

# Index

## • *Symbols and Numerics* •

- (minus sign), 97, 98, 103
- != (not equal) operator, 98, 103
- # (number sign), 74, 76
- % operator, 98, 103
- %= operator, 101, 103
- & operator, 100, 103
- () parentheses, 103, 106, 246
- \* (asterisk)
  - multiplication operator, 98, 103, 236
  - variable argument lists, 111, 281
- \*\* operator, 98, 103
- \*\*= operator, 101, 103
- \*= operator, 101, 103
- / (forward slash), 98, 103, 295
- // operator, 98
- /= operator, 101, 103
- //= operator, 101, 103
- : (colon), 106, 118, 125, 219
- [ ] square brackets, 211, 226, 229
- \ (backslash), 209–210, 295
- ^ operator, 100, 103
- { } curly brackets, 219
- | operator, 100
- ~ operator, 97, 100, 103
- + (plus sign)
  - addition operator, 98
  - concatenation using, 212, 236
  - operator precedence, 103
  - overloading, 283–284
  - as unary operator, 97
  - using indentation with, 72
  - using with tuples, 247
- += operator, 101, 103
- < (less-than) operator, 99, 103

- << operator, 100, 103
- <= (less-than or equal) operator, 99, 103
- = (assignment) operator, 85, 101, 103
- = operator, 101, 103
- == (equality) operator, 98, 103, 118
- > (greater-than) operator, 98, 103
- >= (greater-than or equal) operator, 99, 103
- >> operator, 100, 103
- " (double quotes), 74, 207, 209
- ' (single quote), 207, 209
- 3ds Max, 342

## • *A* •

- \a escape sequence, 210
- Abaqus, 342
- absolute paths, 295
- accented characters, 209
- accessors, 285
- action warning level, 43
- Add to Path option, 26
- \_\_add\_\_() function, 246, 247, 283
- Additional Help Sources feature, IDLE, 66
- aggdraw library, 333
- AIX (Advanced IBM Unix), 21
- Alice Educational Software, 17
- alignment, string, 220
- American Standard Code for Information Interchange (ASCII), 206, 210
- Amiga Research OS (AROS), 21
- and operator, 99, 103
- append() function, 193, 232, 257, 264, 305
- appendleft() function, 264
- Apple Siri, 7

- Application System 400 (AS/400), 22
  - applications
    - commands in, 68–69
    - commercial, written in Python, 18
    - compile time errors, 152
    - creating in Edit window, 67–68
    - CRUD and, 39
    - debugging, 353
    - decision-making and, 117
    - defined, 9
    - designing, 13–14
    - installing using PyInstaller, 350–351
    - loading in Edit window, 79
    - multithreaded, 261
    - overview, 12
    - procedures and, 10
    - purpose of, 13
    - quitting, 237
    - README files, 40
    - running from command line, 78
    - running from IDLE, 71–72, 79–80
    - runtime errors, 152
    - saving files for, 69–70
    - usage types, 16–17
  - apt-get command, 30–31
  - ArcGIS, 344
  - \*args argument list, 281
  - arguments, command-line, 42
  - arguments, exception
    - listing, 163–164
    - overview, 161–163
  - arguments, function
    - accessing using keywords, 110
    - default values for, 110–111
    - overview, 108
    - positional, 110
    - required, 108–110
    - variable number of, 111–112
  - arguments, method, 281–282
  - arithmetic operators
    - listing of, 97–98
    - precedence, 103
  - ArithmeticError exception, 167, 169
  - AROS (Amiga Research OS), 21
  - as clause, 162
  - as\_string() function, 320
  - AS/400 (Application System 400), 22
  - ASCII (American Standard Code for Information Interchange), 206, 210
  - ASP.NET, 336
  - assignment operators
    - assigning value to variable, 85
    - listing of, 101
    - precedence, 103
  - asterisk ( \* )
    - multiplication operator, 98, 103, 236
    - variable argument lists, 111, 281
  - attributes, module, 184, 193–197
  - audio, 360–361
- B •**
- backslash ( \ ), 209–210, 295
  - backspace character, 210
  - Base 2, 86
  - Base 8, 86
  - Base 10, 86
  - Base 16, 86
  - b command, 199
  - \b escape sequence, 210
  - b option, 42
  - bb option, 42
  - B option, 42, 44
  - BeOS, 22
  - bin() function, 86
  - binary codes, 12
  - binary operators, 96, 103
  - Binary to Decimal to Hexadecimal Converter, 100
  - BitBucket, 348
  - bitwise operators, 99–100, 103
  - Blender, 342
  - blue text in IDLE, 61
  - bool() function, 306

- Boolean type, 89–90
- break statements
  - overview, 136–138
  - for while statements, 144
- bugs
  - defined, 150
  - tracking sites for, 348
  - using virtual environments, 349
- `__builtins__` attribute, 194
- byte code, 353
- byte type, 42, 45
- bytearray type, 42
- c option, 43
  
