

## Contents

| 1 | Introduction                    |                                   | page 1 |
|---|---------------------------------|-----------------------------------|--------|
|   | 1.1                             | Who Is This Book For?             | 3      |
|   | 1.2                             | About the Boxes                   | 4      |
|   | 1.3                             | Structure of This Book            | 7      |
|   | 1.4                             | Acknowledgements                  | 7      |
| 2 | What Are Good Programs?         |                                   | 9      |
|   | 2.1                             | Ethics                            | 10     |
| 3 | How to Get Started              |                                   | 12     |
|   | 3.1                             | What Is a Program Anyway?         | 12     |
|   | 3.2                             | What Do You Need?                 | 13     |
|   | 3.3                             | Understanding What You Have to Do | 18     |
|   | 3.4                             | Writing Your Program              | 20     |
|   | 3.5                             | What to Do If You Get Confused    | 29     |
| 4 | How to Understand Your Language |                                   | 33     |
|   | 4.1                             | Compilation or Interpretation     | 34     |
|   | 4.2                             | Types                             | 37     |
|   | 4.3                             | Structure                         | 41     |
|   | 4.4                             | History, Community and Motivation | 44     |
|   | 4.5                             | Paradigms                         | 45     |
| 5 | How to Use the Best Tools       |                                   | 48     |
|   | 5.1                             | Using the Most Basic Tools        | 49     |
|   | 5.2                             | What Is an IDE?                   | 50     |
|   | 5.3                             | Looking Forward                   | 53     |



| Vi | Contents                                       |     |
|----|--|-----|
| 6  | How to Make Sure You Don't Lose Your Program   | 55  |
|    | 6.1 Immediate Recovery: Undo                   | 55  |
|    | 6.2 Basic Disaster Recovery: Files             | 56  |
|    | 6.3 Avoiding Disaster: Saving Versions         | 58  |
|    | 6.4 Automating the Process: Using a Version    |     |
|    | Control System                                 | 59  |
|    | 6.5 Managing Code that Is Not in Use           | 61  |
|    | 6.6 Backups and the Cloud                      | 65  |
| 7  | How to Test Your Program                       | 68  |
|    | 7.1 Manual Testing                             | 69  |
|    | 7.2 Basic Automated Testing                    | 71  |
|    | 7.3 Proper Automated Testing                   | 75  |
|    | 7.4 What Tests Should You Have?                | 77  |
|    | 7.5 When Should You Write Tests?               | 78  |
|    | 7.6 Property-Based Testing                     | 79  |
| 8  | How to Make Your Program Clear                 |     |
|    | 8.1 How Will Writing Clear Code Help You?      | 83  |
|    | 8.2 Comments                                   | 85  |
|    | 8.3 Names                                      | 89  |
|    | 8.4 Layout and Whitespace                      | 92  |
|    | 8.5 Structure and Idiom                        | 96  |
| 9  | How to Debug Your Program                      |     |
|    | 9.1 When You Can't Run Your Program Yet        | 103 |
|    | 9.2 When Your Program Runs but Behaves Wrongly | 109 |
|    | 9.3 Cardboard Debugging                        | 120 |
|    | 9.4 If All Else Fails                          | 121 |
|    | 9.5 Removing the Bug                           | 122 |
|    | 9.6 After Removing the Bug                     | 124 |
| 10 | How to Improve Your Program                    | 134 |
|    | 10.1 Maintainability                           | 134 |

10.2 Efficiency

145



|    | Contents                                      | vii |
|----|---|-----|
|    | 10.3 Refactoring                              | 149 |
|    | 10.4 Improving Your Skills                    | 153 |
| 11 | How to Get Help (without Cheating)            | 156 |
|    | 11.1 Solving a General Problem                | 157 |
|    | 11.2 Solving a More Specific Problem          | 160 |
|    | 11.3 How to Cope When Your Teacher Is         |     |
|    | Confusing You                                 | 168 |
| 12 | How to Score Well in Coursework               | 170 |
|    | 12.1 Seven Golden Rules                       | 170 |
|    | 12.2 Lab Exercises                            | 172 |
|    | 12.3 Individual Projects                      | 173 |
|    | 12.4 Team Working                             | 174 |
|    | 12.5 Demonstrations                           | 175 |
|    | 12.6 Reflective Writing                       | 177 |
| 13 | How to Score Well in a Programming Exam       | 179 |
|    | 13.1 Preparing for the Exam                   | 179 |
|    | 13.2 In the Exam                              | 182 |
|    | 13.3 Specific Points for Paper Exams          | 183 |
|    | 13.4 Specific Points for Computer-Based Exams | 184 |
|    | 13.5 What about Multiple Choice Exams?        | 185 |
| 14 | How to Choose a Programming Language          | 186 |
|    | 14.1 Questions to Consider                    | 186 |
|    | 14.2 A Few Languages You May Encounter        | 189 |
|    | 14.3 The Changing Landscape of Languages      | 192 |
| 15 | How to Go Beyond This Book                    | 194 |
|    | 15.1 Doing More Programming                   | 194 |
|    | 15.2 Specific Programming Languages           | 195 |
|    | 15.3 Programming Generally                    | 195 |



| viii             | Contents   |            |
|------------------|--|------------|
|                  | <ul><li>.4 Software Engineering</li><li>.5 Programming Language Theory</li></ul> | 196<br>198 |
| Bibliog<br>Index | graphy   | 200<br>202 |