
INDEX

A

`abs()` method, 199–201
Abscissas, 322
`AbsDemo` class, 200–201
Absolute value methods, 199–201
Abstract classes, 87–89
 compared to interfaces, 132
 using, 88–89
Abstract methods, 123–24
Abstract Window Toolkit (AWT), 4, 176
`AbstractGas` class, 227–28, 229
Access control, and packages, 144
Access modifiers:
 and inheritance, 84–85
 methods, 114–16
 variables, 102–3
Access privileges, 67–68
 types of access, 67
`AccessDemo` class, 115–16
`AccessDriver` class, 116
Accessibility API, 4
`acos()` method, 204
`ActionListener` class, 78
`ActionListener` interface, 428–29
`Air` class, 160–61, 233–34
`Air2` class, 165
`Air3` class, 166–67
`AirDriver` class, 233–34
Aliasing, 346–47
Angle of attack, 327
Angles, converting, 207
`AnonDemo` class, 80–81
Anonymous inner classes, 77, 80–81
Apache server, 438
`ArgDemo` class, 137–38, 168–69
Arguments, passing by value, 16
Arithmetic operators, 44–45
`ArithOpDemo` class, 45

Array elements:

 accessing, 166–67
 initializing, 164–67
`ArrayList` class, 170
Arrays, 159–72
 accessing an element in, 17
array elements:
 accessing, 166–67
 initializing, 164–67
collection classes in the Java API, 170–71
defined, 159
indices, 16–17
length, 169–70
as method arguments and return types, 167–69
of more than two dimensions, 164
moving from C to Java, 26–27
moving from Fortran to Java, 16–17
one-dimensional, 160–61
passing as a method argument, 168–69
size of, 16
two-dimensional, 161–64
`asin()` method, 204
Assignment operators, 45–46
`AssignOpDemo` class, 46
`atan()` method, 204
`AtmGUI` class, 421–23
 final form of, 430–33
`AtmServlet` class, 443–47
 source code, 444–47
`AudioInputStream` class, 389
`available()` method, `InputStream` class, 385

B

Basic syntax, *See* Syntax:
`BigDecimal` class, 197
`BigInteger` class, 197
Binary operators, 44

- Bins, 347–49
 Bitwise operators, 50–51
`BitWiseDemo` class, 51
`BlackBody` class, 96–97, 119
`BlackBody2` class, 104
`BlackBody2Driver` class, 104–5
`BlackBody3` class, 105–6
`BlackBody4` class, 128–29
 Blottner curve fit expression, 203
`Boolean` class, 185
`boolean` data type, 14–15, 24, 93
 Boolean operators, 48–50
`BooleanOpDemo` class, 50
`BorderLayout` class, 426
 Braces, 13
 break statements, 60–61
`BreakDemo` class, 61
 Brigham, E. Oran, 334
`BufferedInputStream` class, 384, 385–86
`BufferedOutputStream` class, 390, 391
`BufferedReader` class, 175, 397–98
`BufferedWriter` class, 175, 400–401
 Built-in math functions, 19, 197–214, *See also User-defined math functions*
 absolute value methods, 199–201
 angles, converting, 207
 comparing built-in math capability of C/C++/
 Fortran/Java, 212–14
 conversion methods, 206–7
 `java.math` package, 212
 `Math` class, 198
 mathematical constants, 199
 maximum methods, 208–9
 minimum methods, 208–9
 moving from C to Java, 29
 moving from C++ to Java, built-in math functions,
 34–35
 `pow()` method, 201–2
 random number generator methods, 211–12
 remainder methods, 209–11
 rounding methods, 209–11
 `sqrt()` method, 201–2
 `StrictMath` class, 198
 transcendental math functions, 203–4
 trigonometric methods, 204–6
`Byte` class, 184–86
`byte` data type, 14–15, 24, 93
 Byte input streams:
 `AudioInputStream` class, 389
 `BufferedInputStream` class, 384, 385–86
 `ByteArrayInputStream` class, 384, 386
 `DataInputStream` class, 384, 386–87
 `FileInputStream` class, 384, 387–88
 `FilterInputStream` class, 384, 388
 `InputStream` class, 385
 `ObjectInputStream` class, 384, 388–89
 `PipedInputStream` class, 389
 `SequenceInputStream` class, 389
 `StringBufferInputStream` class, 389
 Byte output streams, 389–96
 `BufferedOutputStream` class, 391
 `ByteArrayOutputStream` class, 391–92
 `DataOutputStream` class, 392–93
 `FileOutputStream` class, 393
 `FilterOutputStream` class, 393
 `ObjectOutputStream` class, 393–95
 `OutputStream` class, 390–91
 `PrintOutputStream` class, 395–96
 Byte streams, 20, 382
`ByteArrayInputStream` class, 384, 386
`ByteArrayOutputStream` class, 391–92
 Bytecode, 6
- C**
 C/C++, 442
`Camber`, 327
`CamberFunction` class, 329
 constructor, 329
`CardLayout` class, 426
`CastDemo` class, 107–8
 Casting, 106–8
 catch clause, 152–53
 Catenary, 222–23
`ceil()` method, 209
`ChainDemo` class, 125
`char` data type, 14–15, 24, 93
 `double` data type, 24
`Character` class, 185
 Character input streams, 396–99
 `BufferedReader` class, 397–98
 `CharArrayReader` class, 399
 `FileReader` class, 398
 `FilterReader` class, 399
 `InputStreamReader` class, 383, 398–99
 `PipedReader` class, 399
 `PushbackReader` class, 399
 `Reader` class, 396–97
 `StringReader` class, 399
 Character output streams, 399–403
 `BufferedWriter` class, 400–401
 `CharArrayWriter` class, 403
 `FileWriter` class, 401
 `FilterWriter` class, 403
 `OutputStreamWriter` class, 401–2
 `PipedWriter` class, 403
 `PrinterWriter` class, 402–3
 `StringWriter` class, 403
 `Writer` class, 399–400

