

INDEX

Numbers and Symbols

256 objects and 257 objects, 154–155
./, using with Ubuntu, 42
/? command line argument, 25–26
= assignment operator, 113
== comparison operator, 113, 336
 chaining, 103, 105
 using to compare objects, 154
 using with None, 94–95
!= comparison operator, 336
* and ** syntax
 using to create variadic functions,
 167–171
 using to create wrapper functions,
 171–172
 using with arguments and
 functions, 166–167
* character, using as wildcard, 28–29
? character, using as wildcard, 28–29
[:] syntax, using, 104
< comparison operator, 337
<= comparison operator, 337
> comparison operator, 337
>= comparison operator, 337
-> (arrow), using with type hints, 191
\
 purpose of, 18
 using with strings, 95
: (colon), using with lists, 97–98, 104
, (comma), including in single-item
 tuples, 150
- (dash), using with command line
 arguments, 25
\$ (dollar sign), using in macOS, 23
.
 (dot), using with commands, 31
-- (double dash), using with command
 line arguments, 25

__(double underscore), using in
 dunder methods, 322. *See also*
 underscore (_)
/ (forward slash)
 purpose of, 18
 using with command line
 arguments, 25
(hash mark)
 using with comments, 183
 using with docstrings, 188
[] (index operator), using, 117
; (semicolons), using with `timeit`
 module, 226–227
' (single quote), using, 46
~ (tilde), using in macOS, 23
- (unary operator), 155–157
+ (unary operator), 156–157
_
 (underscore)
 PEP 8's naming conventions,
 60–61
 as prefix for methods and
 attributes, 291–292
 private prefix, 81
 using with `_spaces` attribute, 290
 using with dunder methods, 120
 using with private attributes and
 methods, 283
 using with `WizCoin` class, 279

A

`abcTraceback.py` program, saving, 4
__abs__() numeric dunder
 method, 328
absolute versus relative paths, 20–21
__add__() numeric dunder method, 327
addTotal() function, creating,
 172–173

- algebra for big O, 236
- algorithm analysis. *See* big O algorithm
- aliases, defined, 121
- all() function, 157–158
- alphabetical sort, performing, 146–147
- ALT key. *See* keyboard shortcuts
- Amdahl’s Law, 229–230
- and operator, using, 103
- __and__() numeric dunder method, 328
- anonymous functions, 174–175
- answer archive, building with Stack Overflow, 12
- antigravity feature, enabling, 160
- API (application programming interface), 130
- API vs. library vs. framework vs. SDK vs. engine, 130
- append() method, using, 115
- applications, opening, 22
- arguments. *See also* positional arguments
 - vs. parameters, 128
 - passing to functions, 166–167
 - setting defaults for parameters, 142–143
- arrow (->), using with type hints, 191
- ASCII (American Standard Code for Information Interchange), 146
- ASCII art, using in Four-in-a-Row game, 272
- AsciiArt class, creating, 304–305
- assignment and comparison operators, chaining, 103, 105
- atoms and literals, 110
- attributes
 - as backing fields, 317–318
 - defined, 278, 282–284
 - vs. properties, 128–129
 - turning into properties, 316–319
 - vs. variable, 124

B

- backing field, relationship to attributes, 317–318
- backporting type hints, 196
- backslash (\)
 - purpose of, 18
 - using with strings, 95
- base class, relationship to inheritance, 296
- Bash file, 22–23
- BFG Repo-Cleaner tool, 220
- big O algorithm
 - algebra, 236
 - algorithm analysis, 230
 - analysis, 230
 - analysis examples, 239–242
 - analyzing, 243–244
 - best practice, 244
 - bookshelf metaphor for orders, 231–235
 - determining order for code, 237–244
 - doing analysis, 236
 - function calls, 242–243
 - lower and higher orders, 230–231
 - lower orders and coefficients, 238–239
 - math for analysis, 236
 - measuring worst-case scenario, 235
 - “n” is small, 244
 - order of function calls, 242–243
 - orders of notation, 245
- big Omega notation, 235
- big Theta notation, 235
- binary code, explained, 129
- Black code formatting tool
 - adjusting line length setting, 55
 - described, 45
 - disabling double-quoted strings setting, 55–56
 - disabling for parts of code, 57
 - installing, 54
 - previewing changes, 56–57
 - running from command line, 54–57
 - semantic decisions, 58
 - syntactic decisions, 58
- block vs. clause vs. body, 123–124
- __bool__() numeric dunder method, 328
- Boolean values, 158–159. *See also* values
- Bourne Shells, 22–23
- bugs, types of, 109, 150–151
- bytecode vs. machine code, 129

