

A black and white photograph of a lighthouse situated on a rocky coastline. The lighthouse is white with a dark lantern room and sits atop a stone pier. To its left is a large, multi-story keeper's house with a prominent gabled roof. The foreground is filled with large, light-colored, layered rock formations. The ocean waves are visible crashing against the rocks at the base of the pier. The sky above is filled with heavy, textured clouds.

Index

COPYRIGHTED MATERIAL

Note to the Reader: Throughout this index **boldfaced** page numbers indicate primary discussions of a topic. *Italicized* page numbers indicate illustrations.

A

abstract classes
 concrete classes from, 262–263
 creating, 259
 defining, 260–262
 extending, 263–265
abstract specifiers
 interfaces, 267–269
 methods, 168, 271–273
access modifiers, 173
 default, 175
 description, 7
 inheritance, 237
 methods, 166–167
 private, 173, 174
 protected, 176, 176
 public, 180–181
 static, 181–188
add() method, 130–131
addition
 dates, 142–143
 precedence, 53–54
ampersands (&) for logical operators, 64, 64
ancestors in inheritance, 234
“and” logical operator, 64, 64
anonymous arrays, 120
append() method, 115
args parameters in main(), 7–8
arithmetic operators, 53–55
ArithmaticException class, 314
ArrayIndexOutOfBoundsException class, 123, 314–315
ArrayLists, 129
 arrays from, 136–137
 autoboxing, 136
 creating, 129
 methods, 130–134
 sorting, 138
 wrapper classes, 134–135
arrays, 119
 ArrayLists, 129
 declaring, 121
 indexes, 7, 120, 120

multidimensional, 126–129, 127–128
parameters, 7
primitives, 119–121, 119–120
reference variables, 121, 122
searching, 125–126
sorting, 124–125
varargs, 126
working with, 123–124
arrow operator (->) for lambda expressions, 211–212, 212
asList() method, 187–188
assignment operators
 compound, 62–63
 overview, 60
 precedence, 53
assumed keywords in interfaces, 268
asterisks (*)
 comments, 4–5
 packages, 10
asymmetric arrays, 128, 128
autoboxing
 overloading methods, 193
 type conversions, 136

B

B prefix for binary, 22
backed lists, 137
base 10 numbering system, 22
Beginning Java forum, 6
binary number format, 22–23
binary operators
 arithmetic, 53–55
 assignment, 60
 casting, 60–61
 compound assignment operators, 62–63
 equality, 65–66
 logical, 64–65, 64
 numeric promotion, 55–57
 relational, 63
binary searches, 125–126
bitwise operators, 64, 64

blocks
 description, 67
 initialization order, 19–20
 instance initializer, 18
 scope in, 31–34

bodies
 lambda expressions, 212,
 212
 methods, 171–172

boolean type
 default initialization, 31
 if statements, 70
 logical operators, 57–58
 size and range, 21
 ternary operators, 71–72
 while statements, 77
 wrapper classes, 134–135

braces ({})
 blocks, 18–19, 32–33
 if-then statements, 68
 lambda expressions, 212,
 212
 methods, 171
 try statements, 306–307

brackets ([]) for arrays, 7, 119–122

break statements
 in loops, 88–90, 88
 in switch, 74

byte type
 default initialization, 31
 promotion rules, 56
 size and range, 21
 switch statements, 72–73
 wrapper classes, 134–135

bytecode, 6

catch blocks, 305–309, 305
 chaining
 constructors, 201
 methods, 110–111
 StringBuilder, 112–113

char type
 default initialization, 31
 promotion rules, 56
 size and range, 21
 switch statements, 72–73
 wrapper classes, 134–135

charAt() method, 106, 114, 135

checked exceptions, 303, 305, 317

child classes in inheritance, 234

child packages, 10

.class extension, 6

class variables in default initialization, 30–31

ClassCastException class, 315

classes
 abstract, 259–265
 concrete, 262–263
 description, 2
 element ordering, 34–35
 extending, 235–236, 235
 fields and methods, 2–4
 vs. files, 5
 immutable, 207–208
 inheritance. *See* inheritance
 interfaces. *See* interfaces
 packages, 9
 paths, 15
 subclasses, 319–321
 wrapper, 134–136

clear() method, 133

closures. *See* lambda expressions

code
 blocks, 18–19
 compiling, 6, 14–15
 exam formatting, 16

colons (:)
 dates and times, 150
 labels, 88
 paths, 15
 ternary operators, 71

commas (,)
 dates and times, 150
 exception lists, 171
 interface implementation, 267
 parameter lists, 171
 variable declarations, 26

