# Preface

*Damn the torpedoes!*
*Full speed ahead.*
*– Admiral Farragut*

Programming is the art of expressing solutions to problems so that a computer can execute those solutions. Much of the effort in programming is spent finding and refining solutions. Often, a problem is only fully understood through the process of programming a solution for it.

This book is for someone who has never programmed before but is willing to work hard to learn. It helps you understand the principles and acquire the practical skills of programming using the C++ programming language. It can also be used by someone with some programming knowledge who wants a more thorough grounding in programming principles and contemporary C++.

Why would you want to program? Our civilization runs on software. Without understanding software, you are reduced to believing in ‘‘magic’’ and will be locked out of many of the most interesting, profitable, and socially useful technical fields of work. When I talk about programming, I think of the whole spectrum of computer programs from personal computer applications with GUIs (graphical user interfaces), through engineering calculations and embedded systems control applications (such as digital cameras, cars, and cell phones), to text manipulation applications as found in many humanities and business applications. Like mathematics, programming – when done well – is a valuable intellectual exercise that sharpens our ability to think. However, thanks to feedback from the computer, programming is more concrete than most forms of math and therefore accessible to more people. It is a way to reach out and change the world – ideally for the better. Finally, programming can be great fun.

There are many kinds of programming. This book aims to serve those who want to write nontrivial programs for the use of others and to do so responsibly, providing a decent level of system quality. That is, I assume that you want to achieve a level of professionalism. Consequently, I chose the topics for this book to cover what is needed to get started with real-world programming, not just what is easy to teach and learn. If you need a technique to get basic work done right, I describe it, demonstrate concepts and language facilities needed to support the technique, and provide exercises for it. If you just want to understand toy programs or write programs that just call code provided by others, you can get along with far less than I present. In such cases, you will probably also be better served by a language that's simpler than C++. On the other hand, I won't waste your time with material of marginal practical importance. If an idea is explained here, it's because you'll almost certainly need it.

Programming is learned by writing programs. In this, programming is similar to other endeavors with a practical component. You cannot learn to swim, to play a musical instrument, or to drive a car just from reading a book – you must practice. Nor can you become a good programmer without reading and writing lots of code. This book focuses on code examples closely tied to explanatory text and diagrams. You need those to understand the ideals, concepts, and principles of programming and to master the language constructs used to express them. That's essential, but by itself, it will not give you the practical skills of programming. For that, you need to do the exercises and get used to the tools for writing, compiling, and running programs. You need to make your own mistakes and learn to correct them. There is no substitute for writing code. Besides, that's where the fun is!

There is more to programming – much more – than following a few rules and reading the manual. This book is not focused on "the syntax of C++." C++ is used to illustrate fundamental concepts. Understanding the fundamental ideals, principles, and techniques is the essence of a good programmer. Also, "the fundamentals" are what last: they will still be essential long after today's programming languages and tools have evolved or been replaced.

Code can be beautiful as well as useful. This book is written to help you to understand what it means for code to be beautiful, to help you to master the principles of creating such code, and to build up the practical skills to create it. Good luck with programming!

## Previous Editions

The third edition of *Programming: Principles and Practice Using C++* is about half the size of the second edition. Students having to carry the book will appreciate the lighter weight. The reason for the reduced size is simply that more information about C++ and its standard library is available on the Web. The essence of the book that is generally used in a course in programming is in this third edition ("PPP3"), updated to C++20 plus a bit of C++23. The fourth part of the previous edition ("PPP2") was designed to provide extra information for students to look up when needed and is available on the Web:

- Chapter 1: Computers, People, and Programming
- Chapter 11: Customizing Input and Output
- Chapter 22: Ideas and History
- Chapter 23 Text Manipulation
- Chapter 24: Numerics
- Chapter 25: Embedded Systems Programming
- Chapter 26: Testing
- Chapter 27: The C Programming Language
- Glossary

Where I felt it useful to reference these chapters, the references look like this: PPP2.Ch22 or PPP2.§27.1.

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Also, thanks to the many people who contributed to the first and second editions of this book. Many of their comments are reflected in this third edition.