C

- C:\ part of path, 18
- c switch, using to run code from
 - command line, 26
- callable and first-class objects, 121–122
- camelCase, 60
- casing styles, 60
- Catalina version, 23
- cd (change directories) command,
 - 29–30
- `__ceil__()` numeric dunder
 - method, 328
- chaining operators, 103, 105, 159–160
- child class, creating, 294
- class attributes, 306
- class methods, 304–306
- class objects, 284
- classes. *See also* inheritance
 - creating, 77
 - creating objects from, 278
 - creating `WizCoin`, 279–284
 - defined, 276
 - designing for real world, 290–291
 - as functions or modules, 77
 - “is a” relationships, 299
- clause vs. block vs. body, 123–124
- CLI (command line interface), 22
- `close()` and `open()` functions, 93–94
- `cls` and `clear` (clear terminal)
 - commands, 35
- code. *See also* source code
 - avoiding guesses, 90
 - beauty of, 88
 - commented out, 74–75
 - flat vs. nested, 89
 - formatting for readability, 12–13
 - implementation, 90
 - interrupting, 134
 - namespaces, 91
 - organizing, 77
 - readability of, 89
 - running from command line, 26
 - silenced errors, 89–90
 - simplicity and complexity of, 89
 - sparse vs. dense, 89
 - special cases, 89
 - speed of, 90
 - verbose and explicit, 89
 - code formatting, defined, 45
 - code point, getting for characters,
 - 146–147
- code smells. *See also* source code
 - classes as functions or modules, 77
 - commented-out code, 74–75
 - dead code, 74–75
 - defined, 69
 - duplicate code, 70–71
 - empty except blocks, 79–80
 - error messages, 79–80
 - list comprehensions, 77–79
 - magic numbers, 71–73
 - myths, 80–84
 - print debugging, 75–76
 - summary, 84–85
 - variables with numeric suffixes, 76
- codetags and TODO comments, 187
- coercion, explained, 128
- collections module, contents of, 120
- `collections.defaultdict`, using for
 - default values, 99–100
- colon (:), using with lists, 97–98, 104
- comma (,), including in single-item
 - tuples, 150
- command history, viewing, 28
- command line
 - arguments, 24–26
 - options, 25
 - overview, 22–23, 42
 - running code with -c switch, 26
 - running programs from, 23–24
 - running `py.exe` program, 26–27
 - running Python programs
 - from, 26
 - tab completion, 27–28
 - terminal window, 23
- Command Prompt shell, 23
- commands
 - canceling, 28
 - cd (change directories), 29–30
 - `cls` and `clear` (clear terminal), 35
 - copy and cp (copy files), 31–32
 - del (delete files and folders), 33–34
 - dir (list folder contents), 30
 - dir /s (list subfolder contents), 31
 - find (list subfolder contents), 31
 - ls (list folder contents), 30

- commands (*continued*)
 - md and mkdir (make folders), 34
 - move and mv (move files), 32
 - mv (rename files and folders), 32–33
 - rd and rmdir (delete folders), 34–35
 - ren (rename files and folders), 32–33
 - rm (delete files and folders), 33–34
 - running from Python programs, 27
 - shortened names, 32
 - where (find programs), 35
 - which (find programs), 35
 - wildcard characters, 28–29
- commented-out code, 74–75
- comments
 - best practices, 197
 - myth about, 83–84
 - using, 182–188
 - using with type hints, 196
- commit history, rewriting in Git, 220
- commit log, viewing in Git, 216–217
- commits, rolling back in Git, 218–220
- comparing objects, 154–155
- comparison operators. *See also*
 - sequence comparisons
 - chaining with assignment operators, 103, 105
 - function form of, 333
- comparisons, making, 94–95
- `__complex__()` numeric dunder method, 328
- composition vs. inheritance, 299–301
- conditional expressions, ternary operator, 101–102
- containers, defined, 119–120
- Cookiecutter, using to create projects, 200–202
- copy and cp commands, 31
- `copy.copy()` and `copy.deepcopy()`, using with mutable values, 140–142
- copying
 - files and folders, 31
 - mutable values, 140–142
- cProfile profiler, 154, 228–230
- CPU, instruction set of, 129

