

---

## Contents

<b>Chapter 1 - The Visual Studio 2010 C# Environment .....</b>	14
1.1 Introduction .....	14
1.1.1 What's new in VS2010? .....	14
1.2 Obtaining the Visual C# 2010 software.....	15
1.3 The Visual Studio development environment.....	15
1.3.1 The Form.....	17
1.3.2 The Code Editor. ....	18
1.3.3 The Toolbox. ....	18
1.3.4 The properties and events box.....	19
1.4 Exercises .....	21
1.4.1 Your First C# Program .....	21
1.4.2 Copying files .....	25
1.4.3 Common errors.....	26
1.4.4 Properties exercises .....	27
1.5 The Solution Explorer.....	28
1.6 Program execution. ....	28
1.7 Number conversion.....	28
1.8 Exercise: Simple calculator.....	30
1.9 Self Assessment Exercises .....	31
1.10 Summary .....	32
<b>Chapter 2 - Common controls, properties and events .....</b>	33
2.1 Introduction .....	33
2.2 The Button.....	33
2.3 The TextBox.....	33
2.3.1 Dealing with text in a TextBox .....	34
2.4 The ListBox control.....	36
2.5 The CheckBox .....	37
2.6 The CheckBox.....	38
2.7 The RadioButton .....	38
2.8 The NumericUpDown control.....	38
2.9 Displaying Images – the PictureBox control .....	39
2.10 Focus and TabIndex.....	40
2.11 Even more controls. ....	40
2.12 The Containers controls toolbox .....	40
2.13 Listing controls.....	41
2.14 Exercise: Dating registration form .....	41
2.15 Self Assessment Exercises .....	44
2.16 Summary .....	44
<b>Chapter 3 - Dialogs and forms .....</b>	46
3.1 Introduction .....	46
3.2 User messages – The Message Box Dialog .....	46
3.2.1 Message Reply .....	48

---

3.3 Creating your own dialogs - Prompting for input .....	48
3.3.1 User input - Adding forms exercise.....	48
3.4 Splash forms and the Timer control .....	51
3.5 Accessing controls on other forms .....	52
3.6 Random numbers.....	54
3.7 Self Assessment Exercises .....	55
3.8 Summary .....	57
 <b>Chapter 4 - The C# Language - the basics.....</b>	 58
4.1 Introduction .....	58
4.2 Declarations - Variables and data type identifiers.....	58
4.2.1 Naming convention.....	59
4.2.2 Some declaration examples:.....	59
4.3 Assignments and operators .....	59
4.3.1 Shortcuts.....	60
4.4 Comments .....	60
4.5 Casting (converting) data types.....	61
4.6 Characters and strings.....	62
4.7 Escape sequences .....	62
4.8 Logical operations – Boolean data type.....	62
4.9 Mathematical Functions.....	63
4.10 Date and Time .....	64
4.10.1 DateTime properties and methods .....	65
4.11 Scope.....	65
4.11.1 Block scope .....	65
4.11.2 Class scope .....	66
4.12 Self Assessment Exercises .....	67
4.13 Summary .....	68
 <b>Chapter 5 - The C# Language - arrays, structures and strings .....</b>	 69
5.1 Introduction.....	69
5.2 Arrays .....	69
5.3 Multidimensional arrays .....	71
5.4 Structures .....	72
5.4.1 The public declaration .....	73
5.5 Character arrays and strings .....	73
5.6 String manipulation .....	74
5.7 String conversion.....	74
5.8 String methods.....	75
5.8.1 The Substring( ) method .....	75
5.8.2 The IndexOf( ) and IndexOfAny( ) methods .....	75
5.8.3 Dealing with spaces – the Trim and Remove methods.....	76
5.8.4 The Replace method .....	76
5.8.5 The Split method - parsing strings.....	77
5.8.6 Upper and lower case methods.....	78
5.9 Dynamic Arrays. The ArrayList Class .....	78

---

5.10 System.Collection.Generic namespace .....	79
5.11 Self Assessment Exercises .....	83
5.12 Summary .....	87
<b>Chapter 6 - Program Flow, Loops and Decisions.....</b>	<b>88</b>
6.1 Introduction .....	88
6.2 The if statement .....	88
6.2.1 The if .. else statement .....	89
6.2.2 The if .. else shortcut.....	90
6.3 The switch statement .....	90
6.3.1 The goto statement.....	92
6.3.2 Switching on a string variable .....	92
6.4 Looping - The for statement.....	92
6.4.1 The foreach statement .....	94
6.5 The while and do-while statements.....	94
6.6 Exceptions. The try-catch code .....	96
6.7 Self Assessment Exercises .....	98
6.8 Summary .....	99
<b>Chapter 7 - Object oriented programming: Methods and classes .....</b>	<b>101</b>
7.1 Introduction.....	101
7.2 Method declaration.....	101
7.3 Parameter passing.....	103
7.4 Pass by reference – ref and out keywords.....	105
7.5 Scope of a method – private and public.....	106
7.6 Recursion .....	107
7.7 Calling an event.....	107
7.8 Classes and Namespaces.....	108
7.9 Self Assessment Exercises .....	108
7.10 Summary .....	109
<b>Chapter 8 - Object oriented programming - creating objects .....</b>	<b>110</b>
8.1 Introduction .....	110
8.2 Creating Objects .....	111
8.3 Constructors .....	115
8.4 The ToString method .....	117
8.5 Overriding .....	117
8.6 Adding Methods to a class .....	118
8.7 Method overloading.....	119
8.8 Static classes.....	120
8.9 Inheritance.....	121
8.10 Overriding methods .....	123
8.11 Self Assessment Exercises .....	123
8.12 Summary .....	124

