A Natural Introduction to Computer Programming with C#

Kari Laitinen

www.naturalprogramming.com

Table of contents

INTRODUCTORY PAGES

| | Acknowledgments | . iv |
|----|--|--------------|
| | Some reasons to choose this book. | v |
| | _r Notes for teachers and other experienced programmers. | V |
| | Some advice for studying. | . vii |
| | The structure of this book. | ; ix |
| | The structure of program descriptions. | X |
| | Table of contents. | X11 |
| | C# programs in this book. | XVI |
| | Pages where exercises can be found. | AIX |
| P/ | ART I: THE WORLD OF COMPUTERS | 1 |
| 1 | COMPUTING: SOME CONCEPTS AND TERMINOLOGY. | 3 |
| | 1.1 Hardware and software. | 4 |
| | 12 Operating systems, main memory, and memory devices. | 4 |
| | 1.3 Source programs and executable programs. | 8 |
| | 14 Programs, applications, and systems. | 9 |
| 2 | A FIRST LOOK AT C# SOURCE PROGRAMS. | 11 |
| | 2.1 A program that can print text to the screen | .12 |
| | 2.2 A program that can read from the keyboard and calculate. | 14 |
| | 2.3 Getting a C# compiler to your computer. | 20 |
| | " 2.4 Installing the electronic material of this book | 23 |
| | 2.5 Compiling with the C# compiler. | 25 |
| | 2.6 Finding an editor tool for writing computer programs. | 26 |
| | 2.7 Modifying and recompiling programs. | . 27 |
| 3 | HOW INFORMATION IS STORED IN THE MEMORY OF A COMPUTER. | 29 |
| | 3.1 Numerical information: numbering systems. | 30 |
| | 3.2 Numerical information: the binary world of computers. | 38 |
| | 3.3 Textual information: character coding systems. | .43 |
| | 3.4 More information: pictures, sound, and moving pictures. | . 46 |
| 4 | LOGICAL OPERATING PRINCIPLES OF COMPUTERS | 47 |
| | 4.1 How does the main memory operate? | . 48 |
| | 4.2 The components of an imaginary computer. | 52 |
| | 4.3 Inside the imaginary processor. | . 54 |
| | 4.4 Machine instructions. | 57 |
| | 4.5 The steps and states of program execution. | 64 |
| | 4.6 Programs to print text "Hello!" | 66 |
| | 4.7 Programming language IVIL and compilation. | /1 |
| | 4.0 A program that contains a loop | /8 |
| | 4.7 A program that contains a loop | . 3U . 20 |
| | 4.10 Subjourne cans and stack operations. | 02 |
| | 4.12. Chapter summary - towards high-level programming | 05 |
| | | |

| P | PART II: FUNDAMENTALS OF PROGRAMMING | 95 |
|---|---|----|
| 5 | VARIABLES AND OTHER BASIC ELEMENTS IN C# PROGRAMS | |
| | 5.1 Integer variables (int, short, long, byte, uint, ushort, ulong, sbyte, char). 5.2 Keywords, names, spaces, andnewlines. 5.3 Floating-point variables. 5.4 Operators, assignments, and literal constants. 5.5 Reading data from the keyboard - a first look at strings. 5.6 The double role of operator+. 5.7 Formatting the output on the screen. | |
| (| 5.8 Chapter summary. | |
| 6 | DECISIONS AND REPETITIONS: BASIC ACTIVITIES IN PROGRAMS. | |
| | 6.1 Making decisions with keywords if and else. 6.2 Making decisions with switch-case constructs. 6.3 while loops enable repetition. 6.4 for loops repeat a known number of times. 6.5 do-while loops execute at least once. 6.6 The block structure of C# programs. 6.7 try-catch constructs handle exceptions. 6.8 Truth values and variables of type bool. 6.9 Chapter summary. | |
| 7 | ARRAYS: SETS OF SIMILAR DATA ITEMS | |
| | 7.1 Creating arrays and referring to array elements. 7.2 Array declaration vs. array creation. 7.3 Initialized arrays. 7.4 Multidimensional arrays. 7.5 Chapter summary. | |
| 8 | STRINGS STORE SEQUENCES OF CHARACTER CODES | |
| | 8.1 "Variables" of type string. 8.2 String literals. 8.3 Accessing individual characters of a string. 8.4 String methods. 8.5 Class StringBuilder - mutable strings. 8.6 Arrays of strings. 8.7 Chapter summary. | |
| 9 | METHODS - LOGICAL PERFORMING UNITS IN PROGRAMS | |
| | 9.1 Simple static methods and the concept of calling 9.2 Methods that take parameters. 9.3 Methods that return data to the caller. 9.4 Calling static methods of another class. 9.5 The role of the stack in method calls. 9.6 Scope of variables. 9.7 Parameters for the method Main(). 9.8 Overloading method names. 9.9 Declaring and using namespaces. 9.10 Chapter summary. | |

