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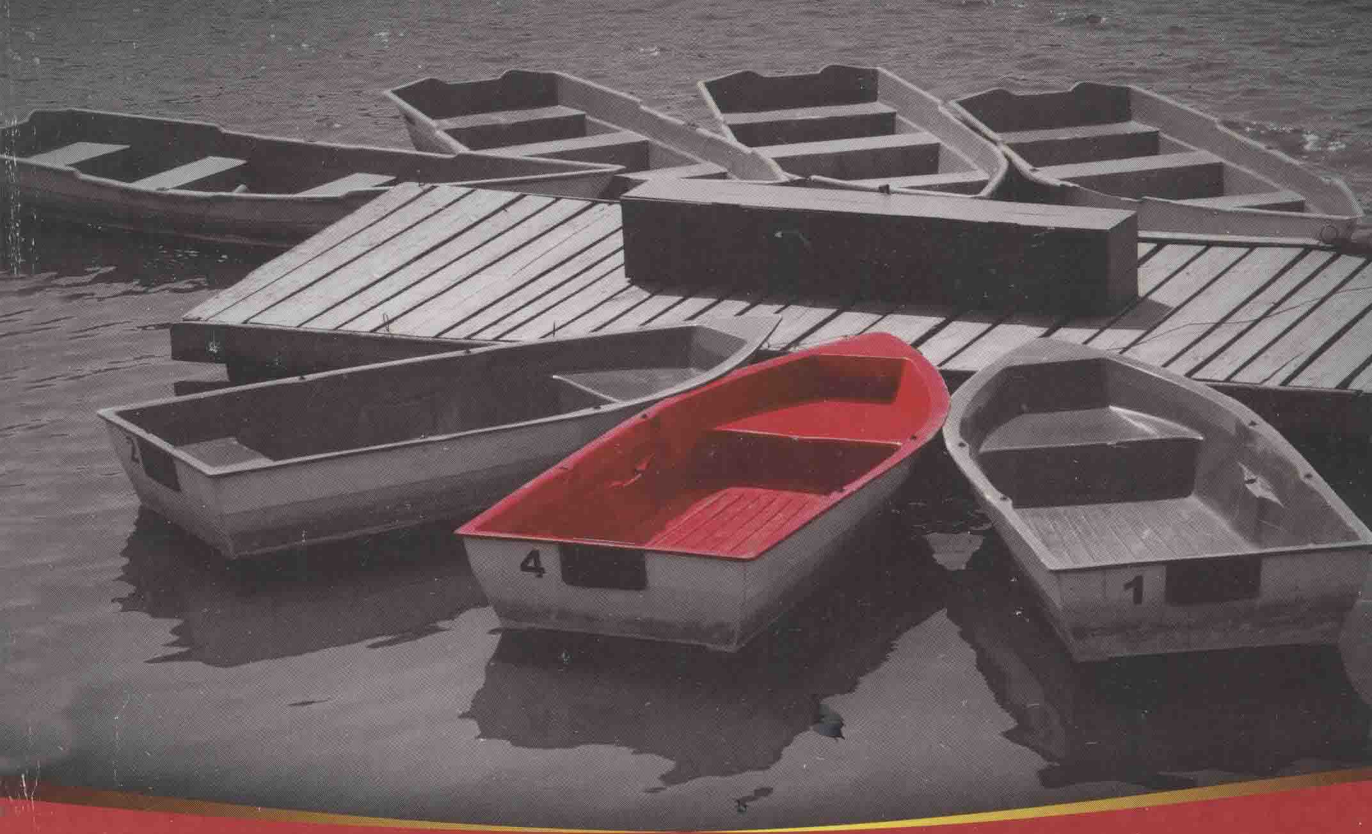

Functional Programming in C#

Classic Programming Techniques for Modern Projects

Oliver Sturm

PROFESSIONAL

Functional Programming in C#

CLASSIC PROGRAMMING TECHNIQUES FOR MODERN PROJECTS

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Professional Functional Programming in C#: Classic Programming Techniques for Modern Projects

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ABOUT THE AUTHOR

OLIVER STURM has over 20 years experience developing professional software. He is a well-known expert in various areas of application architecture, programming languages and the third party .NET tools made by DevExpress. His main focus has been on the .NET platform since 2002. Oliver has spoken at many international conferences and has written more than 20 training classes and more than 100 magazine articles in English as well as German. He has also taught classes on topics around computer programming for more than 15 years. For his contributions to the .NET community, he has been awarded the C# MVP Award by Microsoft United Kingdom for several years now.

Based in Scotland, UK, Oliver works as a freelance consultant and trainer, and he is an associate at thinktecture, an international consultancy firm. You can find his blog at `www.sturmnet.org/blog` and his commercial website at `www.oliversturm.com`. His e-mail address is `oliver@oliversturm.com`.