---

<b>Chapter 9 - File handling and menu dialogs .....</b>	125
9.1 Introduction.....	125
9.2 File Types – Text (ASCII) or Binary.....	125
9.2.1 Text Files.....	125
9.2.2 Binary Files - Typed and Untyped files.....	125
9.3 File Dialog Boxes and MenuStrip control .....	125
9.3.1 The MenuStrip control – a simple RichTextBox editor .....	126
9.3.2 The OpenFileDialog .....	128
9.3.3 The SaveFileDialog .....	129
9.3.4 Open and Save Dialog Box properties.....	130
9.3.5 File error handling .....	131
9.4 Adding Menu items – About box.....	131
9.5 PrintDialog boxes .....	133
9.6 RichTextBox editor: cut, paste copy and find.....	133
9.7 File and Directory classes .....	134
9.8 File handling example.....	135
9.8.1 Using StreamWriter and StreamReader objects.....	135
9.9 Self Assessment Exercises .....	136
9.10 Summary .....	137
 <b>Chapter 10 - Graphics and Multimedia .....</b>	138
10.1 Introduction .....	138
10.2 Drawing Graphics.....	138
10.3 The Paint event.....	139
10.4 Drawing on the form.....	140
10.5 The Pen .....	141
10.6 The Brush.....	142
10.7 Drawing Text.....	142
10.8 Basic Shapes.....	142
10.9 Other shapes – arcs, pies, polylines and polygons. ....	144
10.10 Reading and writing a single pixel .....	145
10.11 Drawing Graphs and Charts .....	148
10.12 Multimedia applications.....	148
10.12.1 MediaPlayer events.....	150
10.13 Self Assessment Exercises .....	151
10.14 Summary .....	155
 <b>Chapter 11 - Debugging .....</b>	156
11.1 Introduction .....	156
11.2 Writing to the Debug Window .....	156
11.3 Using the Debugger .....	157
11.3.1 Setting a breakpoint .....	157
11.3.2 Pausing the Program .....	159
11.4 Conditional Breakpoints .....	159
11.5 Restarting – Stepping code .....	160

---

11.6 The breakpoint windows.....	160
11.6.1. Local window .....	160
11.6.2 Watch window.....	161
11.6.3. The Immediate window. ....	161
11.6.4. The Call Stack. ....	162
11.7 Self Assessment Exercises .....	162
11. 8 Summary .....	162
<b>Chapter 12 - Threading.....</b>	<b>163</b>
12.1 Introduction .....	163
12.2 Threads.....	163
12.3 Writing Thread Code .....	164
12.4 Thread sleeping example .....	165
12.5 Multiple Threading example .....	167
12.6 Accessing form controls from threads.....	168
12.7 Other thread considerations.....	171
12.8 Self Assessment Exercises .....	171
12.9 Summary .....	171
<b>Chapter 13 - Internet Applications.....</b>	<b>172</b>
13.1 Introduction .....	172
13.2 Client-Server communication .....	172
13.3 TCP and UDP.....	172
13.4 Creating a TCP server.....	173
13.5 Threads.....	174
13.6 Creating a TCP client.....	174
13.7 TCP Client-Server application .....	174
13.8 TCP Client Code.....	178
13.9 UDPClient communications – A chat program.....	181
13.9.1 UDPClient.Send( ).....	181
13.9.2 UDPClient.Receive( ) .....	181
13.9.3 UDP program threads .....	182
13.9.4 UDP GUI design.....	183
13.9.5 UDP server code.....	183
13.9.6 UDP client code.....	186
13.10 A Local Chat program .....	187
13.10.1 The Second Chat program.....	188
13.11 Remote Chat program.....	189
13.12 Finding your PC's IP address.....	190
13.13 Self Assessment Exercises .....	190
13.14 Summary .....	191
<b>Chapter 14 - Introduction to Databases .....</b>	<b>192</b>
14.1 Introduction .....	192
14.2 A typical database.....	192
14.3 Dealing with Databases .....	193