- C •
- C#
  - job opportunities and, 15
  - Python versus, 19
  - user interfaces, 17
- `__cached__` attribute, 194
- caller, 105, 175–176
- capitalization, 154, 171
- `capitalize()` function, 213
- car security systems, 345
- Carnegie Mellon University, 17
- carriage return character, 210
- Cascading Style Sheets (CSS), 336
- CASE (Computer Aided Software Engineering), 17
- case sensitivity, 154
- catching exceptions. *See* exceptions, handling
- category warning level, 43
- C/C++, 15, 340
- celementree library, 333
- `center()` function, 213, 216
- CentOS, 29
- CGI (Common Gateway Interface), 332
- characters
  - ASCII, 206–207
  - creating strings from, 207–208
  - escape sequences, 209–210
  - selecting individual in string, 211–213
  - sets of, 207
  - special, 208–211
- child classes, 287
- Cinema 4D, 342
- `__class__` attribute, 271
- classes
  - built-in attributes, 271–272
  - class suite, 270
  - constructors, 275–277
  - creating, 269–271
  - creating external, 284–285
  - explained, 268–269
  - extending, 287–290
  - importance of application organization, 267
  - importing module for, 286
  - inheritance, 287
  - method arguments, 281–282
  - methods, 273–275
  - overloading operators, 282–284
  - using external, 285–287
  - variables, 277–280
- `clear()` function, 232, 234, 241, 253
- client (web) applications, 332
- CMS (Content Management System), 332
- code
  - blocks of, 120–121
  - cleaning using `Isort`, 355
  - color coding, 61, 63–64
  - commenting out, 75–77
  - comments in, 74–75
  - common mistakes, 336–337
  - grouping into collections, 184–185
  - highlighting, 63–64
  - indentation, 72–73
  - inspecting, 43
  - introspection, 331
  - optimizing, 43
  - readability, 1, 15
  - reusability, 104–105

- code (*continued*)
  - runnable, 184
  - spaghetti code, 267
  - understandable, 93
  - using Edit window, 67–68
  - version control, 355–356
- collections, 241, 243–244
- colon (:), 106, 118, 125, 219
- color coding, 61, 63–64
- Comma Separated Values (CSV), 297
- command-line Python. *See also* IDLE
  - accessing from command prompt, 34–35
  - advantages of, 40
  - arguments, 42
  - close button of terminal, 55
  - commands in, 46
  - Enter key in, 46
  - environment variables and, 44–45
  - exiting, 54–56
  - help mode, 48–49
  - IDLE versus, 58
  - options for, 42–44
  - running applications, 78
  - starting, 41
  - viewing result in, 46–47
- comments
  - commenting out code, 75–77
  - multiline, 74–75
  - single-line, 74
  - uses for, 75
- Common Gateway Interface (CGI), 332
- communication
  - applications and, 9, 13
  - computers and, 7–8
  - exceptions and, 150–151
- comparisons
  - function output, 114
  - if statements, 121–123
  - overview, 94–95
  - precedence, 103
- compile time errors, 152, 154
- complex numbers, 88
- Computer Aided Software Engineering (CASE), 17
- computers
  - characters and, 206–207
  - communication with, 7–8
  - comparisons and, 95
  - CRUD, 39
  - data storage, 84
  - exceptions, 150–151
  - lists and, 225–226
  - preciseness of, 11
  - procedures, 10–11
  - programming languages, 12
  - purpose of applications, 9
  - strings and, 205
- concatenation
  - creating lists using, 236
  - defined, 72
  - using + operator, 212
  - using with tuples, 247
- conditions for if statements, 118
- configuration
  - environment variables, 44–45
  - IDLE, 63–66
- console library, 333
- constants, 193
- constructors, 275–277
- Content Management System (CMS), 332
- Content-Type header, 320
- Context-Transfer-Encoding
  - header, 320
- continue statements
  - overview, 138–139
  - pass clause versus, 140
  - for while statements, 144
- control characters, 208–209, 296
- control statements
  - if statements, 118–123
  - if...elif statements, 125–128
  - if...else statements, 124–125
  - nesting, 129–132
  - switch statement and, 128

