Contents

Contents **5**

1 Object Oriented Programming **9**

1.1 Classes 10

1.2 Properties 12

1.3 Aggregation and Composition 15

1.4 Inheritance 15

1.5 Multiple Inheritance 17

1.6 Abstract Base Class 35

1.7 Class Diagrams 39

1.8 Hands-On Activities 43

2 Data Structures **45**

2.1 Array-Based Data Structures 47

2.2 Node-based Data Structures 76

2.3 Hands-On Activities 96

3 Functional Programming **101**

3.1 Python Functions 101

3.2 Decorators 123

3.3 Hands-On Activities 130

4 Meta Classes **135**

4.1 Creating classes dynamically 137

4.2 Metaclasses 140

4.3 Hands-On Activities 146

5 Exceptions **147**

5.1 Exception Types . . . 147

5.2 Raising exceptions . . . 150

5.3 Exception handling . . . 152

5.4 Creating customized exceptions . . . 156

5.5 Hands-On Activities . . . 160

6 Testing **163**

6.1 Unittest . . . 163

6.2 Pytest . . . 172

6.3 Hands-On Activities . . . 181

7 Threading **185**

7.1 Threading . . . 185

7.2 Synchronization . . . 197

7.3 Hands-On Activities . . . 207

8 Simulation **209**

8.1 Synchronous Simulation . . . 210

8.2 Discrete Event Simulation (DES) . . . 215

8.3 Hands-On Activities . . . 222

9 Handling Strings and Bytes **227**

9.1 Some Built-in Methods for Strings . . . 227

9.2 Bytes and I/O . . . 236

9.3 bytearrays . . . 239

9.4 Hands-On Activities . . . 240

10 I/O Files **245**

10.1 Context Manager . . . 248

10.2 Emulating files . . . 250

11 Serialization **253**

11.1 Serializing web objects with JSON . . . 257

11.2 Hands-On Activities . . . 261

12 Networking **263**

12.1 How to identify machines on internet . . . 263
12.2 Ports . . . 263
12.3 Sockets . . . 265
12.4 Client-Server Architecture . . . 266
12.5 Sending JSON data . . . 273
12.6 Sending data with `pickle` . . . 274
12.7 Hands-On Activities . . . 276

13 Web Services **277**

13.1 HTTP . . . 278
13.2 REST architecture . . . 279
13.3 Client-side Script . . . 280
13.4 Server-side Script . . . 281
13.5 Request . . . 284
13.6 Request Data . . . 285
13.7 Response . . . 287
13.8 Other architectures for Web Services . . . 289

14 Graphical User Interfaces **291**

14.1 PyQt . . . 291
14.2 Layouts . . . 300
14.3 Events and Signals . . . 303
14.4 Sender . . . 305
14.5 Creating Custom Signals . . . 306
14.6 Mouse and Keyboard Events . . . 308
14.7 QT Designer . . . 308

15 Solutions for Hands-On Activities **315**

15.1 Solution for activity 1.1: Variable stars . . . 316
15.2 Solution for activity 1.2: Geometric Shapes . . . 319
15.3 Solution for activity 2.1: Production line of bottles . . . 326
15.4 Solution for activity 2.2: Subway Map . . . 330
15.5 Solution for activity 3.1: Patients in a Hospital . . . 332

15.6 Solution for activity 3.2: Soccer Team 334
15.7 Solution for activity 3.3: Hamburger Store 337
15.8 Solution for activity 4.1: MetaRobot 341
15.9 Solution for activity 5.1: Calculator 343
15.10 Solution for activity 6.1: Testing the encryptor 347
15.11 Solution for activity 6.2: Testing ATMs 354
15.12 Solution for activity 7.1: Godzilla 357
15.13 Solution for activity 7.2: Mega Godzilla 360
15.14 Solution for activity 8.1: Client queues 364
15.15 Solution for activity 8.2: GoodZoo 368
15.16 Solution for activity 9.1: Fixing data 378
15.17 Solution for activity 9.2: Audio files 382
15.18 Solution for activity 11.1: Cashiers' data 383

Bibliography **389**