# **Contents at a Glance**

#### Introduction 1

- 1 Getting Started with C++ 9
- 2 Setting Out to C++ 27
- 3 Dealing with Data 65
- 4 Compound Types 115
- 5 Loops and Relational Expressions 195
- 6 Branching Statements and Logical Operators 253
- 7 Functions: C++'s Programming Modules 305
- 8 Adventures in Functions 379
- 9 Memory Models and Namespaces 447
- 10 Objects and Classes 505
- 11 Working with Classes 563
- 12 Classes and Dynamic Memory Allocation 627
- 13 Class Inheritance 707
- 14 Reusing Code in C++ 785
- 15 Friends, Exceptions, and More 877
- 16 The string Class and the Standard Template Library 951
- 17 Input, Output, and Files 1061
- 18 Visiting with the New C++ Standard 1153

## **Appendixes**

- A Number Bases 1215
- B C++ Reserved Words 1221
- C The ASCII Character Set 1225
- D Operator Precedence 1231
- E Other Operators 1235
- F The string Template Class 1249
- G The Standard Template Library Methods and Functions 1271
- H Selected Readings and Internet Resources 1323
- I Converting to ISO Standard C++ 1327
- J Answers to Chapter Reviews 1335

Index 1367

# **Table of Contents**

#### Introduction 1

#### 1 Getting Started with C++ 9

Learning C++: What Lies Before You 10
The Origins of C++: A Little History 10
Portability and Standards 15
The Mechanics of Creating a Program 18
Summary 25

## 2 Setting Out to C++ 27

C++ Initiation 27
C++ Statements 41
More C++ Statements 45
Functions 48
Summary 61
Chapter Review 62
Programming Exercises 62

## 3 Dealing with Data 65

Simple Variables 66
The const Qualifier 90
Floating-Point Numbers 92
C++ Arithmetic Operators 97
Summary 109
Chapter Review 110
Programming Exercises 111

#### 4 Compound Types 115

Introducing Arrays 116
Strings 120
Introducing the string Class 131
Introducing Structures 140
Unions 149
Enumerations 150
Pointers and the Free Store 153
Pointers, Arrays, and Pointer Arithmetic 167
Combinations of Types 184
Array Alternatives 186
Summary 190
Chapter Review 191
Programming Exercises 192

# 5 Loops and Relational Expressions 195

Introducing for Loops 196
The while Loop 224
The do while Loop 231
The Range-Based for Loop (C++11) 233
Loops and Text Input 234
Nested Loops and Two-Dimensional Arrays 244
Summary 249
Chapter Review 250
Programming Exercises 251

# 6 Branching Statements and Logical Operators 253

The if Statement 254
Logical Expressions 260
The cctype Library of Character Functions 270
The ?: Operator 273
The switch Statement 274
The break and continue Statements 280
Number-Reading Loops 283
Simple File Input/Output 287
Summary 298
Chapter Review 298
Programming Exercises 301

# 7 Functions: C++'s Programming Modules 305

Function Review 306
Function Arguments and Passing by Value 313
Functions and Arrays 320
Functions and Two-Dimensional Arrays 337
Functions and C-Style Strings 339
Functions and Structures 343
Functions and string Class Objects 353
Functions and array Objects 355
Recursion 357
Pointers to Functions 361
Summary 371
Chapter Review 372
Programming Exercises 374

## 8 Adventures in Functions 379

C++ Inline Functions 379
Reference Variables 383
Default Arguments 409
Function Overloading 412
Function Templates 419

Summary 442 Chapter Review 443 Programming Exercises 444

#### 9 Memory Models and Namespaces 447

Separate Compilation 447
Storage Duration, Scope, and Linkage 453
Namespaces 482
Summary 497
Chapter Review 498
Programming Exercises 501

#### 10 Objects and Classes 505

Procedural and Object-Oriented Programming 506
Abstraction and Classes 507
Class Constructors and Destructors 524
Knowing Your Objects: The this Pointer 539
An Array of Objects 546
Class Scope 549
Abstract Data Types 552
Summary 557
Chapter Review 558
Programming Exercises 559

### 11 Working with Classes 563

Operator Overloading 564
Time on Our Hands: Developing an Operator
Overloading Example 565
Introducing Friends 578
Overloaded Operators: Member Versus Nonmember
Functions 587
More Overloading: A Vector Class 588
Automatic Conversions and Type Casts for Classes 606
Summary 621
Chapter Review 623
Programming Exercises 623

#### 12 Classes and Dynamic Memory Allocation 627

Dynamic Memory and Classes 628
The New, Improved String Class 647
Things to Remember When Using new in Constructors 659
Observations About Returning Objects 662
Using Pointers to Objects 665
Reviewing Techniques 676
A Queue Simulation 678

Summary 699
Chapter Review 700
Programming Exercises 702

#### 13 Class Inheritance 707

Beginning with a Simple Base Class 708
Inheritance: An Is-a Relationship 720
Polymorphic Public Inheritance 722
Static and Dynamic Binding 737
Access Control: protected 745
Abstract Base Classes 746
Inheritance and Dynamic Memory Allocation 757
Class Design Review 766
Summary 778
Chapter Review 779
Programming Exercises 780

#### 14 Reusing Code in C++ 785

Classes with Object Members 786
Private Inheritance 797
Multiple Inheritance 808
Class Templates 830
Summary 866
Chapter Review 869
Programming Exercises 871

## 15 Friends, Exceptions, and More 877

Friends 877
Nested Classes 889
Exceptions 896
Runtime Type Identification 933
Type Cast Operators 943
Summary 947
Chapter Review 947
Programming Exercises 949

# 16 The string Class and the Standard Template Library 951

The string Class 952
Smart Pointer Template Classes 968
The Standard Template Library 978
Generic Programming 992
Function Objects (a.k.a. Functors) 1026
Algorithms 1035
Other Libraries 1045

Summary 1054 Chapter Review 1056 Programming Exercises 1057

## 17 Input, Output, and Files 1061

An Overview of C++ Input and Output 1062
Output with cout 1069
Input with cin 1093
File Input and Output 1114
Incore Formatting 1142
Summary 1145
Chapter Review 1146
Programming Exercises 1148

#### 18 Visiting with the New C++ Standard 1153

C++11 Features Revisited 1153

Move Semantics and the Rvalue Reference 1164

New Class Features 1178

Lambda Functions 1184

Wrappers 1191

Variadic Templates 1197

More C++11 Features 1202

Language Change 1205

What Now? 1207

Summary 1208

Chapter Review 1209

Programming Exercises 1212

#### **Appendixes**

- A Number Bases 1215
- B C++ Reserved Words 1221
- C The ASCII Character Set 1225
- D Operator Precedence 1231
- E Other Operators 1235
- F The string Template Class 1249
- G The Standard Template Library Methods and Functions 1271
- H Selected Readings and Internet Resources 1323
- I Converting to ISO Standard C++ 1327
- J Answers to Chapter Reviews 1335 Index 1367