- CPython implementation, 108
- CTRL key. *See* keyboard shortcuts
- cwd (current working directory), 19–20, 31

D

- dash (-) using with command line arguments, 25
- data, validating with setters, 319
- data types
 - defined, 276
 - and return values, 177–178
- dead code, 74–75
- `decimal.Decimal()`, passing integers to, 148–149
- decrement and increment operators, 156–157
- default arguments, setting for parameters, 142–143, 165–166
- default values, using collections
 - `.defaultdict` for, 99–100
- deleting
 - files and folders, 33–34
 - files from repo, 214–215
 - folders, 34–35
 - items from list, 134–140
 - and moving files in repo, 215–216
- derived class, relationship to inheritance, 296
- deterministic function, 173. *See also* functions
- dictionaries
 - `get()` and `setdefault()` methods, 104
 - key-value pairs, 118
 - Python mailing list discussion, 131
 - setting type hints for, 195–196
 - using, 98–101
 - using as default arguments, 143–144
- diff program, seeing changes with, 211–212
- dir command, using, 30
- dir /s command, 31
- displays and literals, 110
- `__divmod__()` numeric dunder method, 327
- docs* folder, contents of, 200

- docstrings
 - defined, 182
 - summary, 197
 - using, 188–190
- dollar sign (\$), using in macOS, 23
- doskey* program, 28
- dot (.), using with commands, 31
- double dash (--), using with command
 - line arguments, 25
- double-free bugs, 109
- double underscore (__), using in
 - dunder methods, 322. *See also* underscore (_)
- dunder methods. *See also* methods; OOP (object-oriented programming)
 - comparison, 332–337
 - defined, 120
 - numeric, 325–328
 - in-place augmented assignment, 330–332
 - reflected numeric, 328–330
 - string representation, 323–325
 - using, 322–323
- duplicate code, 70–71
- dynamic typing, 190

E

- Easter egg, *The Zen of Python* as, 88
- encapsulation, explained, 307–308
- encoding definition, using with magic
 - comment, 187–188
- engine vs. library vs. framework vs. SDK vs. API, 130
- enumerate() vs. range(), 92–93, 104
- environment setup, process of, 17, 42
- environment variables and PATH, 35–39
- __eq__() comparison dunder
 - method, 336
- E^Qual operation, 336
- equality (==) operator, using with
 - None, 94–95
- error codes, returning, 178–179
- error messages
 - and except blocks, 79–80
 - getting help with, 11
 - parsing, 15
 - tracing, 178
 - understanding, 4–8

- errors, preventing with linters, 8–9
- exceptions
 - catching, 79–80
 - raising, 4, 90, 178–179
 - RecursionError, 318–319
- explanatory comments, 184–185
- expressions vs. statements, 122–123

F

- False and True keywords, 158–159
- FAQs (Frequently Asked Questions), 10
- filenames, as command line
 - arguments, 25
- filenames and folders, matching with
 - wildcards, 28–29
- file paths, specifying, 20–21
- files
 - copying, 31
 - deleting, 33–34
 - moving, 32
 - renaming, 32–33
- filesystem, 18–21, 42
- filtering with list comprehensions, 175–176
- find command, 31
- find feature, accessing, 64, 67
- find() string method, error related
 - to, 178
- finding programs, 35
- first-class objects and callables, 121–122. *See also* objects
- flag arguments, myth about, 82
- __float__() numeric dunder
 - method, 328
- floating-point numbers, accuracy of, 147–149, 151
- __floor__() numeric dunder
 - method, 328
- __floordiv__() numeric dunder
 - method, 327
- folders
 - adding to PATH on macOS and Linux, 39
 - adding to PATH on Windows, 38–39
 - as command line arguments, 25
 - copying, 31
 - deleting, 33–34
 - in filesystem, 18