C

calling
 constructors, 243–244
 inherited class members, 244–245
 static variables and methods, 182–183

CamelCase names, 28–29

capacity vs. size, 113–114, 114

carets (^) for logical operators, 64, 64

case sensitivity of names, 27

case statements in switch, 73–76, 73

casting
 objects, 282–284
 operators, 60–61

comments, 4
comparators in arrays, 125
compile-time constant values in switch statements, 73–76
compiling code
 extensions for, 6
 and inheritance, 241–242
 with packages, 14–15
compound assignment operators, 62–63
concatenating strings, 102–104
concrete classes, 262–263
conflicts in names, 12–13
consistency of names, 28
constant values in switch statements, 73–76
constructors
 calling, 243–244
 chaining, 201
 creating, 196
 date and time, 141
 default, 197–199
 defining, 238
 definition rules, 242–243
 final fields, 202
 initialization order, 202–204
 objects, 17
 overloading, 199–200
 wrapper classes, 134–135
contains() method
 ArrayLists, 133
 strings, 109–110
continue statements, 90–91, 90
control flow statements
 break, 88–90, 88
 continue, 90–91, 90
 do-while, 78–80, 78
 for, 80–83, 80, 85
 for-each, 83–86, 83
 if-then, 67–68, 67
 if-then-else, 68–70, 69
 labels, 87–89
 nested loops, 87
 switch, 72–76, 73
 while, 76–77, 77, 79
converting
 ArrayLists to arrays, 136–137
 number systems, 23
 objects to wrapper classes, 135–136
covariant return types, 248, 252
curly braces ({})
 blocks, 18–19, 32–33
 if-then statements, 68

lambda expressions, 212, 212
methods, 171
try statements, 306–307

D

data types
 in for statements, 82
 promotion rules, 55–57
 switch statements, 72–73
Date class, 12–13
dates
 creating, 138–142
 earlier versions, 141–142, 144, 150
 formatting, 148–150
 manipulating, 142–145
 parsing, 151
 periods, 145–147
DateTimeFormatter class, 148–150
dd format for dates and times,
 150
decimal numbering system, 22
declare rules for exceptions, 303
declaring
 arrays, 121
 methods, 166, 166
 variables, 25
decrement operators, 58
default statements in switch, 72, 74
defaults
 access modifiers, 167, 175
 constructors, 17, 197–199
 interface methods, 274–278
 packages, 13
 variable initialization, 29
defining
 abstract classes, 260–262
 interfaces, 267–269
delete() method, 116
deleteCharAt() method, 116
descendents in inheritance, 234
destroying objects
 finalize(), 38–39
 garbage collection, 36, 37–38
diamond operator (<>), 130
division
 modulus operation, 54–55
 precedence, 53–54
do-while statements, 78–80, 78

dollar signs (\$) for names, 27, 29
 double quotes (")
 for spaces, 8
 strings, 102–103
 double type
 default initialization, 31
 size and range, 21
 wrapper classes, 134–135

E

else operators, 68–70, 69
 encapsulation
 description, 39
 immutable classes, 207–208
 overview, 205–206
 endsWith() method, 109
 enum type
 dates, 140
 support for, 72–73
 switch statements, 72
 equal signs (=)
 assignment operators, 60
 compound assignment operators, 62–63
 equality, 117–118
 equality operators, 65–66
 precedence, 53
 relational operators, 63
 unary operator, 57
 variable declarations, 25
 equality
 operators, 65–66
 overview, 117–119
 equals() method
 ArrayLists, 133–134
 arrays, 121
 strings, 109, 118–119
 equalsIgnoreCase() method, 109
 Error class, 302, 302, 305, 317–318
 exams, code formatting in, 16
 exception lists for methods, 171
 ExceptionInInitializerError class, 317
 exceptions
 checked, 317
 Error, 317–318
 finally blocks, 307–309, 307
 ignoring, 322
 methods, 318–322
 multiple, 311–313
 printing, 321, 322