- copy() function, 232, 234
- copyright() function, 48
- copyright messages, 43
- count() function, 217, 218, 244
- Counter object, 240–242
- Create, Read, Update, Delete.
  - See CRUD
- credits() command, 48–49
- cross-platform support, 19, 21–22
- CRUD (Create, Read, Update, Delete)
  - applications and, 83
  - defined, 39
  - file storage, 293–294
  - for lists, 232
- CSS (Cascading Style Sheets), 336
- CSV (Comma Separated Values), 297
- curly brackets {}, 219
- current directory, 191
- d option, 43, 44
- D •
- data analysis, real-time, 346
- data integrity, 294
- data mining, 344–345
- data storage
  - assigning values, 85
  - creating files, 298–301
  - deleting files, 308
  - file storage, 294–295
  - purpose of, 83
  - reading files, 301–303
  - structure of content, 295–298
  - variables, 84
  - writing data to files, 303–307
- data types
  - Boolean, 89–90
  - complex numbers, 88
  - dates and times, 91–92
  - defined, 85
  - determining for variable, 90
  - floating-point values, 87–88
  - integers, 86–87
  - numeric types, 89
  - strings, 90–91
- Database Administrator (DBA), 358
- Database Management Systems (DBMSs), 332, 349, 358
- databases, 16, 358–359
- Datalist argument, 299
- DataReader class, 302
- DataWriter class, 299–300
- dates and times, 45, 91–92
- day value, 92
- DBA (Database Administrator), 358
- DBMSs (Database Management Systems), 332, 349, 358
- debugging
  - defined, 150
  - starting debugger, 43
  - using pydbgr, 353
- decryption, 358
- default values for arguments, 110–111
- del command, 253
- deleting files, 308
- delimiters, 214, 296
- deque type
  - defined, 244
  - sequence types, 224
  - using, 263–265
- development tools, 18
- dictionaries
  - creating, 249
  - defined, 244
  - overview, 248–249
  - sequence types, 224
  - as switch statement, 253–256
  - using, 250–253
- dir() function, 164, 193, 228, 271
- directories, 294
- division operator (/), 98, 103
- doc() function, 198
- \_\_doc\_\_ attribute, 194

- documentation
    - accessing from IDLE, 62–63
    - in comments, 75
    - creating using pdoc, 351–352
    - online, 330
    - opening pydoc application, 198–200
    - quick-access links, 200–201
    - searching, 202–204
  - .docx files, 296
  - double quotes ( " ), 74, 207, 209
  - downloading Python, 22–23
  - drawing characters, 209
  - dynamic systems, 88
  - E option, 43
- **E** ●
- Edit window, IDLE, 67–68, 79
  - effbot library, 333
  - elementsoap library, 333
  - elementtidy library, 333
  - elementtree library, 333
  - elif clause, 125–126, 237
  - else clause
    - for if statements, 124–125
    - for loops, 141–142
    - try block and, 157
    - for while statements, 144
  - email
    - creating HTML message, 324–325
    - creating text message, 323–324
    - envelope analogy, 312–313
    - host address, 313–314
    - hostname, 317–318
    - HowStuffWorks article, 310
    - letter analogy, 311–312, 318–319
    - MIME types, 319–321
    - ports, 312, 314–316
    - sending transmission, 321–322
    - SMTP, 309–310
    - subtypes, 322
    - viewing output, 325–326
  - email.mime module, 319
  - Embedded Python, 345
  - empty() function, 261
  - encryption, 358
  - endless loops, 143
  - endswith() function, 217
  - engineering applications, 16, 88
  - Enter key, 46
  - enumerate() function, 281
  - envelope analogy, 311, 312–313
  - environment variables
    - ERRORLEVEL environment variable, 54
    - ignoring, 43
    - PATH environment variable, 26, 34–35
    - Python configuration, 35, 44–45, 191
  - equality ( == ) operator, 98, 103, 118
  - errno argument, 162
  - ERRORLEVEL environment variable, 54
  - errors. *See also* exceptions; exceptions, handling
    - compile time, 152
    - handling, 149
    - logical, 154–155
    - runtime, 152–153
    - semantic, 154
    - syntactical, 154
    - types of, 153
  - escape sequences, 209–210
  - ETags, 364
  - eval command, 353
  - except clause
    - combining specific clauses with generic, 167–170
    - defined, 157
    - listing exception arguments, 164
    - multiple clauses, 165–167
    - single clause, 164–165
    - using, 158–161
  - Exception exception, 155
  - exceptions. *See also* errors
    - arguments for, 161–163
    - built-in, 155

- custom, 176–178
- defined, 122, 149
- listing arguments, 163–164
- online resources, 331
- raising, 174–175
- exceptions, handling
  - except clause, 158–161
  - finally clause, 178–180
  - length checking, 137
  - multiple exceptions, 164–167
  - nesting, 170–173
  - passing error information to caller, 175–176
  - raising exceptions, 174–175
  - range checking, 123
  - single exception, 156–158
  - specific and unknown exceptions, 167–170
- exec() command, 79
- exemaker library, 333
- exit() command, 54–56
- expandtabs() function, 213
- exponents, 87, 89
- expressions, 95, 113
- extend() function, 232, 264
- extending classes, 287–290
- extendleft() function, 264
- Extensible Markup Language (XML), 16, 296, 335–336
- extensions, file, 294
- **F** ●
  - \f escape sequence, 210
  - features, 13, 58
  - Fedora Core, 29
  - Fermilab, 17
  - fields, database, 359
  - FIFO (first in/first out), 244
  - file storage
    - creating files, 298–301
    - deleting files, 308
    - overview, 294–295
    - reading files, 301–303
    - structure of content, 295–298
    - supported file types, 299
    - writing data to files, 303–307
  - \_\_file\_\_ attribute, 194
  - FileNotFoundError exception, 155
  - fill character, 220
  - finally clause
    - exceptions and, 150
    - overview, 178–180
  - find() function, 217, 218
  - first in/first out (FIFO), 244
  - float() function, 90
  - float type, 87
  - floating-point values
    - formatting strings, 221
    - overview, 87–88
    - reasons for multiple numeric types, 89
  - flow control. *See* control statements
  - fluid dynamics, 88
  - flushing data, 300
  - folders, 294
  - Fonts/Tabs tab, IDLE, 63–64
  - for loops
    - break statements, 136–138
    - continue statements, 138–139
    - creating, 135
    - deque type and, 264
    - else clause, 141–142
    - nesting, 145–147
    - pass clause, 140–141
    - for statement, 134
    - using with lists, 231
    - while statement versus, 144
  - format() function, 219–221
  - formfeed character, 210
  - forward slash (/), 98, 103, 295
  - freezing applications, 152, 261
  - from...import statements, 188–191
  - ftpparse library, 333
  - full() function, 261

