

Contents

Chapter 1	The Fundamentals of Object Orientation	1
1.1	Brief Background	1
1.2	Basic Concepts and Terminology	1
1.2.1	Objects	2
1.2.2	Object-Orientated Programming (OOP)	2
1.2.3	Inheritance	3
1.2.4	Message-Passing	4
1.2.5	Polymorphism	5
1.3	The Motivation for a New Approach	6
1.4	Why OOP?	6
1.5	The Next Few Chapters	8
Chapter 2	First Steps in C++ Programming	9
2.1	The Basic Structure of a C++ Program	9
2.2	Basic Data Types and Variable Declarations	12
2.3	Type Conversions	13
2.4	Constants	14
2.5	Standard Input and Formatted Output	15
2.6	Enumerated Types	16
2.7	The Scope of a Variable	17
2.8	The Lifetime of a Variable	18
2.9	Common Operators	18
2.9.1	The Assignment Operator	19
2.9.2	Arithmetic Operators	19
2.9.3	The Bitwise Operators	20
2.9.4	Conditional Operator	20
2.9.5	Compound Operators	21
2.9.6	Comma Operator	21
	Exercises	22
Chapter 3	Selections and Iterations	23
3.1	The Relational Operators	23
3.2	Selection Statements	23
3.2.1	The if Statement	23
3.2.2	The switch Statement	25
3.3	Iterations	26
3.3.1	The while Statement	26
3.3.2	The do Statement	27
3.3.3	The for Statement	27
3.4	The Use of break and continue	28

3.5	The Logical Operators	29
	Exercises	30
Chapter 4	Functions and Header Files	31
4.1	Functions	31
4.1.1	The C++ Approach and Rationale	31
4.1.2	Function Syntax	31
4.1.3	Inline Functions	33
4.2	Linkage	34
4.3	Non-System Header Files	34
4.4	The Multiple Inclusion Problem	38
4.5	Function Overloading	38
4.6	Default Arguments	39
	Exercises	40
Chapter 5	Arrays, Pointers and References	41
5.1	Structured Types	41
5.2	Array Declaration and Usage	41
5.3	Array Initialisation	42
5.4	Array Processing	43
5.5	Strings	44
5.6	Pointers	45
5.7	Pointers and Arguments	46
5.8	Arrays and Pointers	48
5.9	The NULL Pointer	49
5.10	Strings Revisited	49
5.11	Functions for String Processing	49
5.12	Memory Allocation for Strings	52
5.13	Reference Types	52
5.14	References as Arguments	53
	Exercises	54
Chapter 6	Adding Sophistication to Basic I/O	55
6.1	Handling 'Whitespace' in Text Input	55
6.2	The Formatting of Output Via Manipulators	57
6.2.1	Common Manipulators	58
6.2.2	Common Formatting Flags	59
	Exercises	61
Chapter 7	Classes in C++	63
7.1	Structures	63
7.2	Explicit Class Declarations	65
7.3	Access Control	65
7.3.1	Private Access	65
7.3.2	Public Access	66
7.3.3	Default Access Levels	66
7.4	Member Function Definitions	66
7.5	Using a Class	67

7.6	Inline Member Functions	69
7.7	Constructors	70
7.7.1	General Purpose, Syntax and Rationale	70
7.7.2	Constructor Overloading	71
7.7.3	Default Constructors	75
7.7.4	Copy Constructors	76
7.8	Destructors	77
7.9	Arrays of Objects	78
7.10	Objects Within Objects	78
7.11	The <code>this</code> Pointer	80
7.12	Static Class Members	80
	Exercises	83
Chapter 8	Dynamic Memory Management	85
8.1	Introduction	85
8.2	<code>new</code> and <code>delete</code>	86
8.3	Dynamic Memory Usage with Classes	87
8.4	Dynamic Data Structures	87
8.5	Dynamic Arrays of Objects	93
8.6	Dynamic Instance Variables	94
	Exercises	96
Chapter 9	Inheritance	97
9.1	Inheritance in the Context of Object Orientation	97
9.2	Inheritance in C++	98
9.2.1	Syntax	98
9.2.2	Access Rights of Derived Classes	99
9.2.3	Base Class Constructors In Initialisation Lists	100
9.2.4	Bringing it all Together	101
9.2.5	Redefining Inherited Functions	105
9.2.6	The Assignment Compatibility Rule.....	105
9.3	Designing a Class Hierarchy	105
9.3.1	Existing Methods	105
9.3.2	General Principles	107
9.3.3	Windows Interface Example.....	107
9.3.4	M.I.S. Example.....	109
	Exercises	114
Chapter 10	Polymorphism	117
10.1	Polymorphism in the Context of Object Orientation	117
10.2	The Assignment Compatibility Rule Revisited	117
10.3	Function Binding	120
10.4	Virtual Functions	120
10.5	Constructors and Destructors	121
10.6	Pure Virtual Functions and Abstract Base Classes	123
10.7	Heterogeneous Linked Lists	124
	Exercises	128

Chapter 11	Friend Functions and Operator Functions	131
11.1	Access Problems	131
11.2	Friend Functions	132
11.2.1	Individual Friend Functions	132
11.2.2	Friend Classes	134
11.3	Operator Functions and Operator Overloading	135
11.3.1	General Use of Operator Functions	135
11.3.2	Operator Functions Within Classes	137
11.3.3	The Input and Output Operators	139
11.3.4	Multiple Overloading of Operator Functions	144
11.3.5	The Assignment Operator	146
11.3.6	Assignment v Initialisation	149
	Exercises	150
Chapter 12	File Handling	153
12.1	File Streams	153
12.2	Opening and Closing Files	153
12.2.1	Creating an Unattached Stream	154
12.2.2	Creating an Attached Stream	155
12.3	Writing and Reading Lines To/From a Text File	156
12.4	Character-Level I/O	157
12.5	cin and cout as Files	158
12.6	Using Command Line Parameters	159
12.7	Random Access	161
12.7.1	The File Pointer	161
12.7.2	Reading and Writing	162
12.7.3	Testing for End of File	163
	Exercises	165
Chapter 13	Templates	167
13.1	Introduction	167
13.2	Template Functions ('Generic Functions')	167
13.3	Parameterised Types ('Generic Types')	172
	Exercises	179
Appendix A	Exception Handling	181
Appendix B	Platform Variations	185
B.1	Borland C++	185
B.1.1	Creating and Running a Program	185
B.1.2	Single-key Input	186
B.1.3	Screen-Handling	187
B.2	Unix Implementations	188
B.2.1	Compiling and Running a Program	188
B.2.2	Unix Screen-Handling	189
Appendix C	Stream Formatting	191

Contents	ix
Model Solutions to Programming Exercises	196
Index	299