- folders (*continued*)
 - home directory, 19
 - listing contents of, 30
 - making, 34
 - moving, 32
 - renaming, 32–33
- folders and filenames, matching with wildcards, 28–29
- for expressions, including in list comprehension, 79
- for loops
 - in big O analysis, 240
 - getting index and value, 104
 - and lists, 134–140
 - versatility of, 125
- form, filling out, 276–278
- format() string method, 96–97
- formatting for readability, 58
- formatting strings, 96–97
- forward slash (/)
 - purpose of, 18
 - using with command line arguments, 25
- Four-in-a-Row tile-dropping game
 - output, 259–260
 - source code, 260–264
 - summary, 271–272
 - writing code, 264–271
- frame object, explained, 5
- frame summary, explained, 5
- framework vs. library vs. SDK vs. engine vs. API, 130
- f-strings, formatting strings with, 96–97
- functional programming
 - higher-order functions, 174
 - lambda functions, 174–175
 - list comprehensions, 175–176
 - mapping and filtering, 175–176
 - side effects, 172–174
- function calls, order in big O, 242–243
- functions. *See also* deterministic
 - function; higher-order functions; nondeterministic function; pure function; variadic functions; wrapper functions
 - default arguments, 165–166
 - vs. methods, 82, 124

- names, 162
- parameters and arguments, 165–172
- passing arguments to, 166–167
- and return statements, 80–81
- size trade-offs, 162–165
- and try statements, 81–82
- using default arguments with, 142–143

G

- garbage collection, 109, 226
- `__ge__()` comparison dunder method, 337
- `get()`, using with dictionaries, 98–101
- `getPlayerMove()` function, 163–165
- getters and setters, 315, 318
- Git. *See also* repo
 - adding files to track, 208–209
 - command line tool, 207
 - commits and repos, 200, 206–207
 - committed state, 204
 - committing changes, 210–214
 - configuring username and email, 203
 - deleting files from repo, 214–215
 - as distributed version control system, 206
 - frequency of committing changes, 213–214
 - ignoring files in repo, 209–210
 - installing, 202–204
 - keeping track of file status, 204–206
- log command, 216–217
 - modified state, 204
 - recovering old changes, 217–220
 - renaming and moving files in repo, 215–216
 - rewriting commit history, 220
 - running status with watch command, 207
 - staged state, 205–206
 - storing private information in, 220
 - viewing changes before committing, 211–212
 - viewing commit log, 216–217
 - workflow, 204–206

- git add command, 223
- git clone command, 223
- git commit command, 223
- git diff, using, 211–213
- git filter-branch command, 220
- git init command, 223
- GitHub and git push command, 221–223
- glob patterns, explained, 29
- global variables, myth about, 82–83
- glossary, accessing, 108, 131
- GrandchildClass, creating, 294–295
- Greater Than operation, 337
- Greater than or Equal operation, 337
- `__gt__()` comparison dunder method, 337
- GUI (graphical user interface), 22
- GUI Git tools, installing, 203–204

H

- hash mark (#)
 - using with comments, 183
 - using with docstrings, 188
- hashes, defined, 117–119
- `--help` command line argument, 25–26
- help with programming, asking for, 9–14
- higher-order functions, 174. *See also* functions
- home directory, 19
- Homebrew, installing and configuring, 213
- horizontal spacing, 47–51
- Hungarian notation, 63

I

- `id()` function, calling, 111, 154
- identifiers, defined, 59
- identities, defined, 111–114
- IEEE 754 standard and floating-point numbers, 147–148
- `if` statement as clause header, 124
- immutable and mutable objects, 114–117, 144
- `in` operator, using with values of variables, 105
- increment and decrement operators, 156–157

- indentation, using space characters
 - for, 47–48. *See also* significant indentation
- index operator (`[]`), using, 117–118
- `index()` string method, exception related to, 179
- indexes, defined, 117–119
- inequality `!=` operators, avoiding chaining, 149–150
- inheritance. *See also* classes; multiple inheritance; OOP (object-oriented programming)
 - base classes, 296
 - best practice, 308–309
 - class attributes, 306–307
 - class methods, 304–306
 - vs. composition, 299–301
 - creating child classes, 294
 - derived classes, 296
 - downside, 301–303
 - explained, 293
 - `isinstance()` and `issubclass()` functions, 303–304
 - MRO (method resolution order), 310–312
 - overriding methods, 296–297
 - static methods, 306–307
 - subclasses, 296
 - super classes, 296
 - `super()` function, 297–299
 - `__init__()`, and `self`, 280–282
 - `__init__.py` file and packages, 121
- inline comments, 183–184
- in-place augmented assignment dunder methods, 330–332
- installing
 - Black code formatting tool, 54
 - Git, 202–204
 - Homebrew, 213
 - Meld for Linux, 213
 - Mypy, 192–193
 - Pyflakes, 9
 - tkdiff, 213
- instances, defined, 111–114, 276. *See also* `isinstance()`
- instruction set, explained, 129
- `int()` function, using, 158

