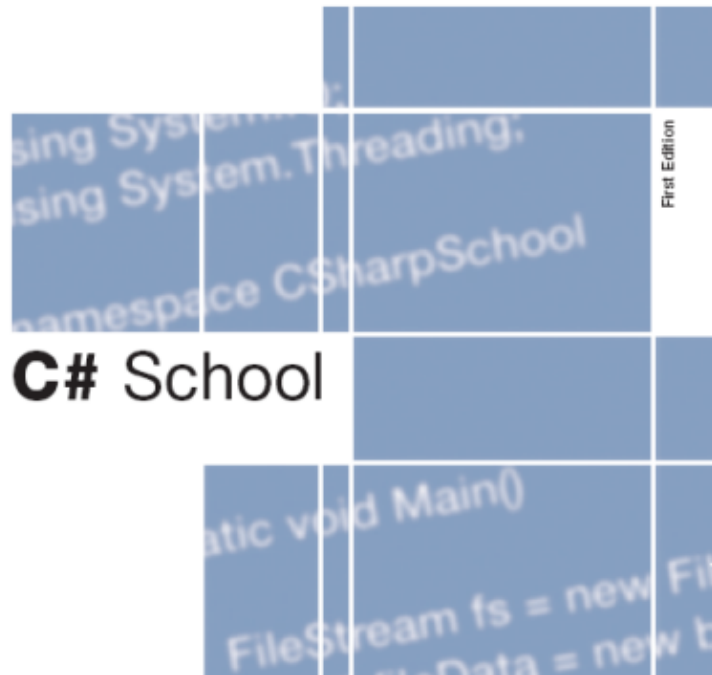




14 lessons to get you started with C# and .NET

Author: Faraz Rasheed

Editors: Tore Nestenius
Jonathan Worthington
Lee Addy

www.programmersheaven.com

14 lessons to get you started with C# and .NET

Author: Faraz Rasheed

Editors: Tore Nestenius

Jonathan Worthington Lee Addy

www.programmersheaven.com

Programmer's Heaven

C# School

First Edition

Faraz Rasheed

Edited By:

Tore Nestenius

Jonathan Worthington

Lee Addy Wright

Programmer's Heaven

C# School

First Edition

Faraz Rasheed

Edited By:

Tore Nestenius

Jonathan Worthington

Lee Addy Wright

Copyright (C) Synchron Data 2005-2006. All rights reserved.
Published 5th December 2006.

Synchron Data S.L.
Av. Clemente Diaz Ruiz
Urb. Puebla Lucia local 7, 12-20
296 40 Fuengirola, Spain

Electronic redistribution of this book is permitted if the book is transmitted unmodified, in its entirety and non-commercially. All other redistribution and copying beyond that allowed by fair use is prohibited without written permission from Synchron Data S.L.

The information in this book is distributed on an "as is" basis, without warranty. Although every precaution has been taken in the preparation of this work, neither the authors nor Synchron Data shall have any liability to any person or entity with respect to any loss or damage caused or alleged to be caused directly or indirectly by the information contained in this work.

Trademarked names may appear in the text of this book. Trademarked names are not explicitly marked with the trademark symbol within this book, however they are only used in an editorial fashion and to the benefit of the trademark owner with no intention of infringement of the trademark.

To obtain the latest updates to this book, to suggest corrections or to make other comments, visit:
<http://www.programmersheaven.com/2/CSharpBook>

Copyright (C) Synchron Data 2005-2006. All rights reserved. Published 5th December 2006.

Synchron Data S.L Av. Clemente Diaz Ruiz Urb. Puebla Lucia local 7, 12-20 296 40 Fuengirola, Spain

Electronic redistribution of this book is permitted if the book is transmitted unmodified, in its entirety and non-commercially. All other redistribution and copying beyond that allowed by fair use is prohibited without written permission from Synchron Data S.L.

The information in this book is distributed on an "as is" basis, without warranty. Although every precaution has been taken in the preparation of this work, neither the authors nor Synchron Data shall have any liability to any person or entity with respect to any loss or damage caused or alleged to be caused directly or indirectly by the information contained in this work.

Trademarked names may appear in the text of this book. Trademarked names are not explicitly marked with the trademark symbol within this book, however they are only used in an editorial fashion and to the benefit of the trademark owner with no intention of infringement of the trademark.

To obtain the latest updates to this book, to suggest corrections or to make other comments, visit:

<http://www.programmersheaven.com/2/CSharpBook>

Foreword

from Jonathan Worthington

I approached the .NET platform and the C# language with skepticism in the beginning. A number of things have turned me to view both of them as generally good technologies; editing the Programmer's Heaven C# School, the lessons of which are collected together in this e-book, was one of them.