- Character streams, 20, 382
CharArrayReader class, 399
CharArrayWriter class, 403
Chord, 327
Chord line, 327
CircCylGrid class, 162–63
.class files, using the CLASSPATH to locate, 143–44
Class hierarchies, 225–46
 AbstractGas class, 227–28, 229
 Air class, 233–34
 gas mixture, defining state/behavior of, 226–27
 general class hierarchy structure, 227–29
 N class, 241–42
 N2 class, 240–41
 NitrogenGas class, 242–45
 PerfectGas class, 227–28, 230–33
 RealGas class, 227–28, 234–38
 Species class, 238–40
 class hierarchy, 228
Class loader, 7
Class method, 70
Class variables, 24, 69–70, 91, 95–98
Classes, 12–13, 22, 23, 37, 65–90, *See also Abstract classes; Anonymous inner classes; Final classes; Instance (inner) nested classes; Nested classes; Static nested classes*
abstract, 87–89
 using, 88–89
access privileges, 67–68
constructors, 65, 72–74
declaration syntax, 66–67
defined, 65
encapsulation, 81–82
fields, declaring, 69–70
final, 89
garbage collector, 89–90
inheritance, 82–84
initializers, 65
members, 65
methods, declaring, 70–71
nested, 77–81
and object structure, 13
objects, 68–69
 copying, 75–77
static initialization blocks, 74
super keyword, 86
this keyword, 86–87
CLASSPATH environment variable, 143–44
Client machine, 436
 sending output back to, 443
Client-server relationship, 437
close() method:
 InputStream class, 385
 OutputStream class, 391
 Reader class, 396–97
 Writer class, 400
CmdLineDemo class, 408–9
Code blocks, 13
Code libraries, moving from Fortran to Java, 18–19
Collection classes, 170–71
Collection interface, 137
Collision integrals, 373
Color class, 176
Command line arguments, getting input, 407–9
CommandLine class, 120
Comment statements, 13
CommentDemo class, 43
Common Gateway Interface (CGI), 7
Comparator, 191
Comparator, defined, 191
compareTo() method, 190
CompareToIgnoreCase() method, 190
Compiler, 6, 8–9
 and exception handling, 18
 obtaining, 7
 options, 8
 output of, 9
Compressible boundary layer (example problem), 296–305
 CompressODE class, 300–302
 ShootingCompress class, 303–5
CompressODE class, 300–302
computeGaussWeights() method, 323–24
computeMolarMass() method, 235
computepressure() method, 404
computeTemperature() method, 404
ConcatDemo class, 189–90
Constants, 133
Constructors, 72–74
 classes, 65
Content panes, 420–21
continue statements, 61–62
Control statements, 54–60
 transfer of, 60–62
 break statements, 60–61
 continue statements, 61–62
 return statements, 62
ConvertDemo class, 207
CORBA Object Request Broker (ORB), 4
Core J2SE libraries, 174–76, *See also Java 2 Platform Standard Edition (J2SE)*
 java.io package, 174–75
 java.lang package, 174–75
 java.math package, 174–75
 java.util package, 175–76
Core JDBC API, 174
cos() method, 204
CreateDemo class, 69

