

Effective Python

90 Specific Ways to Write Better Python

SECOND EDITION



Contents

| Preface | | xvii |
|----------|-----------------------------------------------------------------------------|-------|
| Acknowl | edgments | xxi |
| About th | e Author | xxiii |
| Chapter | 1 Pythonic Thinking | 1 |
| Item 1: | Know Which Version of Python You're Using | 1 |
| Item 2: | Follow the PEP 8 Style Guide | 2 |
| Item 3: | Know the Differences Between bytes and str | 5 |
| Item 4: | Prefer Interpolated F-Strings Over C-style Format Strings and str.format | 11 |
| Item 5: | Write Helper Functions Instead of Complex Expressions | 21 |
| Item 6: | Prefer Multiple Assignment Unpacking Over Indexing | 24 |
| Item 7: | Prefer enumerate Over range | 28 |
| Item 8: | Use zip to Process Iterators in Parallel | 30 |
| Item 9: | Avoid else Blocks After for and while Loops | 32 |
| Item 10: | Prevent Repetition with Assignment Expressions | 35 |
| Chapter | 2 Lists and Dictionaries | 43 |
| Item 11: | Know How to Slice Sequences | 43 |
| Item 12: | Avoid Striding and Slicing in a Single Expression | 46 |
| Item 13: | Prefer Catch-All Unpacking Over Slicing | 48 |
| Item 14: | Sort by Complex Criteria Using the key Parameter | 52 |

xii Contents

| Item 15: | Be Cautious When Relying on dict Insertion Ordering | 58 |
|----------|---------------------------------------------------------------------------------|-----|
| Item 16: | Prefer get Over in and KeyError to | |
| | Handle Missing Dictionary Keys | 65 |
| Item 17: | Prefer defaultdict Over setdefault to Handle Missing Items in Internal State | 70 |
| Itom 19 | Know How to Construct Key-Dependent | 70 |
| item 18. | Default Values withmissing | 73 |
| Chapter | 3 Functions | 77 |
| Item 19: | Never Unpack More Than Three Variables | |
| | When Functions Return Multiple Values | 77 |
| Item 20: | Prefer Raising Exceptions to Returning None | 80 |
| Item 21: | Know How Closures Interact with Variable Scope | 83 |
| Item 22: | Reduce Visual Noise with Variable | |
| | Positional Arguments | 87 |
| Item 23: | Provide Optional Behavior with Keyword Arguments | 90 |
| Item 24: | Use None and Docstrings to Specify Dynamic Default Arguments | 94 |
| Item 25: | Enforce Clarity with Keyword-Only and | |
| | Positional-Only Arguments | 97 |
| Item 26: | Define Function Decorators with functools.wraps | 102 |
| Chapter | 4 Comprehensions and Generators | 107 |
| Item 27: | Use Comprehensions Instead of map and filter | 107 |
| Item 28: | Avoid More Than Two Control Subexpressions in Comprehensions | 109 |
| Item 29: | Avoid Repeated Work in Comprehensions by Using | |
| | Assignment Expressions | 111 |
| Item 30: | Consider Generators Instead of Returning Lists | 114 |
| Item 31: | Be Defensive When Iterating Over Arguments | 117 |
| Item 32: | Consider Generator Expressions for Large List Comprehensions | 122 |
| Item 33: | Compose Multiple Generators with yield from | 124 |
| | Avoid Injecting Data into Generators with send | 127 |
| | Avoid Causing State Transitions in Generators with throw | 133 |