function arguments  
 default values, 110–111  
 overview, 108  
 required, 108–110  
 using keywords, 110  
 variable number of, 111–112

functions  
 calling, 107–108  
 code reusability and, 104–105  
 comparing output from, 114  
 defined, 104  
 defining, 105–107  
 overloading, 268  
 partial, 331  
 purpose of, 104  
 returning data from, 112–113  
 user input, 114–116  
 FUNCTIONS topic, 50

## • G •

GCC (GNU Compiler Collection), 28  
 General tab, IDLE, 65–66  
 generators, 331  
 geocoding, 359  
 Geographic Information System (GIS),  
 344, 359  
 get() function, 241, 261  
 getaddrinfo() function, 315  
 \_\_getattr\_\_() function, 164  
 gethostbyaddr() function, 313, 317  
 gethostbyname() function, 313, 317  
 gethostname() function, 317  
 getserverbyport() function, 316  
 getters/setters, 285, 297  
 GIMP, 342  
 GIS (Geographic Information System),  
 344, 359  
 Github, 348  
 GNU Compiler Collection (GCC), 28  
 Go.com, 17  
 Google, 17

Google App Engine, 342  
 Google Code, 348  
 Google Maps, 359  
 grabscreen library, 333  
 Graphic User Interface (GUI), 17,  
 359–360  
 graphs, 361–362  
 greater-than (>) operator, 98, 103  
 greater-than or equal (>=) operator,  
 99, 103  
 green text in IDLE, 61  
 GUI (Graphic User Interface), 17, 359–360  
 -h option, 43

## • H •

handling exceptions. *See* exceptions,  
 handling  
 headers, email, 311  
 help  
 Additional Help Sources feature, 66  
 command for, 48–49, 53–54  
 displaying, 43  
 help mode, 48–49, 50–52  
 in IDLE, 62–63  
 for specific commands or topics,  
 52–54  
 Hewlett-Packard Unix (HP-UX), 22  
 hex() function, 86  
 hexadecimal values, 86, 210  
 hierarchy of tuples, 247–248  
 highlighting code, 63–64, 334–335  
 horizontal tab character, 210  
 host address, 313–314  
 hostname, 317–318  
 Houdini, 342  
 hour value, 92  
 HP-UX (Hewlett-Packard Unix), 22  
 HTML (Hypertext Markup Language),  
 324–325, 336  
 -i option, 43, 45



- IDE (Integrated Development Environment), 45, 334, 352
- identity operators, 102, 103
- IDLE (Interactive Development Environment). *See also* command-line Python
  - accessing on Mac, 36
  - accessing on Windows, 32–33
  - color coding in, 37, 61, 63–64
  - command-line Python versus, 58
  - commands in, 60
  - comments in, 74–77
  - configuration, 63–66
  - Edit window, 67–68
  - exiting, 80
  - feature overview, 58
  - help in, 62–63
  - indentation in, 72–73
  - overview, 58
  - Python versions and, 29
  - running applications from, 71–72, 79–80
  - saving files, 69–70
  - shortcut keys, 65
  - starting, 59
  - testing installation, 36–37
- IETF (Internet Engineering Task Force), 349
- if statements
  - code blocks for, 120–121
  - if...elif statements, 125–128
  - if...else statements, 124–125
  - multiple comparisons for, 121–123
  - nesting, 129–132
  - overview, 118
  - using relational operators, 119–120
- IIS (Internet Information Server), 342
- imaging library, 333
- immutable types, 245
- import statements
  - ignoring case in, 44
  - importing entire module, 187–188
  - importing only needed attributes, 188–191
  - overview, 183, 185–186
  - using, 162
- in operator, 102, 103, 236
- indentation, 63, 72–73
- index
  - for dictionaries, 250
  - for lists, 229
  - for lists, negative, 230
  - for tuples, 247
- index() function, 217, 244, 306
- Industrial Light & Magic, 17
- inheritance, 268, 287
- \_\_init\_\_() constructor function, 275–276
- initializing values, 275
- \_\_initializing\_\_ attribute, 194
- Inkscape, 342
- input() function, 114–115
- insert() function, 232, 233
- insertion pointer, 208–209
- inspecting code, 43
- installing applications, 350–351
- installing Python
  - on Linux, 30–32
  - on Mac, 27–29
  - testing installation, 36–38
  - on Windows, 25–27
- instances
  - creating, 270
  - defined, 268
  - methods, 274–275
  - variables, 279–280
- instantiation, 269
- int() function, 90, 306
- integers, 86–87, 220
- Integrated Development Environment (IDE), 45, 334, 352
- Interactive Development Environment. *See* IDLE