- `__int__()` numeric dunder method, 328
- integers, passing to `decimal.Decimal()`, 148–149.
- `__invert__()` numeric dunder method, 328
- “is a” relationships for classes, 299
- is operator, using, 113
- `isinstance()`. *See also* instances and `issubclass()` functions, 303–304, 312
- using with Boolean values, 158
- items
 - best practices for dealing with, 134–140
 - defined, 114
- iterable unpacking, using to swap variables, 227
- iterable vs. iterator, 125–126
- iterating
 - explained, 134
 - forward and backward, 139

J

- JDK (Java Development Kit), 130
- `join()` operator, using with strings, 151
- JVM (Java Virtual Machine), 129

K

- keyboard shortcuts
 - canceling commands, 28
 - find feature, 64, 67
 - interrupting code, 134
 - interrupting infinite loops, 134
 - opening applications, 22
 - opening terminal window, 23, 41
 - Task Manager, 22
 - viewing running processes, 22
- keys, defined, 117–119
- keywords
 - arguments, 167
 - defined, 110–111
 - True and False, 158–159
- Kompare, using, 213

L

- lambda functions, 174–175. *See also* functions

- `__le__()` comparison dunder method, 337
- legal comments, 186
- `len()` function, using, 92
- Less Than operation, 337
- Less than or Equal operation, 337
- “lessons learned” comments, 185–186
- library vs. framework vs. SDK vs. engine vs. API, 130. *See also* *Python Standard Library*
- LICENSE.txt file, 200
- links to URLs, including in comments, 183
- linters, preventing errors with, 8–9, 15
- Linux
 - installing Meld for, 213
 - running Python programs on, 41
- list comprehensions
 - and `all()` function, 157
 - mapping and filtering with, 175–176
 - using, 77–79, 137
- list concatenation, 115
- lists
 - adding or deleting items from, 134–140
 - best practices for dealing with, 134–140
 - contents of, 141–142
 - making shallow copies of, 97–98
 - setting type hints for, 195–196
 - using as default arguments, 143–144
- literals, defined, 109–110
- logfiles, setting up, 75–76
- logical error, defined, 127
- looping, explained, 134
- loops
 - interrupting, 134
 - moving duplicate code into, 71
- `ls` command, using, 30
- `__lshift__()` numeric dunder method, 328
- `__lt__()` comparison dunder method, 337

M

- machine code vs. bytecode, 129

- macOS
 - installing tkdiff, 213
 - running Python programs on, 41
- magic comments and source file
 - encoding, 187–188
- magic methods, defined, 120
- magic numbers, 71–73
- main() function, changing to override
 - methods, 296–297
- mapping. *See also* objects
 - defined, 119–120
 - and filtering with list
 - comprehensions, 175–176
- mapping data types, passing, 167
- math dunder methods, 325–328
- `__matmul__()` numeric dunder
 - method, 327
- max() and min() functions, 169
- MCR (minimum, complete,
 - reproducible) example, 11
- md and mkdir commands, 34
- Meld, installing for Linux, 213
- memory leaks, 109
- memory usage, 137–138
- metasyntactic variables, 60. *See also*
 - variables
- methods. *See also* dunder methods;
 - private attributes and private
 - methods
 - vs. functions, 82, 124
 - `__init__()`, and self, 280–282
 - overriding, 296–297
- min() and max() functions, 169
- `__mod__()` numeric dunder method, 327
- modules
 - defined, 120–121
 - finding, 14
 - and packages, 120–121
 - requests, 188–189
 - typing, 195–196
- move and mv (move files) commands, 32
- moving files and folders, 32
- MRO (method resolution order),
 - 310–312
- `__mul__()` numeric dunder
 - method, 327
- multiple assignment trick, using to
 - swap variables, 227

