

---

# Contents

---

	<b>Preface</b>	<b>xvii</b>
<b>1</b>	<b>Introduction to .NET and Visual C++ .NET</b>	<b>1</b>
1.1	Introduction	2
1.2	History of the Internet and World Wide Web	2
1.3	World Wide Web Consortium (W3C)	4
1.4	Extensible Markup Language (XML)	4
1.5	Key Software Trend: Object Technology	5
1.6	Introduction to Microsoft .NET	7
1.7	Visual C++ .NET	8
1.8	.NET Framework and the Common Language Runtime	11
1.9	Web Resources	12
<b>2</b>	<b>Introduction to the Visual Studio .NET IDE</b>	<b>18</b>
2.1	Introduction	19
2.2	Visual Studio .NET Integrated Development Environment (IDE) Overview	19
2.3	Menu Bar and Toolbar	24
2.4	Visual Studio .NET Windows	25
2.4.1	<b>Solution Explorer</b>	26
2.4.2	<b>Toolbox</b> Window	27
2.4.3	<b>Properties</b> Window	28
2.5	Using Help	29
2.6	Simple Program: Displaying Text	31
2.7	Simple Program: Displaying Text and an Image	33
<b>3</b>	<b>Introduction to Visual C++ .NET Programming</b>	<b>47</b>
3.1	Introduction	48
3.2	Simple Program: Printing a Line of Text	48

3.3	Another Simple Program: Adding Integers	54
3.4	Memory Concepts	58
3.5	Arithmetic	59
3.6	Decision Making: Equality and Relational Operators	63
<b>4</b>	<b>Control Statements: Part 1</b>	<b>75</b>
4.1	Introduction	76
4.2	Algorithms	76
4.3	Pseudocode	77
4.4	Control Structures	77
4.5	<code>if</code> Selection Statement	81
4.6	<code>if...else</code> Selection Statement	82
4.7	<code>while</code> Repetition Statement	87
4.8	Formulating Algorithms: Case Study 1 (Counter-Controlled Repetition)	88
4.9	Formulating Algorithms with Top-Down, Stepwise Refinement: Case Study 2 (Sentinel-Controlled Repetition)	91
4.10	Formulating Algorithms with Top-Down, Stepwise Refinement: Case Study 3 (Nested Control Structures)	97
4.11	Assignment Operators	100
4.12	Increment and Decrement Operators	101
<b>5</b>	<b>Control Statements: Part 2</b>	<b>112</b>
5.1	Introduction	113
5.2	Essentials of Counter-Controlled Repetition	113
5.3	<code>for</code> Repetition Statement	115
5.4	Examples Using the <code>for</code> Statement	119
5.5	<code>switch</code> Multiple-Selection Statement	124
5.6	<code>do...while</code> Repetition Statement	128
5.7	<code>break</code> and <code>continue</code> Statements	130
5.8	Logical Operators	132
5.9	Structured-Programming Summary	137
<b>6</b>	<b>Functions</b>	<b>149</b>
6.1	Introduction	150
6.2	Functions and Methods in Managed Extensions for C++	150
6.3	<code>Math</code> Class Methods	152
6.4	Functions	153
6.5	Function Definitions	154
6.6	Argument Promotion	159
6.7	Namespaces in Managed Extensions for C++	161
6.8	Value Types and Reference Types	162
6.9	Pointers and References	163
6.10	Passing Arguments: Pass-by-Value vs. Pass-by-Reference	166
6.11	Default Arguments	169
6.12	Random-Number Generation	170
6.13	Example: Game of Chance	175