interactive environment, 354  
 Internet Engineering Task Force (IETF), 349  
 Internet Information Server (IIS), 342  
 IOError exception, 162  
 IPv4 (Internet Protocol version 4), 315  
 IPv6 (Internet Protocol version 6), 315  
 IPython, 354  
 IRLib library, 362–363  
 is not operator, 102, 103  
 is operator, 102, 103  
 isalnum() function, 213  
 isalpha() function, 213  
 isdecimal() function, 213  
 isdigit() function, 214  
 islower() function, 214  
 isnumeric() function, 214  
 Isort, 355  
 isspace() function, 214  
 istitle() function, 214  
 isupper() function, 214  
 items() function, 282  
 iterable items, 264

## • J •

j identifier, 88  
 Java  
   development time, 15  
   Python versus, 19  
   using libraries in Python, 363  
 JavaScript, 16, 336  
 job opportunities  
   data mining, 344–345  
   embedded systems interaction, 345  
   GIS, 344  
   IT departments, 341–342  
   network administration, 343  
   programming languages and, 15  
   QA, 340  
   real-time data analysis, 346  
   scientific tasks, 345–346

  specialty scripting, 342–343  
   teaching, 343  
 join() function, 214  
 JPype library, 363  
 jQuery, 336  
 Jython, 363

## • K •

KeyboardInterrupt exception, 155, 172  
 keys() function, 250–251  
 key/value pairs. *See* dictionaries  
 keywords topic, 50  
 Komodo Edit, 58, 352  
 \*\*kwargs argument list, 281

## • L •

Language Integrated Query (LINQ), 16  
 last in/first out (LIFO), 244  
 Launchpad, 348  
 Lawrence Livermore National Library, 17  
 learning curve, 15  
 LearnPython.org tutorial, 331  
 len() function, 214, 232, 253  
 length checking, 137  
 less-than (<) operator, 99, 103  
 less-than or equal (<=) operator, 99, 103  
 letter analogy, 311–312, 318–319  
 libraries  
   defined, 183  
   finding online, 357  
   Google Maps, 359  
   httplib2, 364  
   IRLib, 362–363  
   JPype, 363  
   NumPy, 16  
   PrettyTable, 360  
   PyAudio, 360–361  
   PyCrypto, 358  
   PyQtGraph, 361–362

- SciPy, 16
  - socket, 313, 315, 316, 317
  - SQLAlchemy, 358–359
  - third-party libraries, 332–333
  - TkInter, 359–360
  - Twisted Matrix, 364
  - `license()` command, 49
  - LIFO (last in/first out), 244
  - Lightwave, 342
  - linefeed character, 210
  - `lineno` warning level, 43
  - LINQ (Language Integrated Query), 16
  - Linux
    - accessing Python on, 36
    - installing Python, 30–32
    - Python support, 22
  - lists
    - accessing items in, 228–230
    - computer view of, 225–226
    - `Counter` object for, 240–242
    - creating, 226–227
    - creating stacks using, 256–260
    - functions for, 228
    - looping through, 231
    - modifying items in, 232–235
    - mutable types, 245
    - negative indexes, 230
    - overview, 223–225
    - range of values in, 229
    - searching in, 236–238
    - sorting, 238–240
    - using operators with, 236
    - zero-based indexes, 229
  - `ljust()` function, 214
  - `__loader__` attribute, 194
  - local hostname, 317–318
  - logical errors, 154–155
  - logical operators
    - listing of, 99
    - multiple comparisons for `if` statements, 121–123
    - precedence, 103
  - loops
    - break statements, 136–138
    - continue statements, 138–139
    - deque type and, 264
    - else clause, 141–142
    - endless, 143
    - for loops, 134–135
    - nesting, 145–147
    - overview, 133–134
    - pass clause, 140–141
    - using with lists, 231
    - while statements, 143–145
  - `lower()` function, 214
  - `lstrip()` function, 214
  - `-m` option, 43
- M •
- Mac OS X
    - accessing Python, 35–36
    - installing Python, 27–29
    - Python support, 22
  - mantissa, 89
  - mathematic applications, 16
  - `max()` function, 214, 216
  - Maya, 342
  - members, class, 268
  - membership operators, 102, 103
  - memory, and floating-point values, 89
  - `MemoryError` exception, 155
  - Mercurial version control, 355–356
  - message warning level, 43
  - methods
    - class, 273–274
    - defined, 269
    - instance, 274–275
    - instance variables and, 279
    - variable argument lists for, 281–282
  - microsecond value, 92
  - Microsoft Disk Operating System (MS-DOS), 22

Microsoft Windows  
 accessing IDLE, 32–33  
 accessing Python from command prompt, 34–35  
 ignoring case in `import` statements, 44  
 installing Python, 25–27  
 opening `pydoc` application, 198  
 platform support, 22