reasons, 300
 vs. return codes, 301–302
 roles, 300–301
 runtime, 314–316
 subclasses, 319–321
 throwing, 304–305
 try statements, 305–307, 305
 types, 302–303, 302, 309
 exclamation points (!)
 equality operators, 65–66
 logical operator, 57–58
 unary operator, 57
 “exclusive or” operator, 64, 64
 exit() method, 309
 extending
 abstract classes, 263–265
 classes, 235–236, 235
 interfaces, 269

F

false value in logical operators, 57
 fields
 in classes, 35, 41
 final, 202
 initialization order, 19–20
 overview, 2–4
 reading and writing, 18
 static, 181–182
 FileNotFoundException class, 317
 files vs. classes, 5
 final specifiers
 abstract classes, 261
 constants, 74
 constructor fields, 202
 interfaces, 267, 273–274
 methods, 168, 256
 finalize() method, 38
 finally blocks, 307–309, 307
 float type
 default initialization, 31
 promotion rules, 55
 size and range, 21
 wrapper classes, 134–135
 for statements, 80–83, 80, 85
 for-each statements, 83–86,
 83
 format() method, 148
 formatting dates and times, 148–150
 free store, 36

functional interfaces with lambda expressions, 214
functional programming, 208–209
functions. *See* methods

G

garbage collection, 36, 37–38
gc() method, 36
generics, 130
getter methods in JavaBeans, 206
getting variables, 18
GMT (Greenwich Mean Time), 146
greater than signs (>)
 diamond operator, 130
 lambda expressions, 211–212, 212
 relational operators, 63
Greenwich Mean Time (GMT), 146

H

handle rules for exceptions, 303
heap, 36
hexadecimal number format, 22–23
hh format for dates and times, 150
hiding
 vs. overriding, 254–255
static methods, 252–254
variables, 257

I

identifiers, 27
if-then statements, 67–68, 67
if-then-else statements, 68–70, 69
ignored returned values, 191
IllegalArgumentException class, 315–316
immutability of strings, 104–105
immutable classes, creating, 207–208
imports
 element ordering, 35
 packages, 9, 11–12
 static, 187–188
“inclusive or” operator, 64, 64
increment operators, 58
indentation in if-then statements, 68

indexes
 arrays, 7, 120, 120
 strings, 105–107, 106
indexOf() method, 106–107, 114
infinite loops, 78
infinite recursion, 317
inheritance
 access modifiers, 237
 calling class members, 244–245
 compiler enhancements, 241–242
 constructors, 238, 242–244
 extending classes, 235–236, 235
 interfaces, 269–273, 277
 methods, 246
 object creation, 237–238, 238
 overview, 234, 235
 variables, 257
initialization
 constructor order, 202–204
 default variables, 29
 object order, 19–20
 static, 186–187
 variables, 25–26
initialization blocks in for statements, 80–82, 80
initializer blocks, instances in, 18–19
insert() method, 115
instance members vs. static, 183–185
instance variables
 default initialization, 30–31
 scope, 33
instanceof operator, 63, 283
instances
 creating, 17
 initialization order, 19
 initializer blocks, 18–19
 objects, 2
instantiation process, 196
int type
 default initialization, 31
 promotion rules, 55
 size and range, 21–22
 switch statements, 72–73
 wrapper classes, 134–135
integrated development environment (IDE), 14
interfaces
 abstract methods, 271–273
 with classes, 270
 default methods, 274–278
 defining, 267–269
 extending, 269
 implementing, 266, 266
 inheriting, 269–273

lambda expressions, 214
 multiple inheritance, 277
 static methods, 278
 variables, 273–274
 intValue() method, 135
 IOException class, 317
 isEmpty() method, 132–133

J

JAR files, 15
 Java Development Kit (JDK), 6
 .java extension, 6
 java.lang package, 11
 Java Runtime Environment (JRE), 6
 Java Virtual Machine (JVM), 6
 JavaBeans names, 205–206
 javac command, 15
 Javadoc comments
 description, 4
 key benefits, 39–40
 JDK (Java Development Kit), 6
 JRE (Java Runtime Environment), 6
 JVM (Java Virtual Machine), 6

