C How to Program, Ninth Edition

with Case Studies Introducing Applications Programming and Systems Programming

by Paul Deitel & Harvey Deitel

PART 1 (Introductory) Programming Fundamentals Quickstart

1. Introduction to Computers and C
Intro to Hardware, Software & Internet; Test-Drive Microsoft Visual Studio, Apple Xcode, GNU gcc & GNU gcc in Docker

2. Intro to C Programming
Input, Output, Types, Arithmetic, Decision Making, Secure C

3. Structured Program Development
Algorithm Development, Problem Solving, `if`, `if/else`, `while`, Secure C

4. Program Control
`for`, `do/while`, `switch`, `break`, `continue`, Logical Operators, Secure C

5. Functions
Custom Functions, Simulation, Random-Number Generation, Enumerations, Function Call and Return Mechanism, Recursion, Recursive Factorial, Recursive Fibonacci, Secure C

- C is one of the world's most popular and senior programming languages
- C18/C11 standards
- Topical, innovative presentation
- Rich coverage of fundamentals
- Problem-solving/developing algorithms
- 20+ fun computer-science, data-science and artificial-intelligence case studies show C as it's intended to be used—some are fully implemented, some are partially implemented and some require students to do online research
- 147 complete working programs
- 350+ integrated self-check exercises with answers
- 445 end-of-chapter exercises/projects
- Use with Windows®, macOS®, Linux®
- Visual C++®, Xcode® and GNU™ gcc

PART 2 (Intermediate) Arrays, Pointers and Strings

6. Arrays
One- & Two-Dimensional Arrays, Passing Arrays to Functions, Searching, Binary Search Visualization, Sorting, Secure C

7. Pointers
Pointer operators & and *, Pass-By-Value vs. Pass-By-Reference, Array and Pointer Relationship, Secure C

8. Characters and Strings
C Standard Library String- and Character-Processing Functions, Secure C

PART 3 (Intermediate) Formatted Input/Output, Structs and File Processing

9. Formatted Input/Output
`scanf` and `printf` formatting, Secure C

10. Structures, Unions, Bit Manipulation and Enumerations
Creating Custom Types with `struct`s and `union`s, Bitwise Operators, Enumeration Constants, Secure C

11. File Processing
Streams, Text and Binary Files, CSV Files, Sequential and Random-Access Files, Secure C

- Analysis of algorithms with Big O
- Enhanced security and data science coverage as per ACM/IEEE 2020 curricula recommendations
- Use free open-source libraries and tools
- Real-world examples and data
- Traditional or "flipped" classrooms
- Secure C Programming, privacy, ethics
- Case studies in systems programming and applications programming
- Think like a developer with GitHub®, open-source, StackOverflow and more

PART 4 (Advanced) Data Structures and Algorithms

12. Data Structures
Dynamic Memory Allocation, Lists, Stacks, Queues & Binary Trees, Secure C

13. Computer-Science Thinking: Sorting Algorithms and Big O
Insertion Sort, Selection Sort, Visualizing Merge Sort, Additional Algorithms including Quicksort in the Exercises

PART 5 (Advanced) Preprocessor and Other Topics

14. Preprocessor
`#include`, Conditional Compilation, Macros/Arguments, Assertions, Secure C

15. Other Topics
Variable-Length Argument Lists, Command-Line Arguments, Multiple-Source-File Programs, `extern`, `exit`/`atexit`, `calloc`/`realloc`, `goto`, Numeric Literal Suffixes, Signal Handling

Appendices

A. Operator Precedence
B. ASCII Character Set
C. Multithreading/Multicore and Other C11/C18 Topics
D. Intro to Object-Oriented Programming

Online Appendices

E. Number Systems
F–H. Using the Visual Studio, GNU gdb and Xcode Debuggers

- Emphasis on visualization
- Static code analysis tools
- Performance, multithreading, multicore
- Questions? `deitel@deitel.com`
- Updates and errata: `https://deitel.com/chtp9`

Systems Programming Case Studies

Systems Software
- Building Your Own Computer
- Building Your Own Compiler with Infix and Postfix Notation

Embedded Systems Programming
- Webots 3D Robotics Simulator

Performance: Threading/Multicore

Applications Programming Case Studies

Algorithm Development
- Counter-Controlled Iteration
- Sentinel-Controlled Iteration
- Nested Control Statements

Random-Number Simulation
- Building a Casino Game
- Card Shuffling/Dealing with Card Images
- The Tortoise and the Hare Race

Intro to Data Science
- Data Analysis: Mean, Median & Mode

Direct-Access File Processing
- Transaction-Processing System

Visualizing Searching & Sorting

Artificial Intelligence/Data Science
- Machine Learning, GNU Scientific Library, Plotting with gnuplot, CSV Files
- NLP: Who Wrote Shakespeare's Works?

Game Programming with raylib
- SpotOn and Cannon Games

Security Via Cryptography
- Secret-Key & RSA Public-Key Crypto

Visualization with raylib
- Law of Large Numbers Animation

Multimedia: Audio & Animation

Web Services, Mashups, Cloud
- Accessing Web Services with libcurl; OpenWeatherMap JSON Results
- Rapid Applications Development with Web-Service Mashups