---

14.3.1 Viewing a database in C#.....	193
14.4 Creating a new database.....	196
14.5 Adding relationships – Database diagrams.....	199
14.6 Self Assessment Exercises .....	202
14.7 Summary .....	202
<b>Chapter 15 - Displaying databases .....</b>	<b>203</b>
15.1 Introduction .....	203
15.2 The dataset, data binding and ActiveX Data Objects (ADO.NET).....	203
15.3 Displaying database information.....	204
15.3.1 DataGridView .....	205
15.3.2 Details view .....	208
15.4 Viewing the data set .....	210
15.5 Structured Query Language (SQL).....	210
15.6 Query Builder.....	212
15.7 Self Assessment Exercises and errors.....	214
15.8 Summary .....	215
<b>Chapter 16 - Accessing a database with code .....</b>	<b>216</b>
16.1 Introduction .....	216
16.2 Creating the database .....	216
16.2.1 Creating a database from within Visual Studio.....	216
16.3 Displaying the database.....	218
16.3.1 Add the Data Source.....	219
16.3.2 Select Database Objects .....	219
16.3.3 Accessing the database from code.....	221
16.3.4 Update the Database .....	224
16.4 Reading and saving nulls in database .....	225
16.5 Self Assessment Exercises .....	226
16.6 Summary .....	226
<b>Chapter 17 - Plotting and Charts.....</b>	<b>227</b>
17.1 Introduction .....	227
17.2 Plotting with Nplot .....	227
17.3 Obtaining the software.....	227
17.4 Adding NPlot to your project .....	228
17.5 NPlot Windows Form Tutorial.....	229
17.6 Drawing a graph .....	230
17.7 Graph exercise.....	231
17.7.1 Different graph types.....	233
17.8 Self Assessment Exercises .....	234
17.9 Summary .....	235
<b>Chapter 18 - Dynamic link libraries (DLL) and using Windows API.....</b>	<b>236</b>
18.1 Introduction .....	236
18.2 Writing a DLL .....	236

---

18.3 Calling the DLL.....	237
18.4 Static Classes.....	239
18.5 Windows Application Program Interface (API).....	240
18.6 Using Win API calls .....	240
18.7 MessageBox API example .....	241
18.8 Playing sounds.....	242
18.9 Unsafe code.....	243
18.10 DLL for measuring time .....	245
18.11 Self Assessment Exercises: .....	247
18.12 Summary .....	247
<b>Chapter 19 - Hardware interfacing .....</b>	<b>248</b>
19.1 Introduction .....	248
19.2 The Serial and Parallel ports. ....	248
19.3 Visual Studio Serial Port control.....	248
19.4 Serial Port example program.....	248
19.5 Serial Port connections .....	250
19.6 The parallel printer interface. ....	251
19.7 Printer port connections .....	251
19.8 Accessing the parallel port.....	252
19.8.1 The hardware .....	252
19.8.2 The software.....	252
19.8.3 Parallel port inputs .....	255
19.9 Self Assessment Exercises. ....	255
19.10 Summary .....	255
<b>Chapter 20 - Using the sound card and DirectX drivers .....</b>	<b>256</b>
20.1 Introduction .....	256
20.2 DirectX.....	256
20.3 The DirectX components .....	256
20.3.1 The DirectSound class. ....	256
20.3.2 The DirectInput class .....	257
20.3.3 Cooperative level.....	257
20.3.4 The Buffers.....	257
20.3.5 The input device .....	258
20.4 Playing sounds.....	258
20.5 Playing waveforms .....	260
20.6 Detecting input devices.....	262
20.7 Capturing sounds .....	263
20.8 Capturing sound program .....	264
20.9 Self Assessment exercises.....	268
20.10 Summary .....	269
<b>Chapter 21 - USB interfacing.....</b>	<b>270</b>
21.1 Introduction .....	270
21.2 The USB interface .....	270

---

21.3 USB Module installation and hardware .....	271
21.3.1 Installing the drivers .....	272
21.3.2 The DLL communication software.....	273
21.3.4 The hardware design.....	273
21.3.5 Communications Protocol.....	275
21.4 USB Module Software.....	276
21.4.1 Setting outputs.....	277
21.4.2 Reading Inputs.....	279
21.5 Self Assessment Exercises: .....	280
21.6 Summary .....	281
<b>Chapter 22 - USB Interfacing .....</b>	<b>282</b>
22.1 Introduction .....	282
22.2 Microchip PIC (Peripheral Interface Controller) Design .....	282
22.3 The PIC/USB hardware .....	282
22.4 The USB PIC Hardware interface .....	283
22.5 The PIC firmware .....	284
22.5.1 Introduction .....	284
22.5.2 Modifying the firmware .....	285
22.5.3 The protocol .....	285
22.5.4 Adding commands to the firmware .....	286
22.6 The USB drivers .....	287
22.7 Summary .....	288
<b>Chapter 23 - USB interfacing - The PC code .....</b>	<b>289</b>
23.1 Introduction .....	289
23.2 The Microchip MPUSBAPI DLL libraries .....	289
23.2.1 Windows 7 exceptions .....	290
23.3 The C# application.....	291
23.4 Self Assessment exercises.....	300
23.5 Summary .....	300
<b>Chapter 24 - Conclusion.....</b>	<b>301</b>