In many ways the .Net platform has asked “what do developers waste time doing” and tried to improve developer performance. For example, the .NET virtual machine provides memory management, a task that takes up much developer time when it has to be done manually. A large and well-documented class library helps avoid re-inventing the same wheel many times over. Inter-operability between code in a number of languages is made trivial.



The C# language was created alongside the .NET platform. It could be considered the “native” language of .NET, providing access to the vast majority of language features that the .NET runtime is optimized to support. It takes the best bits of Java, C and C++, producing a language with the clear object oriented programming constructs of Java along with useful features such as enumerations and structures from C. The initial version of C#, as taught in the original C# School, is mostly focused on the object oriented programming paradigm. C# 2.0 has added support for parametric polymorphism (known as generics) as well as a range of other features, and I have written an additional chapter for this book to cover some of these. The future C# 3.0 is even more adventurous, bringing in ideas from both declarative and functional programming.

I hope that this e-book helps you get to grips with the C# programming language and the .Net platform and proves a useful reference for the future. It is the first edition, but hopefully not the last – your feedback will help us in that sense, so please do not hesitate to send your comments and especially information about any mistakes to info@programmersheaven.com.

Have fun,

Jonathan Worthington
Programmer's Heaven C# School Editor

Foreword

from Jonathan Worthington

I approached the .NET platform and the C# language with skepticism in the beginning. A number of things have turned me to view both of them as generally good technologies; editing the Programmer's Heaven C# School, the lessons of which are collected together in this e-book, was one of them.

In many ways the .Net platform has asked —what do developers waste time doing“ and tried to improve developer performance. For example, the .NET virtual machine provides memory management, a task that takes up much developer time when it has to be done manually. A large and well-documented class library helps avoid re-inventing the same wheel many times over. Inter-operability between code in a number of languages is made trivial.

The C# language was created alongside the .NET platform. It could be considered the —native“ language of .NET, providing access to the vast majority of language features that the .NET runtime is optimized to support. It takes the best bits of Java, C and C++, producing a language with the clear object oriented programming constructs of Java along with useful features such as enumerations and structures from C. The initial version of C#, as taught in the original C# School, is mostly focused on the object oriented programming paradigm. C# 2.0 has added support for parametric polymorphism (known as generics) as well as a range of other features, and I have written an additional chapter for this book to cover some of these. The future C# 3.0 is even more adventurous, bringing in ideas from both declarative and functional programming.

I hope that this e-book helps you get to grips with the C# programming language and the .Net platform and proves a useful reference for the future. It is the first edition, but hopefully not the last æ your feedback will help us in that sense, so please do not hesitate to send your comments and especially information about any mistakes to info@programmersheaven.com.

Have fun,

Jonathan Worthington Programmer's Heaven C# School Editor

About Programmer's Heaven

Started by Tore Nestenius in 1998, the Programmer's Heaven website has grown to be one of the leading developer resource sites on the net. Taking its name from a range of developer resource CDs published by Tore in the years before the site began, it now features over 30,000 resources spanning a wide range of technologies, from assembly programming to XML.

Today Programmer's Heaven is more than just a massive resource directory. It features many message boards where hundreds of thousands of messages have been posted on a vast range of topics, with experts answering questions for those getting started. Recent years have seen a great deal of original content published by Programmer's Heaven too. The C# School, now collected together into this e-book, was one very successful example of this. The latest developments on the site include a Usenet archive and a range of "Web Tools", essential web-based utilities designed to assist those who are building web sites and web-based applications.



Since 2000, Tore has worked full time on Programmer's Heaven. A range of freelance experts from around the world, including England, the USA, China, Korea and India, have also contributed to the site.

So, why not see how Programmer's Heaven can help you with your development work today? 650.000 unique visitors a month can't be wrong!

<http://www.programmersheaven.com/>

.NET newsletter

The Programmer's Heaven .Net newsletter, sent out up to four times a month, contains the latest .Net news along with information on new .Net articles and resources on Programmer's Heaven. The .Net platform is evolving fast, and signing up for our newsletter is a great way to be kept in the picture. In the immediate future, expect coverage of C# 3.0 and WCF.

Sign up today for free at <http://www.programmersheaven.com/2/DotNet-Newsletter>

About Programmer's Heaven

Started by Tore Nestenius in 1998, the Programmer's Heaven website has grown to be one of the leading developer resource sites on the net. Taking its name from a range of developer resource CDs published by Tore in the years before the site began, it now features over 30,000 resources spanning a wide range of technologies, from assembly programming to XML

Today Programmer's Heaven is more than just a massive resource directory. It features many message boards where hundreds of thousands of messages have been posted on a vast range of topics, with experts answering questions for those getting started. Recent years have seen a great deal of original content published by Programmer's Heaven too. The C# School, now collected together into this e-book, was one very successful example of this. The latest developments on the site include a Usenet archive and a range of —Web Tools“, essential web-based utilities designed to assist those who are building web sites and web-based applications.