MIME (Multipurpose Internet Mail Extensions), 319–321

`min()` function, 214

minus sign (`-`), 97, 98, 103

minute value, 92

Modo, 342

module warning level, 43

modules  
 defined, 183  
 finding on disk, 191–193  
 finding online, 357  
 from...`import` statements, 188–191  
 grouping code and, 184–185  
 ignoring paths for, 43  
 importing, 92, 185–188  
 numeric processing, 345  
 opening `pydoc` application, 198–200  
 quick-access documentation links, 200–201  
 running, 43  
 scientific, 345  
 searching documentation, 202–204  
 viewing attributes in, 193–197

modules topic, 50

month value, 92

MorphOS, 22

MotionBuilder, 342

MS-DOS (Microsoft Disk Operating System), 22

multiline comments, 74–75

multiplatform support, 19, 21–22

multiple processors, 245

multiplication operator (`*`), 98, 103, 236

Multipurpose Internet Mail Extensions (MIME), 319–321

multithreaded applications, 261

mutable types, 245, 248

## • N •

`\n` escape sequence, 210, 215, 299

`__name__` attribute, 194

NASA (National Space and Aeronautics Administration), 17

negation operator (`-`), 97

nesting  
 defined, 129  
 exception handling, 170–173  
 if statements, 129–132  
 loops, 145–147

network administration, 343

New York Stock Exchange, 17

newline attribute, 299

not equal (`!=`) operator, 98, 103

not in operator, 102, 103

not operator, 99, 103

`now()` function, 92

Nuke, 342

number sign (`#`), 74, 76

numeric types  
 complex numbers, 88  
 floating-point values, 87–88  
 integers, 86–87  
 reasons for multiple, 89

NumPy library, 16, 362

`-o` option, 43

## • O •

ObjectDomain, 17

objects, 269

`oct()` function, 86

octal numeric values, 210

`-OO` option, 43, 45

`open()` function, 79, 162, 299

- open source, 19
- operands, 96
- Operating System 2 (OS/2), 22
- Operating System 390 (OS/390), 22
- operators
  - arithmetic, 97–98
  - assignment, 101
  - binary, 96
  - bitwise, 99–100
  - comparisons and, 95
  - identity, 102
  - logical, 99
  - membership, 102
  - overloading, 269, 282–284
  - overview, 95–97
  - precedence, 103
  - relational, 98–99
  - ternary, 96
  - unary, 96, 97
  - using with lists, 236
- optimizing code, 43
- or operator, 99
- ord() function, 90
- orphaned projects, 351
- os.\_exit() command, 56
- OS/2 (Operating System 2), 22
- OS/390 (Operating System 390), 22
- os.environ[ ] attributes, 192–193
- os.pathsep constant, 193
- os.remove() function, 308
- os.rmdir() function, 308
- overloading
  - functions, 268
  - operators, 269, 282–284
- *p* •
- \_\_package\_\_ attribute, 194
- padding strings with zeroes, 215
- Paint Shop Pro, 342
- PalmOS, 22
- parent classes, 287
- parentheses (), 103, 106, 246
- partial functions, 331
- pass clause
  - overview, 140–141
  - for while statements, 144
- PATH environment variable, 26, 34–35
- paths, directory, 295
- pdoc, 351–352
- performance
  - resources for, 338
  - using virtual environments, 349
- Perl, 20
- PHP, 336
- PIL (Python Imaging Library), 333
- platform support, 21–22
- Playstation, 22
- plus sign (+)
  - addition operator, 98
  - concatenation using, 212, 236
  - operator precedence, 103
  - overloading, 283–284
  - as unary operator, 97
  - using indentation with, 72
  - using with tuples, 247
- Pocket PC, 22
- pop() function, 232, 234, 257, 264
- POP3 (Post Office Protocol 3), 312
- popleft() function, 264
- ports, 314–316
- positional arguments, 110
- Post Office Protocol 3 (POP3), 312
- precedence, operator, 103
- precision of decimal number, 220
- PrettyTable library, 360
- print() function
  - testing installation, 36–37
  - typing commands, 46
  - using in application, 68–69
  - viewing command result, 46–47
- procedures
  - commands and, 46
  - computers and, 10–11