- multiple inheritance, 309–310. *See also*
 - inheritance
- mutable and immutable objects,
 - 114–117, 151
- mutable values
 - best practices for dealing with,
 - 142–144
 - copying, 140–144
 - and default arguments, 142–144
- Mypy, using, 192–194

N

- name length, considering, 61–64
- nameless functions, 174–175
- names.
 - advice about, 64–65
 - avoiding overwriting, 65–66
 - choosing, 67
 - making searchable, 64
 - prefixes in, 63–64
 - sequential numeric suffixes in, 64
- namespaces, 90–91
- `__ne__()` comparison dunder
 - method, 336
- `__neg__()` numeric dunder method, 328
- nested conditional expressions, 102
- nested loops, using in big O
 - analysis, 241
- next() function, calling, 126
- no operation, explained, 74
- nondeterministic function, 173. *See also*
 - functions
- None, using == (equality) operator with,
 - 94–95
- Not Equal operation, 336
- NotImplementedError, raising, 75
- numbers, magic, 71–73.
- numeric dunder methods, 325–328

O

- 0(1), Constant time, 231–232
- objects. *See also* mapping
 - and classes, 276
 - comparing, 154–155, 334
 - creating from classes, 278
 - defined, 111–114
 - mutable and immutable, 114–117
 - sorting, 336

- $O(\log n)$, Logarithmic, 232
- $O(n!)$, Factorial Time, 234–235
- $O(n)$, Linear Time, 232
- $O(n \log n)$, N-Log-N Time, 232–233
- $O(n^2)$, Polynomial Time, 233
- $O(n!)$, Exponential Time, 233–234
- OOP (object-oriented programming).
 - See also* dunder methods;
 - inheritance
 - creating objects from classes, 278
 - defined, 275
 - designing classes, 290–291
 - encapsulation, 307–308
 - filling out form, 276–278
 - and non-OOP examples, 285–290
 - polymorphism, 308
 - properties, 316–322
 - summary, 292
 - tic-tac-toe, 285–290
 - type() function and `__qualname__` attribute, 284–285
 - using class and static features, 307
 - WizCoin class, 279–284
- open()
 - and `close()` functions, 93–94
 - and `readlines()` functions, 126
- operator module, 333, 336–337
- operators, chaining, 103, 105, 151, 159–160
- optimizations
 - preallocated integers, 154
 - string interning, 155
- `__or__()` numeric dunder method, 328
- ordinal, getting for characters, 146–147
- `os.chdir()`, using, 20

P

- packages
 - defined, 120–121
 - and modules, 120–121
- parameters vs. arguments, 128
- ParentClass, creating, 294–295
- PascalCase, 60
- pass statement
 - relationship to stubs, 74–75
 - using with `except` block, 79–80
- PATH and environment variables, 35–39
- pathlib module, importing, 18–19

- paths, specifying, 18–21
- p-code, explained, 129
- PEP (Python Enhancement Proposal) 8
 - documentation, 67
 - naming conventions, 61
 - and style guides, 46–47
- Perl programming language, 90
- pip list, running, 14
- polymorphism, explained, 308
- portable code, explained, 129
- porting vs. backporting, 196
- `__pos__()` numeric dunder method, 328
- positional arguments, defined, 166–167.
 - See also* arguments
- `__pow__()` numeric dunder method, 328
- practice projects. *See also* projects
 - Four-in-a-Row, 259–271
 - The Tower of Hanoi, 248–259
- preallocated integers, 154.
- premature optimization, 226
- print debugging, 75–76
- print() function
 - arguments for, 168
 - passing list to, 166
 - using with wrapper functions, 171
- private attributes and private methods, 282–284. *See also* methods
- processes and programs, 21–22
- professional comments, 186
- profiling, explained, 228
- program vs. script, 129–130
- programming help, asking for, 9–14
- programming language vs. scripting language, 129–130
- programs. *See also* Python programs
 - finding, 35
 - and processes, 21–22
 - running from command line, 23–24, 26
 - running without command line, 39–42
 - vs. scripts, 129–130
- project folder, contents of, 200
- projects, creating with Cookiecutter, 200–202. *See also* practice projects