| PAI | RT III: OBJECT-ORIENTED PROGRAMMING | .287 |
|-----|---|---|
| 10 | CLASSES AND OBJECTS | .289 |
| | 10.1 Classes, fields, and instance methods. 10.2 Constructors are methods that build objects. 10.3 Several constructors in a class. 10.4 Arrays containing references to objects. 10.5 Value types vs. reference types. 10.6 When objects become garbage. 10.7 A stack that grows dynamically. 10.8 Chapter summary. | 290 .300 .306 .310 .324 .325 .326 .333 |
| 11 | MORE ADVANCED CLASSES | .335 |
| | 11.1 Class Date - an example of a larger class. 11.2 The this keyword 11.3 Graphical UML class diagrams. 11.4 "Objects inside objects". 11.5 Properties can replace accessor methods. 11.6 Indexers provide array-like access. 11.7 Chapter summary. | . 336 . 356 . 359 . 360 . 373 . 378 . 386 |
| 12 | INHERITANCE AND CLASS HIERARCHIES | . 387 |
| | 12.1 Base classes and derived classes. 12.2 Larger class hierarchies. 12.3 Polymorphism -redefining methods in derived classes. 12.4 Structs are class-like constructs that cannot be inherited. 12.5 Chapter summary. | 388 404 418 432 437 |
| 13 | SOME STANDARD C# CLASSES AND STRUCTS | .439 |
| | 13.1 Structs Byte, Intl6, Int32, Int64, Char, Single, Double, SByte, UIntl6, etc. 13.2 Object: the class above all classes. 13.3 Exception classes. 13.4 Class Array: the base class for all arrays. 13.5 Chapter summary. | 440 442 446 452 456 |
| 14 | STORING INFORMATION IN FILES. | . 457 |
| | 14.1 Classes to read and write files. 14.2 Reading and writing text files. 14.3 Handling files as binary files. 14.4 A larger program that uses a binary file. 14.5 Chapter summary. | 458 460 477 486 504 |
| 15 | MORE STANDARD C# TYPES | 509 |
| | 15.1 ArrayList class 15.2 IComparable and other interfaces 15.3 DateTime struct 15.4 Chapter summary | 510 522 529 536 |
| 16 | GOING CLOSER TO THE MACHINE. | 537 |
| | 16.1 Bit operators &, , ^A, ~. », and « 16.2 Playing with the time in programs - introduction to threads. 16.3 Chapter summary. | 538 546 556 |