- CreateString class, 188–89
 CreateWrapper class, 183–84
 Crocco's method, 304
 Curve fitting specified heat data (example problem), 370–73
- D**
 Damped spring motion (example problem), 280–85
 solution, 283–85
 SpringODE class, 282–83
 Damping forces, 281
 Data modeling, 365–79
 curve fitting specified heat data (example problem), 370–73
 DataModeling class, 368–69
 least squares fit to a polynomial equation, 366–68
 nonpolynomial equations, fitting to, 373–74
 Polynomial class, 369–70
 Power class, 374–78
 Data streams, 382–83
 Data types, moving from C++ to, 33
 DataInputStream class, 384, 386–87
 DataModeling class, 354, 358, 368–69, 374
 DataOutputStream class, 392–93
 Decimation in Frequency (DIF) technique, 349
 Decimation in Time (DIT) technique, 349
 DeclareDemo class, 99–100, 113–14
 Default access, 67–68
 variables, 102
 Deitel, Harvey M., 124
 Deitel, Paul J., 124
 Differential equations, 271–307
 compressible boundary layer (example problem), 296–305
 damped spring motion (example problem), 280–85
 solution, 283–85
 SpringODE class, 282–83
 defined, 271
 embedded Runge-Kutta algorithms, 285–91
 initial value problems, 275–76
 ODE class, 273–75
 ODESolver class, 279–80
 ordinary, 272–73
 first-order ODE, 272–73
 second-order ODE, 272
 partial, 306
 Runge-Kutta schemes, 276–80
 rungeKutta4() method, 279–83
 shooting methods, 292–96
 two-point boundary problems, 292, 305–6
 Dimension class, 176
 Discrete Fourier transform (DFT), 333–34, 336–43
 defined, 336
 discreteFT() method, 338–41
 TestDF class, 340–41
 discreteFT() method, 338–41, 343, 354
 do-while loops, 56–57
 do-while statement, 14
 Documentation comments, 13
 Double class, 184–86
 double data type, 14–15, 16, 24, 93, 208
 doubleValue() method, 183–84, 185
 DoWhileDemo class, 57
 Dynamic memory allocation, 17
 moving from C to Java, 27–28
- E**
 Eckel, Bruce, 225
 Electrostatic interface, 133
 Embedded Runge-Kutta algorithms, 285–91
 embeddedRK5() method, 287–91
 EmbedSpring class, 290–91
 Empty statement, 112
 Encapsulation, 37–38, 81–82, 111
 Enterprise JavaBeans, 30
 Enthalpy ratio, 299
 Enumerations, moving from C++ to Java, 34
 EqnSolver class, 249
 methods, testing, 263–65
 equals() method, 191
Essential JNI: Java Native Interface (Gordon), 124
 Euler's number, 199
 Event handlers, 427–30
 EventDemo class, 79–80
 Exception handling, 149–57
 Exception class hierarchy, 150–51
 moving from C to Java, 28
 moving from Fortran to Java, 18
 passing exceptions to another method, 156–57
 throw and throws keywords, 155–57
 try statements, 151–55
 catch clause, 152–53
 finally clause, 153
 try keyword, 152
 using, 154–55
 exp() method, 203–4
 Extensible Markup Language (XML), 173–78
 Java API for, 4
- F**
Fast Fourier Transform and Its Applications
 (Brigham), 334
 Fast Fourier transforms (FFTs), 334, 349–54
 Decimation in Frequency (DIF) technique, 349
 Decimation in Time (DIT) technique, 349