Since 2000, Tore has worked full time on Programmer's Heaven. A range of freelance experts from around the world, including England, the USA, China, Korea and India, have also contributed to the site.

So, why not see how Programmer's Heaven can help you with your development work today? 650.000 unique visitors a month can't be wrong!

<http://www.programmersheaven.com/>

.NET newsletter The Programmer's Heaven .Net newsletter, sent out up to four times a month, contains the latest .Net news along with information on new .Net articles and resources on Programmer's Heaven. The .Net platform is evolving fast, and signing up for our newsletter is a great way to be kept in the picture. In the immediate future, expect coverage of C# 3.0 and WCF.

Sign up today for free at <http://www.programmersheaven.com/2/DotNet-Newsletter>

About Faraz Rasheed

Faraz Rasheed is currently working towards his MS (Computer Engineering) from Kyung Hee University, South Korea, and working as a research assistant in the Ubiquitous Computing Group (UCG) of Realtime & Multimedia Lab (www.oslab.khu.ac.kr). His current research area is 'Information management in context aware & ubiquitous computing environments'. He completed his BS (Computer Science) at the Department of Computer Science, University of Karachi, Pakistan.

He has a strong interest in the object oriented software development process, specifically using .Net and Java based technologies. He has done various projects using C#, VB.Net, ASP.Net on standard and compact edition of .Net, which also involve technologies like ADO.Net, web services, .Net remoting, reflection and strong named shared assemblies.

He can be contacted by email at either frazrasheed@hotmail.com or faraz@oslab.khu.ac.kr.



C# 3.0

C# 3.0 is the next version of the C# language, currently in BETA and due for release in 2007. We have created an area on the Programmer's Heaven site to provide coverage of the exciting new features in C# 3.0. This will include a series of articles explaining the new features and the concepts behind them in the same plain English that you have found in this book.

About Faraz Rasheed

Faraz Rasheed is currently working towards his MS (Computer Engineering) from Kyung Hee University, South Korea, and working as a research assistant in the Ubiquitous Computing Group (UCG) of Realtime & Multimedia Lab (www.oslab.khu.ac.kr). His current research area is "Information management in context aware & ubiquitous computing environments". He completed his BS (Computer Science) at the Department of Computer Science, University of Karachi, Pakistan.

He has a strong interest in the object oriented software development process, specifically using .Net and Java based technologies. He has done various projects using C#, VB.Net, ASP.Net on standard and compact edition of .Net, which also involve technologies like ADO.Net, web services, .Net remoting, reflection and strong named shared assemblies.

He can be contacted by email at either frazrasheed@hotmail.com or faraz@oslab.khu.ac.kr.

C# 3.0 C# 3.0 is the next version of the C# language, currently in BETA and due for release in 2007. We have created an area on the Programmer's Heaven site to provide coverage of the exciting new features in C# 3.0. This will include a series of articles explaining the new features and the concepts behind them in the same plain English that you have found in this book.

Contents In Summary

1. Introduction	17
2. C# Language Fundamentals	31
3. Classes and Objects	53
4. Inheritance & Polymorphism	78
5. Structures, Enumeration, Garbage Collection & Nested Classes	99
6. Abstract Classes & Interfaces	115
7. Arrays, Collections & String Manipulation	129
8. Exception Handling	155
9. Delegates & Events	171
10. WinForms & Windows Applications	190
11. More Windows Controls & Standard Dialog Boxes	211
12. Data Access using ADO.Net	230
13. Multithreading	265
14. The File System & Streams	288
15. New Features In C# 2.0	322
16. The Road Ahead	338

Contents In Summary

1.	Introduction	17
Language	2. C#	
Fundamentals.....	3. Classes	31
and Objects	4.	53
Inheritance	&	
Polymorphism.....	5.	78
Structures, Enumeration, Garbage Collection & Nested Classes	6. Abstract Classes & Interfaces	99
String Manipulation	7. Arrays, Collections &	115
Handling	8. Exception	129
Delegates	9.	155
&	Events	
.....	10. WinForms	171
& Windows Applications.....	11.	190
More Windows Controls & Standard Dialog	12. Data Access using	
Boxes.....	13.	211
ADO.Net.....		230
Multithreading.....		2
65	14. The File System &	
Streams.....	15. New	288
Features In C# 2.0		322
16. The Road Ahead		
.....		338