- properties
 - vs. attributes, 128–129
 - best practices, 322
 - read-only, 320–321
 - turning attributes into, 316–319
 - using, 316
- public access attributes and methods, 283
- pure function, 173–174. *See also*
 - functions
- push* command, using in Git, 221–223
- .py* source code files, locating, 200
- .pyc* files, bytecode in, 129
- py.exe* program, running, 26–27
- Pyflakes, installing, 9
- PyPy just-in-time compiler, 108
- Python
 - documentation, 121
 - error messages, 4–8
 - glossary, 108, 131
 - language and interpreter, 108–109
 - programming language, 109
- Python programs, running without
 - command line, 39–42. *See also*
 - programs; *The Zen of Python*
- Python Standard Library, 120–121. *See also*
 - library vs. framework vs. SDK vs. engine vs. API
- pythonic code, core of, 104

Q

- `__qualname__` attribute and `type()`
 - function, 284–285
- questions, asking, 10–11, 14–15

R

- `__radd__()` reflected numeric dunder
 - method, 330
- raising exceptions, 90, 178–179
- `__rand__()` reflected numeric dunder
 - method, 330
- `range()` vs. `enumerate()`, 92–93, 103–104
- `rd` and `rmdir` commands, 34–35
- `__rdivmod__()` reflected numeric
 - dunder method, 330
- `readlines()` and `open()` functions,
 - using, 126
- README* files, 200, 211–212,
 - 215–216, 218
- read-only properties, 320–321
- `RecursionError` exception, raising,
 - 318–319
- references, explained, 137–138
- reflected numeric dunder methods,
 - 328–330
- relative vs. absolute paths, 20–21
- renaming files and folders, 32–33
- repo. *See also* Git
 - cloning for GitHub repo, 222–223
 - creating, 223
 - creating on computer, 206–207
 - deleting and moving files in,
 - 215–216
 - deleting files from, 214–215
 - ignoring files in, 209–210
 - and version control systems, 200
- `__repr__()` method, using, 325
- `repr` string, sensitive information
 - in, 325
- requests module, *sessions.py* file,
 - 188–189
- return values and data types, 177–178.
 - See also* values
- `__rfloordiv__()` reflected numeric
 - dunder method, 330
- `__rlshift__()` reflected numeric
 - dunder method, 330
- `rm` (removing files and folders)
 - command, 33–34
- `__rmatmul__()` reflected numeric
 - dunder method, 330
- `__rmod__()` reflected numeric dunder
 - method, 330
- `__rmul__()` reflected numeric dunder
 - method, 330
- roll back, performing in Git, 217–220
- root folder, explained, 18
- `__ror__()` reflected numeric dunder
 - method, 330
- `__round__()` numeric dunder
 - method, 328
- `__rpow__()` reflected numeric dunder
 - method, 330
- `__rrshift__()` reflected numeric
 - dunder method, 330
- `__rshift__()` numeric dunder
 - method, 328

`__rsub__()` reflected numeric dunder method, 330
`__rtruediv__()` reflected numeric dunder method, 330
running processes, viewing, 22
runtime
 defined, 226
 quickening for functions, 173
 vs. syntax vs. semantic errors, 126–127
`__rxor__()` reflected numeric dunder method, 330

S

%s conversion specifiers, using, 96–97
script vs. program, 129–130
scripting language vs. programming language, 129–130
SDK vs. library vs. framework vs. engine vs. API, 130
`self` and `__init__()`, 280–282
semantic vs. syntax vs. runtime errors, 126–127
semicolons (;), using with `timeit` module, 227
sensitive information in repr strings, 325
sequence comparisons, 335–336. *See also* comparison operators
sequences
 defined, 119–120
 and iterables, 125
`sessions.py` file in `requests` module, 188–189
set types, defined, 119–120
`setdefault()`, using with dictionaries, 98–100
setters
 and getters, 315, 318
 using to validate data, 319–320
sh file, 22–23
shell programs, 22–23
side effects, 172–174
significant indentation, 91–92, 104. *See also* indentation
single quote ('), using, 46
slice syntax, explained, 97
`snake_case`, 60
snapshots, saving with Git, 200