defined, 349–50
`fastFT()` method, 351–53
implementing as a Java method, 351
 `TestFFT` class, 353–54
`fastFT()` method, 351–53
`fastft()` method, 351–54
`fastFT()` method, 354
Fields, 12–13
 declaring, 69–70
`FileDemo` class, 412–14
`InputStream` class, 384, 387–88
`OutputStream` class, 393
`FileReader` class, 398
`FileWriter` class, 399, 401
`FilterInputStream` class, 384, 388
`FilterOutputStream` class, 390, 393
`FilterReader` class, 399
`FilterWriter` class, 403
Final classes, 89
`final` keyword, 89
Final methods, 124
Final, methods, 124
Final variables, 105–6
`finally` clause, 153
First-order ODE, 272–73
`FifthOrderDemo` class, 371–73
`Float` class, 184–86
float data type, 14–15, 24, 93, 208
`floor()` method, 209
`FlowLayout` layout manager, 426
`Fluids.Gas` package, 141–42
`flush()` method:
 `OutputStream` class, 391
 `Writer` class, 400
`Font` class, 176
for loops, 57–58
`ForDemo` class, 58
Fortran, 442
Forward transforms, 335–36
`Fourier` class, 339–40
Fourier transforms, 333–54
 composite signals, analyzing, 343–45
 defined, 333
 discrete Fourier transform (DFT), 333–34, 336–43
 defined, 336
 `discreteFT()` method, 338–41, 354
 `TestDF` class, 340–41
fast Fourier transforms (FFTs), 334, 349–54
 Decimation in Frequency (DIF) technique, 349
 Decimation in Time (DIT) technique, 349
 defined, 349–50
 `fastFT()` method, 351–53, 354
 implementing as a Java method, 351
 `TestFFT` class, 353–54
forward, 335–36
generic part implementation, 354
 `leastSquaresFit()` method, 354, 361, 363
inverse, 333, 335–36
sampling theory, 345–47
 aliasing, 346–47
signal characterization, 334–35
spectral leakage, 347–49
time and frequency function relationships, 336
`Fredholm` integrals, 308, 326
Free-form coding, 13
Free variables, 273
Freely Distributable Math Library (`fdl.libm`), 19
Full pivoting, 250–51
Function pointer, 355
Functions:
 integration of, 307–31
 moving from C to Java, 25–26
 moving from Fortran to Java, 15–16

G

Gamma function, 219–20
Garbage collector, 17, 89–90
`GasDriver` class, 71
`GasDriver3` class, 73–74
`GasDriver4` class, 76–77
`GasDriver5` class, 95
Gauss–Jordan elimination, 253–55, 261
Gauss–Legendre formula, 323
Gaussian elimination, 255–57
`gaussian()` method, 256–57, 261, 267
Gaussian quadrature methods, 322–26
`gaussJordan()` method, 254–56
`gaussLegendre()` method, 324–25
Geary, David, 420
Generic class libraries, 355–63
 defined, 355
 least squares fit (example), 356–58
 `LineDemo` Class, 361–63
 problem analysis, 356
 problem-specific part, implementing, 358–61
 testing, 361–63
`getContentPane()` method, 426
`getDensity()` method:
 `PerfectGas` class, 230
 `RealGas` class, 235
`getEnthalpy()` method, 136
 `PerfectGas` class, 230
`getEntropy()` method, 136
 `PerfectGas` class, 230
`getField()` method, 136

- `getFunction()` method, 355
 ODE class, 282, 301
- `getParameter()` method, 443
- `getParameter()` method, `ServletRequest` interface, 441
- `getPressure()` method, `RealGas` class, 235
- `getTemperature()` method, `RealGas` class, 235
- `getViscosity()` method:
 `PerfectGas` class, 230
 `RealGas` class, 236, 267–68
- `getWriter()` method, 443
- Glass panes, 420–21
- Gordon, Rob, 124
- Graphic Java, Volume 2: Swing (3rd ed.)* (Geary), 420
- Graphical User Interface (GUI), 3, *See also* GUI libraries
- Green Project, 2
- Grid, 306
- `GridBagLayout` class, 426
- GUI libraries, 176–78, 420–21
 `java.awt` package, 176
 `java.awt.event` package, 176
 `javax.swing` package, 177
 `javax.swing.border` package, 177
 `javax.swing.event` package, 177
 `javax.swing.table` package, 177
 `javax.swing.text` package, 177
 `javax.swing.tree` package, 177
- GUIs, 419–33
 `AtmGUI` class, 421–23
 final form of, 430–33
- container:
 adding components to, 425–27
 choosing, 422–23
- event handlers, 427–30
- GUI components, selecting, 423–25
- moving from C to Java, 30
- moving from Fortran to Java, 20
- H**
- `HashMap` class, 170, 183
- `HashSet` class, 170
- `Hashtable`, 170
- Header, 112
- Hooke’s law, 280–81
- `HttpServlet` class, 439–40
 subclass, general form of, 440–41
- I**
- I/O capability, 381–417
 atmosphere modeling tool (test case), 403–7
 byte input streams, 384–89
 byte output streams, 389–96
 character input streams, 396–99
 character output streams, 399–403
- command line arguments, getting input from, 407–9
- general concepts, 382–83
- `java.nio` package, 417
- moving from C++ to Java, built-in math functions, 35
- reading to a file, 412–14
- restoring objects, 414–16
- saving objects, 414–16
- streams, using, 409–11
- writing to a file, 412–14
- `IEEEremainder()` method, 209
- `if-else` statements, 54–55
- `IfDemo` class, 55
- `ImplementDemo` class, 135–36
- import declarations, 142–43
- Improper integrals, 308
 solving, 317–22
- `IncopDemo` class, 47
- Increment/decrement operators, 46–47
- Indices, arrays, 16–17
- `InfiniteChargedPlate` class, 134–35
- Inheritance, 39, 67, 82–84, 111
 and access modifiers, 84–85
 and interfaces, 136
 member hiding/member overriding, 86
 and method arguments, 85
 moving from C++ to Java, 34
- Initializers, classes, 65
- Input streams, 382–83
- `InputDemo` class, 122–23
- `InputStream` class, 385
 `close()` method, 385
- `InputStreamReader` class, 383, 398–99
- Inside Servlets: Server-Side Programming for the Java Platform (Callaway), 436
- Instance (inner) nested classes, 77, 78–80
- Instance methods, 16, 70, 116–18
- Instance variables, 70, 91, 95–98
- `InstanceDemo` class, 117–18
- int data type, 14–15, 24, 93, 208–9
- `Integer` class, 184–86
- Integral equations, 307–31
 closed-form solutions, 308–9
 Fredholm integrals, 308, 326
 Gaussian quadrature methods, 322–26
 general form of, 308
 general integral types, 326
 improper integrals, 308
 solving, 317–22
 open-form solutions, 308
 proper integrals, 308
 Simpson’s rule, 314–17
 thin airfoil theory (example), 326–31