| A - 1: Literals. | |
|--|-----|
| A - 2: Variables, constants, and arrays of basic types. | 562 |
| A - 3: String objects, other objects, and arrays of objects | 563 |
| A - 4: Expressions | |
| A - 5: Assignments and left side expressions | 564 |
| A - 6: The most important C# operators in order of precedence | |
| A - 7: Control structures to make decisions (selections). | |
| A - 8: Control structures to perform repetitions (iterations). | |
| A - 9: The basic C# method structures. | 568 |
| A - 10: String methods. | |
| A - 11: Mechanisms for keyboard input and screen output. | |
| A - 12: Input/output from/to files | |
| A - 13: Data conversions | 571 |
| A - 14: C# class declaration. | |
| | |
| APPENDIX B: C# KEYWORDS (RESERVED WORDS) | 573 |
| APPENDIX B: C# KEYWORDS (RESERVED WORDS) | |
| APPENDIX B: C# KEYWORDS (RESERVED WORDS) | |
| APPENDIX B: C# KEYWORDS (RESERVED WORDS). APPENDIX C: PRACTICAL ADVICE FOR PROGRAMMING EXERCISES C - 1: Starting an exercise. C - 2: Writing your program. | |
| APPENDIX B: C# KEYWORDS (RESERVED WORDS). APPENDIX C: PRACTICAL ADVICE FOR PROGRAMMING EXERCISES C - 1: Starting an exercise C - 2: Writing your program C - 3: Compiling and executing your program | |
| APPENDIX B: C# KEYWORDS (RESERVED WORDS). APPENDIX C: PRACTICAL ADVICE FOR PROGRAMMING EXERCISES C - 1: Starting an exercise C - 2: Writing your program C - 3: Compiling and executing your program C - 4: Correcting compilation errors | |
| APPENDIX B: C# KEYWORDS (RESERVED WORDS). APPENDIX C: PRACTICAL ADVICE FOR PROGRAMMING EXERCISES C - 1: Starting an exercise C - 2: Writing your program C - 3: Compiling and executing your program C - 4: Correcting compilation errors C - 5: Searching for errors that compilers do not detect | |
| APPENDIX B: C# KEYWORDS (RESERVED WORDS). APPENDIX C: PRACTICAL ADVICE FOR PROGRAMMING EXERCISES C - 1: Starting an exercise. C - 2: Writing your program C - 3: Compiling and executing your program C - 4: Correcting compilation errors C - 5: Searching for errors that compilers do not detect. C - 6: Programs that do not terminate | |
| APPENDIX B: C# KEYWORDS (RESERVED WORDS). APPENDIX C: PRACTICAL ADVICE FOR PROGRAMMING EXERCISES C - 1: Starting an exercise. C - 2: Writing your program. C - 3: Compiling and executing your program. C - 4: Correcting compilation errors. C - 5: Searching for errors that compilers do not detect. C - 6: Programs that do not terminate. C - 7: Incremental program development. | |
| APPENDIX B: C# KEYWORDS (RESERVED WORDS). APPENDIX C: PRACTICAL ADVICE FOR PROGRAMMING EXERCISES C - 1: Starting an exercise C - 2: Writing your program C - 3: Compiling and executing your program C - 4: Correcting compilation errors C - 5: Searching for errors that compilers do not detect. C - 6: Programs that do not terminate C - 7: Incremental program development C - 8: Printing your program on paper. | |
| APPENDIX B: C# KEYWORDS (RESERVED WORDS). APPENDIX C: PRACTICAL ADVICE FOR PROGRAMMING EXERCISES. C - 1: Starting an exercise C - 2: Writing your program C - 3: Compiling and executing your program C - 4: Correcting compilation errors C - 5: Searching for errors that compilers do not detect. C - 6: Programs that do not terminate. C - 7: Incremental program development C - 8: Printing your program on paper. C - 9: Program versions and backups. | |
| APPENDIX B: C# KEYWORDS (RESERVED WORDS). APPENDIX C: PRACTICAL ADVICE FOR PROGRAMMING EXERCISES C - 1: Starting an exercise C - 2: Writing your program C - 3: Compiling and executing your program C - 4: Correcting compilation errors C - 5: Searching for errors that compilers do not detect. C - 6: Programs that do not terminate C - 7: Incremental program development. C - 8: Printing your program on paper. C - 9: Program versions and backups. | |