| Con | tents xiii |
|--------------------------------------------------------------------------------------|------------|
| Item 36: Consider itertools for Working with Iterators and Generators | 138 |
| Chapter 5 Classes and Interfaces | 145 |
| Item 37: Compose Classes Instead of Nesting Many Levels of Built-in Types | 145 |
| Item 38: Accept Functions Instead of Classes for Simple Interfaces | 152 |
| Item 39: Use @classmethod Polymorphism to Construct Objects Generically | 155 |
| Item 40: Initialize Parent Classes with super | 160 |
| Item 41: Consider Composing Functionality with Mix-in Classes | 165 |
| Item 42: Prefer Public Attributes Over Private Ones | 170 |
| Item 43: Inherit from collections.abc for Custom Container Types | 175 |
| Chapter 6 Metaclasses and Attributes | 181 |
| Item 44: Use Plain Attributes Instead of Setter and Getter Methods | 181 |
| Item 45: Consider @property Instead of Refactoring Attributes | 186 |
| Item 46: Use Descriptors for Reusable @property Metho | ods 190 |
| Item 47: Usegetattr,getattribute, andsetattr for Lazy Attributes | 195 |
| Item 48: Validate Subclasses withinit_subclass | 201 |
| Item 49: Register Class Existence withinit_subclass | 208 |
| Item 50: Annotate Class Attributes withset_name | 214 |
| Item 51: Prefer Class Decorators Over Metaclasses for Composable Class Extensions | 218 |
| Chapter 7 Concurrency and Parallelism | 225 |
| Item 52: Use subprocess to Manage Child Processes | 226 |
| Item 53: Use Threads for Blocking I/O, Avoid for Paralle | elism 230 |
| Item 54: Use Lock to Prevent Data Races in Threads | 235 |
| Item 55: Use Queue to Coordinate Work Between Thread | ds 238 |
| Item 56: Know How to Recognize When Concurrency Is Necessary | 248 |

xiv Contents

| It | em 57 | Avoid Creating New Inread Instances for | |
|-----|--------|-------------------------------------------------------------------------------------|-----|
| | | On-demand Fan-out | 252 |
| It | em 58: | Understand How Using Queue for | |
| | | Concurrency Requires Refactoring | 257 |
| It | em 59: | Consider ThreadPoolExecutor When Threads | 004 |
| | | Are Necessary for Concurrency | 264 |
| | | Achieve Highly Concurrent I/O with Coroutines | 266 |
| | | Know How to Port Threaded I/O to asyncio | 271 |
| It | em 62: | Mix Threads and Coroutines to Ease the Transition to asyncio | 282 |
| It | em 63: | Avoid Blocking the asyncio Event Loop to Maximize Responsiveness | 289 |
| It | em 64: | Consider concurrent.futures for True Parallelism | 292 |
| Cha | apter | 8 Robustness and Performance | 299 |
| It | em 65: | Take Advantage of Each Block in try/except /else/finally | 299 |
| It | em 66: | Consider contextlib and with Statements for Reusable try/finally Behavior | 304 |
| It | em 67: | Use datetime Instead of time for Local Clocks | 308 |
| It | em 68: | Make pickle Reliable with copyreg | 312 |
| It | em 69: | Use decimal When Precision Is Paramount | 319 |
| It | em 70: | Profile Before Optimizing | 322 |
| It | em 71: | Prefer deque for Producer–Consumer Queues | 326 |
| It | em 72: | Consider Searching Sorted Sequences with bisect | 334 |
| It | em 73: | Know How to Use heapq for Priority Queues | 336 |
| It | em 74: | Consider memoryview and bytearray for | |
| | | Zero-Copy Interactions with bytes | 346 |
| Cha | apter | 9 Testing and Debugging | 353 |
| It | em 75: | Use repr Strings for Debugging Output | 354 |
| It | em 76: | Verify Related Behaviors in TestCase Subclasses | 357 |
| It | em 77: | Isolate Tests from Each Other with setUp, tearDown, setUpModule, and tearDownModule | 365 |
| It | em 78: | Use Mocks to Test Code with Complex Dependencies | 367 |
| | | | |

| Contents | xv |
|------------------------------------------------------------------------------|-----|
| Item 79: Encapsulate Dependencies to Facilitate Mocking and Testing | 375 |
| Item 80: Consider Interactive Debugging with pdb | 379 |
| Item 81: Use tracemalloc to Understand Memory Usage and Leaks | 384 |
| Chapter 10 Collaboration | 389 |
| Item 82: Know Where to Find Community-Built Modules | 389 |
| Item 83: Use Virtual Environments for Isolated and Reproducible Dependencies | 390 |
| Item 84: Write Docstrings for Every Function, Class, and Module | 396 |
| Item 85: Use Packages to Organize Modules and Provide Stable APIs | 401 |
| Item 86: Consider Module-Scoped Code to Configure Deployment Environments | 406 |
| Item 87: Define a Root Exception to Insulate Callers from APIs | 408 |
| Item 88: Know How to Break Circular Dependencies | 413 |
| Item 89: Consider warnings to Refactor and Migrate Usage | 418 |
| Item 90: Consider Static Analysis via typing to Obviate Bugs | 425 |
| Index | 435 |