K

keywords, 3

L

L suffix for long, 22
 labels, 87–89
 lambda expressions
 example, 209–211
 predicates, 214–215
 syntax, 211–213, 212
 variable access, 213
 writing, 208–209
 length() method, 106, 114
 less than signs (<)
 diamond operator, 130
 relational operators,
 63
 lists. *See* ArrayLists
 literal values
 primitive types, 22–23
 strings, 105, 117–118

switch statements, 73–75
 local variables, 29
 LocalDate, 138–141, 146
 LocalDateTime, 139–141, 146
 LocalTime, 139–140
 logical operators, 64
 complement, 57
 overview, 64–65
 precedence, 53
 long type
 dates and times, 146
 default initialization, 31
 size and range, 21–22
 wrapper classes, 134–135
 loops
 arrays, 123
 break statements, 88–90, 88
 continue statements, 90–91, 90
 do-while, 78–80, 78
 for, 80, 85
 for-each, 83–86, 83
 infinite, 78
 labels, 87–88
 nested, 87
 while, 76–77, 77, 79

M

main() method, 6
 MAX_VALUE constant, 22
 MEDIUM format for dates and times, 149
 members in classes, 2
 memory
 object destruction, 36, 37–38
 reference types, 24, 24
 methods
 abstract, 259, 271–273
 access modifiers. *See* access modifiers
 ArrayLists, 130–134
 bodies, 171–172
 chaining, 110–111
 constructors. *See* constructors
 dates and times, 144
 declaring, 166, 166
 defining, 3
 designing, 166, 166
 exception lists, 171
 exceptions thrown by, 318–322
 final, 256
 hiding, 252–254
 interfaces, 271–279

main(), 6
 names, 170
 optional specifiers, 168–169
 overloading, 191
 overriding, 246, 319–321
 overriding vs. hiding, 254–255
 overview, 2–4
 parameter lists, 171
 passing data, 188–191, 190
 polymorphism, 287–288
 redeclaring, 251–252
 return types, 169–170
 signatures, 3, 7, 166, 166
 static, 181–182
 StringBuilder class, 114–117
 strings, 105–109
 varargs, 172–173
 virtual, 284–285
 minus signs (-)
 compound assignment operators, 62
 increment operators, 58–59
 lambda expressions, 211–212, 212
 negation operator, 57–58
 unary operator, 57
 mm format for dates and times, 150
 MMMM format for dates and times, 150
 modulus operator (%)
 overview, 54–55
 precedence, 53–54
 multidimensional arrays, 126–129, 127–128
 multiple exceptions, 311–313
 multiple inheritance
 description, 234–235, 235
 interfaces, 271–273, 277
 multiple-line comments, 4–5
 multiple variables, declaring, 26
 multiplication, 53–54
 mutability of StringBuilder, 112–113

N

names
 conflicts, 12–13
 constructors, 17
 identifiers, 27
 JavaBeans, 205–206
 methods, 170
 packages, 10, 12–13
 native specifiers, 168
 negation operator, 57
 nested loops, 87

new keyword for constructors, 17
 no-argument constructors, 198
 NoClassDefFoundError class, 318
 not equals operators, 65–66
 now() method, 139
 null values
 autoboxing, 136
 reference types, 24
 NullPointerException class, 303, 316
 NumberFormatException class, 316
 numbering systems, 22–23
 numeric promotion, 55–57

O

object-oriented languages, 39
 objects
 casting, 282–284
 comparing, 66
 constructors, 17
 creating, 16, 237–238, 238
 description, 2
 destroying, 36–39, 37–38
 initialization order, 19–20
 instance initializer blocks, 18–19
 polymorphism, 281–282, 282
 primitive types, 20–23
 reading and writing fields, 18
 vs. references, 36, 37
 octal number format, 22
 ofLocalized methods, 149
 operators
 arithmetic, 53–55
 assignment, 60, 62
 casting, 60–61
 equality, 65–66
 logical, 64–65, 64
 numeric promotion, 55–57
 order, 52
 overview, 52
 relational, 63
 ternary, 71
 unary, 57–59
 optional specifiers, 168–169
 “or” operator, 64, 64
 order
 class elements, 34–35
 constructor initialization, 202–204
 field initialization, 19–20
 operators, 52

