

Contents

| | |
|---|-----------|
| 1 Essential Notations | 1 |
| 1.1 Simple Values | 1 |
| 1.2 Identifiers and Expressions | 4 |
| 1.3 Functions and Procedures | 6 |
| 1.4 Arithmetic Functions | 7 |
| 1.5 Procedure Calls | 13 |
| 1.6 <i>lambda</i> -Expressions | 14 |
| 1.7 Predicates | 22 |
| 1.8 Conditional Expressions | 26 |
| 1.9 Definitions | 29 |
| 1.10 Local Bindings | 33 |
| 2 The Tool Box | 39 |
| 2.1 List Mapping | 39 |
| 2.2 Constant Procedures | 41 |
| 2.3 Procedure Sections | 43 |
| 2.4 Couplers | 47 |
| 2.5 Adapters | 50 |
| 2.6 Recursion Managers | 56 |
| 2.7 Euclid's Algorithm | 64 |
| 2.8 Raised Boolean Procedures | 68 |
| 2.9 Natural Numbers and Recursion | 71 |
| 3 Data Structures | 83 |
| 3.1 Modeling | 83 |
| 3.2 The Null Value | 84 |
| 3.3 Sum Types | 85 |
| 3.4 Pairs | 89 |

| | |
|--|------------|
| 3.5 Boxes | 95 |
| 3.6 Lists | 97 |
| 3.7 List Algorithms | 113 |
| 3.8 Sources | 130 |
| 3.9 Tuples | 143 |
| 3.10 Trees | 147 |
| 3.11 Bushes | 158 |
| 3.12 Bags | 164 |
| 3.13 Equivalence Relations | 173 |
| 3.14 Sets | 177 |
| 3.15 Tables | 189 |
| 3.16 Buffers | 196 |
| 4 Sorting | 203 |
| 4.1 Ordering Relations | 203 |
| 4.2 Sorting Algorithms | 212 |
| 4.3 Binary-Search Trees | 218 |
| 4.4 Red-Black Trees | 225 |
| 4.5 Heaps | 249 |
| 4.6 Order Statistics | 257 |
| 5 Combinatorial Constructions | 261 |
| 5.1 Cartesian Products | 261 |
| 5.2 List Selections | 270 |
| 5.3 Bag Selections | 284 |
| 5.4 Permutations | 286 |
| 5.5 Partitions | 291 |
| 6 Graphs | 297 |
| 6.1 Implementing Graphs | 297 |
| 6.2 Depth-First Traversal | 315 |
| 6.3 Paths | 320 |
| 6.4 Breadth-First Traversal | 323 |
| 6.5 Spanning Trees | 326 |
| 6.6 Shortest Paths | 331 |
| 6.7 Flow Networks | 339 |
| 7 Sublist Search | 347 |
| 7.1 The Simple, Slow Algorithm | 347 |

| | | |
|--------------|--|------------|
| 7.2 | The Knuth–Morris–Pratt Algorithm | 351 |
| 7.3 | The Boyer–Moore Algorithm | 360 |
| 7.4 | The Rabin–Karp Algorithm | 363 |
| A | Recommended Reading | 371 |
| B | The (<code>afp primitives</code>) Library | 373 |
| C | Using the AFP Libraries | 377 |
| Index | | 383 |