 55: Merge Sort implementation.
- Lab 56: Quick Sort.
- Lab 57: Dijkstra's shortest path.
- Lab 58: Depth-first Search (DFS).

### ☐ **Exception Handling**

- Lab 59: Basic try-catch block.
- Lab 60: Custom exception class.
- Lab 61: Throwing exceptions in constructors.

### ☐ **Project-Oriented Tasks**

- Lab 62: Mini Library Management System.
  - Lab 63: Simple Banking System using OOP.
  - Lab 64: Employee Payroll System with file handling.
  - Lab 65: Vehicle Rental System.
  - Lab 66: Quiz application with question bank.
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## □ Tools & Environment

- **Compiler:** GCC / Clang / MSVC
  - **IDEs:** Code::Blocks, VS Code, Dev C++
  - **Libraries:** STL, Boost (optional)
  - **OS:** Windows / Linux
  - **Version Control:** Git
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## □ Capstone Projects

- **Inventory Management System (OOP + Files + Pointers)**
- **Hospital Management Console App**
- **Student Database with STL Containers**
- **Command-line ATM System**
- **Maze Solver using DFS and Backtracking**