6.14	Duration of Variables	178
6.15	Scope Rules	179
6.16	Recursion	182
6.17	Example Using Recursion: The Fibonacci Series	185
6.18	Recursion vs. Iteration	189
6.19	Function Overloading	190
<b>7</b>	<b>Arrays</b>	<b>203</b>
7.1	Introduction	204
7.2	Arrays	204
7.3	Declaring and Allocating Arrays	207
7.4	Examples Using Arrays	208
7.4.1	Allocating an Array and Initializing Its Elements	208
7.4.2	Totaling the Elements of an Array	210
7.4.3	Using Histograms to Display Array Data Graphically	211
7.4.4	Using the Elements of an Array as Counters	212
7.4.5	Using Arrays to Analyze Survey Results	213
7.5	Passing Arrays to Functions	216
7.6	Sorting Arrays	219
7.7	Searching Arrays: Linear Search and Binary Search	221
7.7.1	Searching an Array with Linear Search	222
7.7.2	Searching a Sorted Array with Binary Search	223
7.8	Multidimensional Arrays	226
<b>8</b>	<b>Object-Based Programming</b>	<b>239</b>
8.1	Introduction	240
8.2	Implementing a Time Abstract Data Type with a Class	241
8.3	Class Scope	252
8.4	Controlling Access to Members	252
8.5	Initializing Class Objects: Constructors	253
8.6	Using Overloaded Constructors	254
8.7	Properties	260
8.8	Composition: Object Pointers as Data Members of Other Classes	267
8.9	Using the <code>this</code> Pointer	272
8.10	Garbage Collection	275
8.11	<code>static</code> Class Members	275
8.12	<code>const</code> Keyword and Read-Only Properties	280
8.13	Indexed Properties	284
8.14	Data Abstraction and Information Hiding	289
8.15	Software Reusability	291
8.16	Namespaces and Assemblies	291
8.17	<b>Class View</b>	297
<b>9</b>	<b>Object-Oriented Programming: Inheritance</b>	<b>304</b>
9.1	Introduction	305
9.2	Base Classes and Derived Classes	306
9.3	<code>protected</code> Members	309

9.4	Relationship Between Base Classes and Derived Classes	309
9.5	Example: Three-Level Inheritance Hierarchy	331
9.6	Constructors and Destructors in Derived Classes	334
9.7	Software Engineering with Inheritance	341
<b>10</b>	<b>Object-Oriented Programming: Polymorphism</b>	<b>346</b>
10.1	Introduction	347
10.2	Derived-Class-Object to Base-Class-Object Conversion	347
10.3	Type Fields and switch Statements	356
10.4	Polymorphism Examples	356
10.5	Abstract Classes	357
10.6	Case Study: Inheriting Interface and Implementation	360
10.7	__sealed Classes and Methods	369
10.8	Case Study: Payroll System Using Polymorphism	369
10.9	Case Study: Creating and Using Interfaces	381
10.10	Delegates	395
10.11	Operator Overloading	400
<b>11</b>	<b>Exception Handling</b>	<b>408</b>
11.1	Introduction	409
11.2	Exception Handling Overview	409
11.3	Example: DivideByZeroException	413
11.4	.NET Exception Hierarchy	416
11.5	__finally Block	417
11.6	Exception Properties	425
11.7	Programmer-Defined Exception Classes	430
<b>12</b>	<b>Graphical User Interface Concepts: Part 1</b>	<b>437</b>
12.1	Introduction	438
12.2	Windows Forms	440
12.3	Event-Handling Model	442
12.3.1	Basic Event Handling	442
12.4	Control Properties and Layout	449
12.5	Labels, TextBoxes and Buttons	452
12.6	GroupBoxes and Panels	459
12.7	CheckBoxes and RadioButtons	463
12.8	PictureBoxes	473
12.9	Mouse Event Handling	477
12.10	Keyboard Event Handling	480
<b>13</b>	<b>Graphical User Interface Concepts: Part 2</b>	<b>490</b>
13.1	Introduction	491
13.2	Menus	491
13.3	LinkLabels	501
13.4	ListBoxes and CheckedListBoxes	507
13.4.1	ListBoxes	509
13.4.2	CheckedListBoxes	513