- procedures (*continued*)
  - defined, 9
  - separating from user interface, 304
  - tasks as, 9–10
- processors, multiple, 245
- production servers, 350
- production-grade classes, 287
- Program Files directory, 26
- programming
  - application usage types, 16–17
  - code reusability, 104–105
  - common mistakes, 336–337
  - communication with computer, 94
  - exceptions and, 150–151
  - knowing multiple languages, 341
  - languages, 12, 14, 19–20
  - Python advantages, 15
- protocol, defined, 310
- prototypes, 16
- Psion, 22
- purple text in IDLE, 61
- put () function, 261
  - .py files, 42
- PyAudio library, 360–361
  - .pyco files, 42
- PyCrypto library, 358
- pydbgr, 353
- pydoc application
  - opening, 198–200
  - quick-access links, 200–201
  - searching, 202–204
- PyGame library, 361
- PyInstaller, 350–351
- PyOpenGL, 362
- PyQtGraph library, 361–362
- Python
  - advantages of, 15
  - applications written in, 18
  - C# versus, 19
  - documentation, 62–63
  - downloading, 22–23
  - Embedded Python, 345
  - environment variables for, 35
  - installing on Linux, 30–32
  - installing on Mac, 27–29
  - installing on Windows, 25–27
  - Java versus, 19
  - language comparisons online, 19
  - online documentation, 330
  - online tutorial, 331
  - organizations using, 17–18
  - Perl versus, 20
  - platform support, 21–22
  - popularity of, 15
  - reporting problems, 330
  - uses for, 16–17
  - using Java libraries in, 363
  - web programming using, 332
- Python and XML Processing site, 336
- python command, 78
- Python GUI. *See* IDLE
- Python Imaging Library (PIL), 333
- PYTHONCASEOK environment variable, 35, 44
- PYTHONDEBUG environment variable, 44
- PYTHONDEFAULTHANDLER environment variable, 45
- pythondoc library, 333
- PythonEditors wiki, 334
- PYTHONFAULTHANDLER environment variable, 35
- PYTHONHASHSEED environment variable, 35, 45
- PYTHONHOME environment variable, 35, 45
- PYTHONINSPECT environment variable, 45
- PYTHONIOENCODING environment variable, 35, 45
- PYTHONNOUSERSITE environment variable, 45
- PYTHONOPTIMIZE environment variable, 45

- PYTHONPATH environment variable, 35, 45, 191
  - PYTHONSTARTUP environment variable, 35, 45
  - PYTHONUNBUFFERED environment variable, 45
  - PYTHONVERBOSE environment variable, 45
  - python.vim utility, 335
  - Pythonware site, 332–333
  - PYTHONWARNINGS environment variable, 45
  - PYTHONWRITEBYTECODE environment variable, 44
  - PyUnit, 354–355
- **Q** •
- q command, 199
  - q option, 43
  - QA (Quality Assurance), 340
  - QNX, 22
  - quantum mechanics, 88
  - queue type
    - defined, 244
    - sequence types, 224
    - using, 260–262
  - quit() command, 38, 54–55
- **R** •
- \r escape sequence, 210
  - raising exceptions. *See also* exceptions, handling
    - defined, 150
    - overview, 174–175
    - passing error information to caller, 175–176
  - range checking, 121, 123
  - range of values in list, 229
  - Raspberry Pi, 343, 345
  - RDBMS (Relational Database Management System), 359
  - read() function, 79
  - readability of code, 1, 15
  - reading files, 301–303
  - README files, 40
  - real-time data analysis, 346
  - records, database, 358
  - Red Hat, 17, 29
  - Red Hat Package Manager (RPM), 29
  - regular expressions, 331
  - Relational Database Management System (RDBMS), 359
  - relational operators
    - listing of, 98–99
    - precedence, 103
    - using with if statements, 119–120
  - relative paths, 295
  - remove() function, 193, 232, 234, 264, 306
  - repetition, 212
  - repetitive tasks. *See* loops
  - replace() function, 217
  - reporting problems, 330
  - required arguments, 108–110
  - resources
    - common mistakes, 336–337
    - IDEs, 334
    - LearnPython.org tutorial, 331
    - online documentation, 330
    - performance, 338
    - third-party libraries, 332–333
    - Unicode characters, 337
    - web programming, 332
    - XML, 335–336
  - ResourceWarning exception, 155
  - returning data from functions, 112–113
  - reusable code, 104–105
  - reverse() function, 240
  - rfind() function, 217, 218
  - rindex() function, 217
  - RISC OS, 22
  - rjust() function, 214
  - rmtree() function, 308

Roundup Issue Tracker, 348  
 RPM (Red Hat Package Manager), 29  
`rstrip()` function, 214  
 runnable code, 184  
 running applications  
   from command line, 78  
   defined, 68  
   from Edit window, 79  
   in IDLE, 71–72, 79–80  
 runtime errors, 152–153

## • S •

`-s` option, 43, 45  
`-S` option, 43  
 scientific applications, 16, 345–346  
 scientific notation, 87  
 SciPy library, 16, 362  
 screenshots in book, 32  
 Scribus, 342  
 SD (Secure Digital), 83  
 searching  
   IRLib library, 362–363  
   in lists, 236–238  
   module documentation, 202–204  
   in strings, 217–219  
 second value, 92  
 Secure Digital (SD), 83  
 seeding with random values, 45  
 selection tree, 129  
`self` object, 274, 283  
 semantic errors, 154  
 sequences, 224–225, 243–244. *See also*  
   lists  
 serialization, 331  
 Series 60, 22  
 server applications, 332  
 sets, 331  
 setters, 285, 297  
 shell, 54  
 shortcut keys for IDLE, 65  
`shutil.rmtree()` function, 308