- overflow, 61
 - overloading methods, 191
 - autoboxing, 193
 - constructors, 199–200
 - vs. overriding, 248
 - overview, 194–196
 - primitive types, 194
 - reference types, 193–194
 - varargs, 192–193
 - overriding
 - vs. hiding, 254–255
 - methods, 246, 319–321
 - vs. overloading, 248
 - polymorphism, 287–288
-
- P**
- package private access modifiers, 167, 175
 - packages
 - compiling code with, 14–15
 - creating, 13–14
 - element ordering, 35
 - names, 10, 12–13
 - overview, 9
 - redundant imports, 11–12
 - wildcards, 10–11
 - parameters
 - main(), 7
 - methods, 3, 171
 - overloading methods, 192–193, 199
 - polymorphic, 285–286
 - parent classes in inheritance, 234
 - parentheses ()
 - lambda expressions, 212–213, 212
 - methods, 167
 - precedence, 54
 - parse() method, 151
 - parseInt() method, 135
 - parsing dates and times, 151
 - pass-by-reference languages, 190–191
 - pass-by-value languages, 188–190, 190
 - passing data in methods, 188–191, 190
 - paths for classes, 15
 - percent signs (%) for modulus, 54
 - Period class, 146–147
 - periods in dates and times, 145–147
 - platform independence, 39–40
 - plus methods for dates, 144
 - plus signs (+)
 - compound assignment operators, 62
 - increment operators, 58–59
 - string concatenation, 103
 - unary operator, 57
 - pointers, 24
 - polymorphism
 - casting objects, 282–284
 - method overriding, 287–288
 - objects vs. references, 281–282, 282
 - overview, 279
 - parameters, 285–286
 - virtual methods, 284–285
 - pools, strings, 105
 - post-decrement operators, 58–59
 - post-increment operators, 58–59
 - pre-decrement operators, 58–59
 - pre-increment operators, 58–59
 - precedence of operators, 52
 - predicates in lambda expressions, 214–215
 - primitive types
 - arrays, 119–121, 119–120
 - casting, 60–61
 - overloading methods, 194
 - overview, 20–23
 - vs. reference, 25
 - printing exceptions, 321, 322
 - private access modifiers
 - abstract classes, 261
 - inheritance, 237
 - interfaces, 267–269
 - methods, 167
 - overview, 173, 174
 - private methods, redeclaring, 251–252
 - procedural languages, 39
 - procedures. *See* methods
 - promotion, numeric, 55–57
 - properties in JavaBeans, 205
 - protected access modifiers
 - interfaces, 267–269
 - methods, 167
 - overview, 176, 177
 - public access modifiers
 - inheritance, 237
 - interfaces, 267–268, 273–274
 - methods, 167
 - overview, 7, 180–181

Q

question marks (?) for ternary operators,
71
quotes ("")
 for spaces, 8
 strings, 102–103

R

ranges of primitive types, 21
readability
 if-then statements, 68
 literal values, 23
 names, 28
 polymorphic parameters, 286
reading fields, 18
recursion, infinite, 317
recursive functions, 247
redeclaring private methods, 251–252
redundant package imports, 11–12
references
 in arrays, 121, 122
 comparing, 66
 methods, 189–191, 190
 vs. objects, 36, 37
 overloading methods, 194
 overview, 24, 24
 polymorphism, 281–282, 282
 vs. primitive, 25
relational operators
 overview, 63
 precedence, 53
remainder operator (%)
 overview, 54–55
 precedence, 53–54
remove() method, 131–132
replace() method, 110
reserved words, 27
return codes vs. exceptions, 301–302
return statement in methods, 169
return types and values
 constructors, 17
 covariant, 248, 252
 description, 7
 ignored, 191
 immutable classes, 207–208

methods, 169–170
reverse() method, 116
robustness, 40
runtime exceptions, 314–316
RuntimeException class, 302–303, 302, 305