13.5	ComboBoxes	517
13.6	TreeViews	523
13.7	ListViews	529
13.8	Tab Control	537
13.9	Multiple-Document-Interface (MDI) Windows	543
13.10	Visual Inheritance	555
13.11	User-Defined Controls	560
<b>14</b>	<b>Multithreading</b>	<b>571</b>
14.1	Introduction	572
14.2	Thread States: Life Cycle of a Thread	573
14.3	Thread Priorities and Thread Scheduling	576
14.4	Creating and Executing Threads	576
14.5	Thread Synchronization and Class Monitor	581
14.6	Producer/Consumer Relationship without Thread Synchronization	583
14.7	Producer/Consumer Relationship with Thread Synchronization	590
14.8	Producer/Consumer Relationship: Circular Buffer	599
<b>15</b>	<b>Strings, Characters and Regular Expressions</b>	<b>616</b>
15.1	Introduction	617
15.2	Fundamentals of Characters and Strings	617
15.3	String Constructors	618
15.4	String Chars Property, Length Property and CopyTo Method	620
15.5	Comparing Strings	622
15.6	Locating Characters and Substrings in Strings	626
15.7	Extracting Substrings from Strings	630
15.8	Miscellaneous String Methods	631
15.9	Class StringBuilder	633
15.10	StringBuilder Length and Capacity Properties, and EnsureCapacity Method	635
15.11	StringBuilder Append and AppendFormat Methods	637
15.12	StringBuilder Insert, Remove and Replace Methods	640
15.13	Char Methods	643
15.14	Card Shuffling and Dealing Simulation	647
15.15	Regular Expressions and Class Regex	653
<b>16</b>	<b>Graphics and Multimedia</b>	<b>669</b>
16.1	Introduction	670
16.2	Graphics Contexts and Graphics Objects	672
16.3	Color Control	673
16.4	Font Control	684
16.5	Drawing Lines, Rectangles and Ovals	691
16.6	Drawing Arcs	695
16.7	Drawing Polygons and Polylines	699
16.8	Advanced Graphics Capabilities	705
16.9	Introduction to Multimedia	712

16.10	Loading, Displaying and Scaling Images	712
16.11	Animating a Series of Images	716
16.12	Windows Media Player	731
16.13	Microsoft Agent	736
<b>17</b>	<b>Files and Streams</b>	<b>756</b>
17.1	Introduction	757
17.2	Data Hierarchy	757
17.3	Files and Streams	759
17.4	Classes <code>File</code> and <code>Directory</code>	761
17.5	Creating a Sequential-Access File	773
17.6	Reading Data from a Sequential-Access File	787
17.7	Random-Access Files	800
17.8	Creating a Random-Access File	805
17.9	Writing Data “Randomly” to a Random-Access File	809
17.10	Reading Data Sequentially from a Random-Access File	815
17.11	Case Study: A Transaction-Processing Program	821
<b>18</b>	<b>Extensible Markup Language (XML)</b>	<b>850</b>
18.1	Introduction	851
18.2	XML Documents	851
18.3	XML Namespaces	856
18.4	Document Object Model (DOM)	859
18.5	Document Type Definitions (DTDs), Schemas and Validation	881
18.5.1	Document Type Definitions	881
18.5.2	Microsoft XML Schema	885
18.5.3	W3C XML Schema	887
18.5.4	Schema Validation in Visual C++ .NET	889
18.6	Extensible Stylesheet Language and <code>XsltTransform</code>	894
18.7	Internet and Web Resources	902
<b>19</b>	<b>Database, SQL and ADO .NET</b>	<b>910</b>
19.1	Introduction	911
19.2	Relational Database Model	912
19.3	Relational Database Overview: Books Database	913
19.4	Structured Query Language (SQL)	918
19.4.1	Basic SELECT Query	919
19.4.2	WHERE Clause	920
19.4.3	ORDER BY Clause	922
19.4.4	Merging Data from Multiple Tables: INNER JOIN	926
19.4.5	Joining Data from Tables <code>Authors</code> , <code>AuthorISBN</code> , <code>Titles</code> and <code>Publishers</code>	927
19.4.6	INSERT Statement	930
19.4.7	UPDATE Statement	932
19.4.8	DELETE Statement	933
19.5	ADO .NET Object Model	934