Contents In Detail

1. Introduction	17
The Way	17
Tools of the trade.....	17
The C# Language	17
The .Net Architecture and .Net Framework	18
The Common Language Runtime (CLR).....	18
MSIL (Microsoft Intermediate Language) Code.....	18
Just In Time Compilers (JITers).....	19
The Framework Class Library (FCL).....	19
The Common Language Specification (CLS)	19
The Common Type System (CTS).....	20
Garbage Collection (GC)	20
The .Net Framework	20
C# compared to C++	20
The Visual Studio.Net IDE	21
Projects and Solutions	21
Toolbox, Properties and Class View Tabs	22
Writing Your First Hello World Console Application in C#	22
Working Without Visual Studio.Net.....	22
With Visual Studio.Net	23
Understanding the Hello World Application Code:	25
Namespaces in C#	25
The using Keyword	26
The class Keyword	26
The Main() Method	26
Printing on the Console	27
Comments.....	27
Important points to remember	28
A more interactive Hello World Application	29
Discussing a more interactive Hello World Application.....	29
2. C# Language Fundamentals.....	31
Lesson Plan	31
Basic Data Types and their mapping to CTS (Common Type System).....	31
Variables.....	32
Constant Variables or Symbols	33
Naming Conventions for variables and methods.....	33
Operators in C#	34
Arithmetic Operators.....	34
Prefix and Postfix notation.....	36

Contents In Detail

1. Introduction	17
.....17 The Way	
.....17 Tools	
of the trade.....17	
.....The C# Language	
.....17 The .Net	
Architecture and .Net Framework	18
Common Language Runtime (CLR).....	18
.....MSIL (Microsoft Intermediate Language)	
Code.....	18
Just In Time Compilers	
(JITers).....	19
The Framework	
Class Library (FCL).....	19
The	
Common Language Specification (CLS)	19
The Common Type System	
(CTS).....	20
Garbage Collection	
(GC)	20
The .Net	
Framework	20
C#	
compared to C++	20
The Visual Studio.Net IDE	
.....21 Projects and Solutions	
.....21 Toolbox,	
Properties and Class View Tabs	22
Writing Your First Hello World Console Application in C#	
.....22 Working Without Visual Studio.Net	
.....22 With Visual Studio.Net	
.....23 Understanding the	
Hello World Application Code:	25
Namespaces in	
C#	25
The using	
Keyword	26
The	
class Keyword	26
The Main() Method	
.....26 Printing on the	
Console	27
Comments.....	
.....27 Important points to remember	
.....28 A more interactive Hello	
World Application	29
Discussing a more	
interactive Hello World Application.....	29
2. C# Language	
Fundamentals.....	31
Lesson	
Plan	31
Basic Data Types and their mapping to CTS (Common Type	

	System).....	31
Variables.....		
	32 Constant Variables or Symbols	
	33 Naming Conventions for	
variables and methods.....	33 Operators in C#	
	34 Arithmetic	
Operators.....	34 Prefix	
and Postfix notation.....	36	

Assignment Operators	36
Relational Operators	37
Other Operators	39
Operator Precedence	39
Flow Control And Conditional Statements	39
The if...else statement	39
The switch...case statement	42
Loops In C#	45
The for Loop	45
Some important points about the for loop	46
The do...while Loop	48
while Loop	48
Arrays in C#	49
Array Declaration	49
Accessing the values stored in an array	49
foreach Loop	50
3. Classes and Objects	53
Lesson Plan	53
Concept of a Class	53
Objects	53
Fields	54
Methods	55
Instantiating the class	56
Accessing the members of a class	56
Access Modifiers or Accessibility Levels	58
Properties	60
Using Properties	61
Precautions when using properties	63
Static Members of the class	65
Some More about Methods	67
Constructors	67
Finalize() Method of Object class	70
Destructors	70
Method and Constructor Overloading	71
Overloading Constructors	72
Value types (out & ref Keywords)	73
Reference types	75
Some more about references and objects	75
4. Inheritance & Polymorphism	78
Lesson Plan	78
Inheritance	78
Inheritance in C#	79