S

scope
 in for statements, 81
 variables, 31–34
searching arrays, 125–126
security, 40
semicolons (;)
 class paths, 15
 in for statements, 81
 lambda expressions, 212–213, 212
 variable declarations, 27
set() method, 132
setter methods in JavaBeans, 206
setting variables, 18
shift operators, 53
short-circuit logical operators
 description, 64–65
 precedence, 53
SHORT format for dates and times, 149
short type
 default initialization, 31
 promotion rules, 56
 size and range, 21
 switch statements, 72–73
 wrapper classes, 134–135
signatures in methods, 3, 7, 166, 166
simplicity, 40
single inheritance, 234, 235
single-line comments, 4
size
 vs. capacity, 113–114, 114
 primitive types, 21
size() method, 132–133
slashes (/)
 comments, 4–5
 division, 53
 precedence, 54
sorting
 ArrayLists, 138

arrays, 124–125
 spaces in arguments, 8
 square brackets ([]) for arrays, 7, 119–122
 StackOverflowError class, 318
 startsWith() method, 109
 statements
 do-while, 78–80, 78
 for, 80–83, 80, 85
 for-each, 83–86, 83
 if-then, 67–68, 67
 if-then-else, 68–70, 69
 overview, 66
 switch, 72–76, 73
 while, 76–77, 77, 79
 static keyword, 7
 static methods, hiding, 252–254
 static specifiers
 calling variables and methods, 182–183
 designing, 181–182
 imports, 187–188
 initialization, 186–187
 vs. instance, 183–185
 interfaces, 273–274, 278
 methods, 168
 variables, 185
 strictfp specifiers, 168
 String class, 102
 StringBuffer class vs, 117
 StringBuilder class, 111–112
 creating, 113–114
 methods, 114–117
 mutability and chaining, 112–113
 vs. StringBuffer class, 117
 strings
 as arrays, 119
 concatenating, 102–104
 description, 3, 102
 immutability, 104–105
 methods, 105–109
 pools, 105
 StringBuilder class, 111–117
 switch statements, 73
 subclasses with exceptions, 319–321
 substring() method, 107–108, 114
 subtraction
 days, 145
 precedence, 53–54
 super() keyword, 239–243, 246
 super keyword, 246–247

switch statements, 72
 compile-time constant values, 73–76
 data types, 72–73, 73
 synchronized specifiers, 168
 System.gc() method, 36

T

ternary operators
 overview, 71
 precedence, 53
 this() keyword, 238
 Throwable class, 302, 302
 throwing exceptions, 304–305
 times
 creating, 138–142
 formatting, 148–150
 manipulating, 142–145
 parsing, 151
 periods, 145–147
 toEpochDay() method, 146
 toEpochTime() method, 146
 toLowerCase() method, 108
 toString() method, 105, 116–117
 toUpperCase() method, 108
 trim() method, 110
 true value in logical operators, 57
 truth tables, 64, 64
 try statements, 305–307, 305
 two-multidimensional arrays, 127

U

unary operators
 increment and decrement, 58–59
 logical complement and negation, 57–58
 precedence, 53
 promotion rules, 56
 working with, 57
 unchecked exceptions, 302
 underflow, 61
 underscores (_)
 in literal values, 23
 names, 27
 Unicode character set, 29
 update statements in for statements, 80–82,
 80

V

valueOf() method, 135
variable argument (varargs) lists, 7–8
 ArrayLists, 137
 arrays, 126
 methods, 172–173
 overloading methods, 192–193
variables
 assignment operators, 60, 62–63
 declaring, 25
 default initialization, 29
 defining, 3
 description, 2
 in for statements, 81–83
 for-each statements, 83
 hiding, 257
 inheriting, 257
 interfaces, 273–274
 lambda expression access, 213
 reading and writing, 18
 scope, 31–34
 static, 185
vertical bars (!) for logical operators, 64, 64
virtual methods, 284–285
void type, 7
 description, 3
 methods, 169

W

while statements, 76–77, 77,
 79
wildcards
 JAR files, 15
 packages, 10–11
wrapper classes
 ArrayLists, 134–135
 converting to, 135–136
 switch statements, 73
“write once, run everywhere”,
 40
writing fields, 18

X

X for hexadecimal, 22

Z

ZonedDateTime, 139