Simple Mail Transfer Protocol (SMTP),  
   309–310, 321–322, 324  
 Simple Object Access Protocol  
   (SOAP), 333  
 single quote ( ' ), 207, 209  
 single-line comments, 74–75  
`__sizeof__` attribute, 194, 196  
 SMTP (Simple Mail Transfer Protocol),  
   309–310, 321–322, 324  
`smtplib` module, 321  
 SOAP (Simple Object Access  
   Protocol), 333  
 socket library, 313, 315, 316, 317  
 Softimage, 342  
 Solaris, 22  
 Solid State Drive (SSD), 293  
`sort()` function, 239  
 sorting lists, 238–240  
 sound technologies, 361  
 spaghetti code, 267  
 special characters, 208–211  
`split()` function, 193, 214, 216, 306  
`splitlines()` function, 215  
 SQL (Structured Query Language), 16,  
   336, 359  
 SQLAlchemy library, 358–359  
 square brackets [ ], 211, 226, 229  
 squeeze library, 333  
 SSD (Solid State Drive), 293  
 stacks  
   defined, 244  
   sequence types, 224  
   using, 256–260  
`startswith()` function, 217  
`str()` function, 42, 91  
`str` type, 45  
`__str__()` function, 284, 285, 297  
`strerror` attribute, 162, 175–176, 177  
 strings  
   creating from characters, 207–208  
   as dictionary keys, 250  
   formatting, 219–222

functions for, 213–216, 217  
overview, 90–91  
searching in, 217–219  
selecting individual characters in,  
211–213  
upper() function, 171  
using special characters, 208–211  
as viewed by computers, 206  
strip() function, 215, 216  
structured data, 295  
Structured Query Language (SQL), 16,  
336, 359  
subtraction operator (-), 98, 103  
sudo command, 31  
SUSE Linux, 29  
swapcase() function, 215  
switch statements, 128, 253–256  
switches, command-line, 42–44  
syntax  
concise, 1  
errors in, 154  
highlighting, 334–335  
sys.exit() command, 56  
sys.path variable, 43, 45, 192

## • T •

\t (tab character), 210  
Tcl (Tool Command Language), 360  
ternary operator, 96  
testing  
C++ applications, 340  
installation, 36–38  
production servers and, 350  
using PyUnit, 354–355  
third-party libraries, 332–333  
throwing exceptions, 150, 174–175. *See*  
also exceptions, handling  
time() function, 92  
TIOBE web site, 15  
title() function, 215  
TkInter library, 333, 359–360

TODO list management, 348  
Tool Command Language (Tcl), 360  
tools  
bug-tracking sites, 348  
IPython, 354  
Isort, 355  
Komodo Edit, 352  
Mercurial version control, 355–356  
pdoc, 351–352  
pydbgr, 353  
PyInstaller, 350–351  
PyUnit, 354–355  
Roundup Issue Tracker, 348–349  
VirtualEnv, 349–350  
topics keyword, 50  
traceback, 45  
Trigger, 343  
try block, 156, 164  
tuples  
defined, 244  
hierarchy of, 247–248  
sequence types, 224  
using, 245–248  
Twisted Matrix, 364  
type() method, 90  
typographical characters, 209

## • U •

\u escape sequence, 210  
-u option, 43, 45  
UAC (User Access Control), 26  
Ubuntu, 31  
unary operators  
defined, 96  
listing of, 97  
precedence, 103  
uncommenting lines, 77  
Unicode characters, 210, 337  
unit testing, 354–355  
Universal Serial Bus (USB), 83, 293  
unstructured data, 295

update() function, 241, 252  
 upper() function, 171, 215  
 USB (Universal Serial Bus), 83, 293  
 UsefulModules site, 357  
 User Access Control (UAC), 26  
 user input, 114–116  
 user interfaces, 17, 304

## • U •

\v escape sequence, 210  
 -v option, 43  
 -v option, 43, 45  
 ValueError exception, 168, 177  
 variables  
   assigning values, 85  
   class, 268, 278–279  
   defined, 84  
   determining type of, 90  
   instance, 269, 279–280  
   returning data from functions, 113  
     verbose mode, 43  
 version control, 355–356  
   --version option, 43  
 vertical tab character, 210  
 VirtualEnv, 349–350  
 Visual Basic, 15  
 VMS (Virtual Memory System), 22  
 -w option, 43, 45

## • W •

W3Schools site, 335–336  
 warning level, 43  
 web programming, 16, 332

while statements  
   nesting, 145–147  
   overview, 143–144  
   using, 144–145  
 whitespace, removing, 215  
 widgets library, 333  
 winsound module, 361  
 with statement, 299  
 writerow() function, 300  
 writing data to files, 303–307

## • X •

\x escape sequence, 210  
 -x option, 44  
 -x option, 44  
 XML (Extensible Markup Language), 16,  
   296, 335–336

## • Y •

Yahoo!, 18  
 year value, 92  
 Yellow Dog Linux, 29  
 YouTube, 18

## • Z •

zero-based indexes, 229  
 ZeroDivisionError exception, 167, 169  
 zeroes, padding with, 215  
 zfill() function, 215  
 .zip files, 296  
 Zope, 18  
 z/OS, 22