	Assignment Operators	
.....	36 Relational	
Operators.....	37 Other	
Operators	39	
	Operator Precedence	
.....	39 Flow Control	
And Conditional Statements	39 The	
if...else statement.....	39	
	The switch...case statement	
.....	42 Loops In	
C#.....	45 The	
for Loop.....	45	
	Some important points about the for loop	
.....	46 The do...while Loop	
.....	48 while	
Loop.....	48	
	Arrays in C#	
.....	49 Array	
Declaration.....	49	
	Accessing the values stored in an	
array.....	49 foreach Loop	
.....	50 3. Classes	
and Objects	53	
	Lesson Plan	
.....	53 Concept	
of a Class.....	53	
Objects.....		53
		54
Fields.....		
		54
Methods.....		
	55 Instantiating the class	
.....	56 Accessing the	
members of a class	56 Access	
Modifiers or Accessibility Levels	58	
Properties.....		
	60 Using Properties	
.....	61 Precautions	
when using properties	63 Static	
Members of the class.....	65	
	Some More about Methods	
.....	67 Constructors	

.....	67	Finalize()
Method of Object class	70	
		Destructors
.....	70	Method
and Constructor Overloading.....	71	
		Overloading Constructors
.....	72	Value types (out & ref
Keywords)	73	Reference types
.....	75	Some more
about references and objects	75	4.
		Inheritance &
Polymorphism.....	78	Lesson Plan
.....	78	
Inheritance.....		
	78	Inheritance in C#
.....	79	

Implementing inheritance in C#.....	80
Constructor calls in Inheritance.....	83
The base keyword - Calling Constructors of the base-class explicitly.....	85
Protected Access Modifier.....	87
The Protected internal Access Modifier.....	88
The sealed keyword.....	88
Object class - the base of all classes.....	89
Polymorphism.....	90
Using the reference of the base type for referencing the objects of child types.....	90
Using methods with the same name in the Base and the Sub-class.....	91
Overriding the methods - virtual and override keywords.....	92
The new keyword.....	95
Type casting the objects - Up-casting and Down-casting.....	96
The is and as keywords.....	96
Boxing and Un-boxing.....	97
5. Structures, Enumeration, Garbage Collection & Nested Classes.....	99
Lesson Plan.....	99
Structures (struct).....	99
Defining a struct.....	99
Instantiating the struct.....	100
structs as Value Types.....	104
Enumeration.....	105
The Need for Enumeration.....	105
Using Enumeration (enum).....	106
More about Enumerations.....	108
Garbage Collection in .Net.....	110
Destructors and Performance Overhead.....	112
System.GC.Collect() method.....	112
Nested Classes in C#.....	112
6. Abstract Classes & Interfaces.....	115
Lesson Plan.....	115
Abstract Classes.....	115
Interfaces.....	118
Implementing More Than One Interface.....	121
Explicit implementation of methods.....	124
Casting to an interface using is and as operators.....	125
An interface inheriting one or more interfaces.....	127
7. Arrays, Collections & String Manipulation.....	129
Lesson Plan.....	129
Arrays Revisited.....	129
Multidimensional Arrays.....	129
Instantiating and accessing the elements of multidimensional arrays.....	131

	Implementing inheritance in	
C#.....	80	Constructor calls in
Inheritance.....	83	The base
keyword - Calling Constructors of the base-class explicitly.....	85	
	Protected Access Modifier	
.....	87	The Protected internal
Access Modifier.....	88	The sealed
keyword.....	88	Object
class - the base of all classes.....	89	
	Polymorphism	
.....	90	Using the
reference of the base type for referencing the objects of child types.....	90	Using
methods with the same name in the Base and the Sub-class	91	
	Overriding the methods - virtual and override	
keywords.....	92	The new keyword
.....	95	Type casting
the objects - Up-casting and Down-casting	96	The is
and as keywords	96	
	Boxing and Un-boxing	
.....	97	5. Structures,
Enumeration, Garbage Collection & Nested Classes	99	Lesson
Plan	99	
	Structures (struct)	
.....	99	Defining a
struct	99	
	Instantiating the struct	
.....	100	structs as Value
Types.....	104	Enumeration
.....	105	The Need
for Enumeration.....	105	Using
Enumeration (enum)	106	
	More about Enumerations	
.....	108	Garbage Collection in
.Net.....	110	Destructors and
Performance Overhead.....	112	
	System.GC.Collect() method	
.....	112	Nested Classes in C#
.....	112	6. Abstract
Classes & Interfaces	115	
	Lesson Plan	
.....	115	Abstract
Classes	115	

	Interfaces	
.....		118
	Implementing More Than One	
Interface.....	121 Explicit implementation of	
methods	124 Casting to an interface	
using is and as operators.....	125 An interface	
inheriting one or more interfaces.....	127 7.	
	Arrays, Collections & String Manipulation	
.....		129 Lesson Plan
.....		129 Arrays
Revisited.....		129
	Multidimensional	
Arrays.....	129 Instantiating	
and accessing the elements of multidimensional arrays.....		131