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INTRODUCTION

FUNCTIONAL PROGRAMMING is an important paradigm of programming that looks back on a long history. The subject has always been very relevant to people who teach others how to program — the clean and logical concepts of functional programming lend themselves especially well to teaching. Certain industries that use computers and self-written programs heavily have also found functional programming to be the most productive approach for their purposes. However, for many of the "mainstream" software manufacturers, functional programming has long held an air of the academic and they widely chose to use approaches with an imperative heritage, like object orientation.

In recent years, more and more functional elements have been included in imperative languages on the .NET platform, and with Visual Studio 2010, F# has been included — the first hybrid functional language in the box with Microsoft's mainstream development platform. Even more than the functional features that have been introduced to C# and VB.NET, this shows a commitment on Microsoft's side.

WHO THIS BOOK IS FOR

The topic of functional programming in C# can be seen from two different angles. On the .NET platform there are many experienced developers and development teams, who have been using C# or VB.NET, or in some cases C++, to create software for the platform. If you have that sort of experience, there are lots of reasons you should be looking into functional programming: it's a clean and easily maintainable style, it's an important basis of programming as we know it today, and certain specific current concerns, like parallelization, can be targeted successfully with the help of functional programming ideas.

On the other hand, perhaps you're not a .NET programmer at all. Instead, you have experience in one or more "traditional" functional programming languages. You need to work with people who use C#, or you want to use the language yourself. This book will help you understand how you can use the approaches you're familiar with in C#, and it may give you valuable starting points when it comes to explaining these ideas to team members without your functional background.

The book assumes a basic level of understanding of C# language constructs, at least up to version 3.0 of the language. However, Part II is written to explain a few particular features of the language that are especially important, rather complex or often misunderstood. From experience, I recommend you give Part II a good look even if you're quite fluent in C# — there are usually some little-known intricacies about the features that have been selected for this part, which may lead to misunderstandings later.

WHAT THIS BOOK COVERS

The language of the vast majority of examples in this book is C# 4.0, running on Microsoft .NET. There are a few examples in other languages, but they are for illustrative purposes only. If you want to try out the examples for yourself, but you're not on C# 4.0 or Visual Studio 2010 yet, you may still have success using C# 3.0 and Visual Studio 2008 — there aren't many new features in C# 4.0 specifically, and none of them have been exploited in the examples. However, a few examples utilize .NET Framework features like Parallel Extensions, which are available only in .NET 4.0.

The book introduces you to concepts of functional programming and describes how these can be used with the C# language. An effort has been made to provide samples with a practical background, but most of them still focus mostly on language level considerations. Functional programming is a technique for code, algorithm and program structure — as opposed to, for instance, application architecture. Of course it needs to fit in with application architecture . . . you get the point: it's sometimes hard to find the perfect compromise between being too theoretical and going off-focus, but I've tried my best.

While I wrote this book, I developed a library of functionally oriented helpers, called FCSlib (that's "Functional CSharp Library"). You can use this library in your own projects as you like, but please note that it doesn't come with any warranty. The downloadable file containing the library code (more information about downloads in the upcoming section "Source Code") includes a copy of the LGPL license text, which applies to the FCSlib code.

HOW THIS BOOK IS STRUCTURED

This book has four parts. The first part provides an overview of functional programming, both from a historical and a current point of view. Part II proceeds to give you the C# background you'll need to understand the more complex examples that follow later. Again, reading this is recommended even if you know C# — it does have a few pretty basic items, but generally it's not meant to be a language introduction for newbies.

Part III is the most important one. Its 10 chapters describe a variety of functional programming topics from a C# point of view, showing lots of examples and code snippets. The code library that accompanies this book, FCSlib, is built on the ideas described in this part.

Finally, Part IV gives you an overview of practical concerns of using functional programming in C#. I picked a few specific scenarios, and there are descriptions of functional programming ideas in existing products and technologies that you may be familiar with.

WHAT YOU NEED TO USE THIS BOOK

All code in this book has been tested with Visual Studio 2010, C# 4.0 and .NET 4.0. Much of it has been originally developed on C# 3.0, so you should have good success running the code on .NET 3.5. Going back further than that would mean major rewrites in many areas — the concepts may translate even to C# 2.0 in many cases, but the language features that make them reasonably easy to use are just not available in that version.

I have made several attempts to build the code on the Mono platform, but unfortunately I stumbled upon compiler bugs every time. Your mileage may vary if you try to use Mono — after all, it changes all the time.

CONVENTIONS

To help you get the most from the text and keep track of what's happening, we've used a number of conventions throughout the book.

> *The pencil icon indicates notes, tips, hints, tricks, and asides to the current discussion.*

As for styles in the text:

- We *italicize* new terms and important words when we introduce them.
- We show keyboard strokes like this: Ctrl+A.
- We show file names, URLs, and code within the text like so: `persistence.properties`.
- We present code in two different ways:

```
We use a monofont type with no highlighting for most code examples.
We use bold to emphasize code that is particularly important in the present
context or to show changes from a previous code snippet.
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PROFESSIONAL FUNCTIONAL PROGRAMMING IN C#

Continues

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