software license, file for, 200
`sort()` function, behavior of, 146–147, 151, 332, 336
source code, avoiding dropping letters from, 62. *See also* code; code smells
source file encoding and magic comments, 187–188
space characters, rendering on screen, 47
spacing within lines, 48–51
Stack Overflow, building answer archive, 12
stack trace, 4–7
staged files
 committing, 211
 unstaging in Git, 218
statements vs. expressions, 122–123
static analysis, explained, 8, 192–194
static methods, 306–307
string concatenation, 144–146, 151
string interning, 155–156
strings
 formatting, 95–97
 as immutable objects, 144
 immutable quality of, 116
 interpolating, 104
stubs, relationship to code smells, 74
style guides and PEP (Python Enhancement Proposal) 8, 46–47
`__sub__()` numeric dunder method, 327
subclass, relationship to inheritance, 296. *See also* `isinstance()`
subfolders, listing contents of, 31
Sublime Text editor, 193
`subprocess.run()` function, 27
`subtract()` function, creating, 172
`sum()` function, 168
summary comments, 185
super class, relationship to inheritance, 296
`super()` function, relationship to overriding method, 297–299
switch statement vs. dictionaries, 100–101
syntax
 catching errors, 6

- misuse of, 92–95
- vs. runtime vs. semantic errors, 58, 126–127

`sys.getsizeof()` function, 137–138

system environment variables, 38

T

tab completion, 27–28

Task Manager, opening, 22

terminal window

- clearing, 35
- opening, 23, 41

ternary operator, 101–102

`tests` folder, contents of, 200

text editor, Sublime Text, 193

tic-tac-toe program

- creating, 285–290
- MRO (method resolution order), 311–312

tilde (~), using in macOS, 23

`timeit` module, using to measure performance, 226–228. *See also* modules

`time.time()` function, 72, 227

`tkdiff`, installing on macOS, 213

TODO comments and codetags, 187

The Tower of Hanoi puzzle

- `getPlayerMove()` function, 163, 165, 254–257, 268
- output, 249–250
- restrictions, 248
- source code, 250–252
- summary, 271–272
- writing code, 252–259

tracebacks, examining, 4–7

True and False keywords, 158–159

`__truediv__()` numeric dunder method, 327

`__trunc__()` numeric dunder method, 328

tuples

- identities, 119
- immutable quality of, 116–117
- using commas with, 150
- values of, 116

type coercion vs. type casting, 128

`type()` function and `__qualname__` attribute, 284–285

type hints, 182, 190–196

types, defined, 276

typing, minimizing with tab completion, 27–28

typing module, 195–196

U

Ubuntu Linux, running Python programs on, 41–42

underscore (`_`). *See also* double underscore (`__`)

- PEP 8’s naming conventions, 60–61
- as prefix for methods and attributes, 291–292
- private prefix, 81

using with `_spaces` attribute, 290

- using with dunder methods, 120
- using with private attributes and methods, 283
- using with `WizCoin` class, 279

undo features, 199, 217–220

Unicode resource, 188

unit tests, folder for, 200

Unix operating system, shell programs, 22–23

URL links, including in comments, 183

user environment variables, 38

UTF-8 encoding, 187–188

V

validating data using setters, 319–320

values. *See also* Boolean values; return values and data types

- defined, 111–114
- modifying in place, 115

variable names, 64, 66. *See also* names

variable values, 103–104

variables. *See also* metasyntactic variables

- vs. attributes, 124
- box vs. label metaphor, 112–113
- checking values, 103–104
- with numeric suffixes, 76
- swapping, 227

variadic functions, creating, 167–171. *See also* functions

version control systems, 199–200

vertical spacing, 51–53

volumes, explained, 18

W

- watch command, using with Git, 207
- webbrowser module, 160
- where command, 35
- which command, 35
- while keyword, 110
- while loops
 - in big O analysis, 241
 - and lists, 134–140
- wildcard characters, 28–29
- Windows, running Python programs
 - on, 40–41
- WinMerge, downloading, 212–213
- with statement, 93–94
- WizCoin class, creating, 279–284

- worst-case scenario, measuring with
 - Big O, 235
- wrapper functions, creating, 171–172.
 - See also* functions

X

- XOR algorithm, using, 226–227
- `__xor__()` numeric dunder method, 328

Z

- Zakharenko, Nina, 131
- The Zen of Python*, 88–91. *See also*
 - programs; Python programs
- zero-based indexing, using, 117
- Zsh and Z shells, 23