19.6	Programming with ADO .NET: Extracting Information from a Database	935
19.6.1	Connecting to and Querying an Access Data Source	935
19.6.2	Querying the Books Database	943
19.7	Programming with ADO .NET: Modifying Database Data	946
19.8	Reading and Writing XML Files	956
19.9	Internet and Web Resources	960
<b>20</b>	<b>Web Services</b>	<b>966</b>
20.1	Introduction	967
20.2	HTTP Request Types	968
20.3	Multi-Tier Architecture	969
20.4	Accessing Web Servers	970
20.5	Simple HTTP Transaction	971
20.6	ASP (Active Server Pages) .NET	973
20.7	.NET Web Services Basics	974
20.8	Simple Object Access Protocol (SOAP) and Web Services	980
20.9	Publishing and Consuming Web Services	982
20.10	Session Tracking	998
20.10.1	Cookies	999
20.10.2	Session Tracking with HttpSessionState	1000
20.11	Session Tracking in Web Services	1001
20.12	Case Study: Temperature-Information Application	1016
20.13	User-Defined Types in Web Services	1028
20.14	Global XML Web Services Architecture (GXA)	1040
20.14.1	WS-Inspection	1041
20.14.2	WS-Routing	1042
20.14.3	WS-Referral	1044
20.14.4	WS-Security	1045
<b>21</b>	<b>Networking: Streams-Based Sockets and Datagrams</b>	<b>1052</b>
21.1	Introduction	1053
21.2	Establishing a Simple Server (Using Stream Sockets)	1054
21.3	Establishing a Simple Client (Using Stream Sockets)	1056
21.4	Client/Server Interaction with Stream-Socket Connections	1057
21.5	Connectionless Client/Server Interaction with Datagrams	1068
21.6	Client/Server Tic-Tac-Toe Using a Multithreaded Server	1075
<b>22</b>	<b>Data Structures and Collections</b>	<b>1098</b>
22.1	Introduction	1099
22.2	Self-Referential Classes	1099
22.3	Linked Lists	1101
22.4	Stacks	1115
22.5	Queues	1120
22.6	Trees	1123
22.6.1	Binary Search Tree of Integer Values	1124
22.6.2	Binary Search Tree of IComparable Objects	1132

22.7	Collection Classes	1140
22.7.1	Class Array	1141
22.7.2	Class ArrayList	1144
22.7.3	Class Stack	1151
22.7.4	Class Hashtable	1156
<b>A</b>	<b>Operator Precedence Chart</b>	<b>1171</b>
<b>B</b>	<b>Number Systems</b>	<b>1174</b>
B.1	Introduction	1175
B.2	Abbreviating Binary Numbers as Octal Numbers and Hexadecimal Numbers	1178
B.3	Converting Octal Numbers and Hexadecimal Numbers to Binary Numbers	1180
B.4	Converting from Binary, Octal or Hexadecimal to Decimal	1180
B.5	Converting from Decimal to Binary, Octal or Hexadecimal	1181
B.6	Negative Binary Numbers: Twos-Complement Notation	1182
<b>C</b>	<b>ASCII Character Set</b>	<b>1185</b>
<b>D</b>	<b>Unicode</b>	<b>1186</b>
D.1	Introduction	1187
D.2	Unicode Transformation Formats	1188
D.3	Characters and Glyphs	1189
D.4	Advantages and Disadvantages of Unicode	1190
D.5	Unicode Consortium's Web Site	1190
D.6	Using Unicode	1191
D.7	Character Ranges	1195
<b>E</b>	<b>Introduction to XHTML: Part 1</b>	<b>1198</b>
E.1	Introduction	1199
E.2	Editing XHTML	1199
E.3	First XHTML Example	1200
E.4	W3C XHTML Validation Service	1203
E.5	Headers	1204
E.6	Linking	1206
E.7	Images	1209
E.8	Special Characters and More Line Breaks	1212
E.9	Unordered Lists	1214
E.10	Nested and Ordered Lists	1216
E.11	Internet and Web Resources	1219
<b>F</b>	<b>Introduction to XHTML: Part 2</b>	<b>1221</b>
F.1	Introduction	1222
F.2	Basic XHTML Tables	1222

F.3	Intermediate XHTML Tables and Formatting	1225
F.4	Basic XHTML Forms	1227
F.5	More Complex XHTML Forms	1230
F.6	Internal Linking	1238
F.7	Creating and Using Image Maps	1241
F.8	meta Elements	1243
F.9	frameset Element	1244
F.10	Nested framesets	1248
F.11	Internet and Web Resources	1250
<b>G</b>	<b>XHTML Special Characters</b>	<b>1252</b>
<b>H</b>	<b>XHTML Colors</b>	<b>1253</b>
<b>I</b>	<b>Bit Manipulation</b>	<b>1256</b>
I.1	Introduction	1257
I.2	Bit Manipulation and the Bitwise Operators	1257
I.3	Class BitArray	1272
	<b>Bibliography</b>	<b>1277</b>
	<b>Index</b>	<b>1281</b>