trapezoidal algorithms, 309–14
`Integrator` class, 311–12, 319
Interfaces, 67, 131–38
compared to abstract classes, 132
declaring, 132–33
defined, 131
as an example of polymorphism, 40
implementing, 134–36
and inheritance, 136
instances as input parameters and return types, 136–38
members, 133
moving from C++ to Java, 34
Internet, 2
Inverse transforms, 335–36
`InvertDemo` class, 264–65
`invertMatrix()` method, 261–63
Ionized interface, 136
`IonizedSpecies` class, 84, 141

J

JANAF Thermochemical Tables, 370
`jar`, 4
`jar` utility, 145–49
 options, 145
`jarsigner`, 4
Java:
 access privileges, 67–68
 assignment operators, 14
 basic syntax, 41–64
 comments, 43
 general syntax, 41–43
 keyboard I/O, 62–64
 loops/control structures, 54–60
 operators, 44–54
 printing, 62–64
 simple Java program, 42–43
 braces, 13
 bytecode, 6
 class loader, 7
 classes, 12–13, 65–90
 declaration syntax, 66–67
 code blocks, 13
 comment statements, 13
 compiler, 6
 compiler options, 8
 expandability of, 7
 free-form coding, 13
 future of, 4
 history of, 2–4
 I/O capability, 381–417
 installing, 7–8
 as an interpreted language, 6
 Java APIs, 28–29

keywords, 15
loop and flow control structures, 14
mathematical operators, 14
memory model, 6
moving from C to, 21–30
 arrays, 26–27
 basic printing, 30
 basic syntax, 23
 built-in math functions, 29
 C structs, 23
 classes, 22, 23
 dynamic memory allocation, 27–28
 exception handling, 28
 functions, 25–26
 GUIs, 30
 I/O capability, 30
 libraries, 28–29
 main () method, 22
 methods, 25–26
 pointers, 25
 program structure, 22
 strings, 29
 variables, 24–25
 Web-base applications, 30
moving from C++ to, 31–36
 basic syntax, 32
 built-in math functions, 34–35
 data types, 33
 enumerations, 34
 I/O capability, 35
 inheritance, 34
 interfaces, 34
 memory management, 35–36
 pointers, 33–34
 preprocessor directives, 32–33
 strings, 35
 structures, 34
 unions, 34
moving from Fortran to, 11–20
 arrays, 16–17
 basic syntax, 13–14
 built-in math functions, 19
 code libraries, 18–19
 dynamic memory allocation, 17
 exception handling, 18
 functions, 15–16
 GUIs, 20
 I/O capability, 19–20
 methods, 15–16
 pointers, 17–18
 program structure, 12–13
 subroutines, 15–16
 variables, 12, 14–15
 Web-base applications, 20

- Java (*cont.*)
as multithreaded language, 7
object-oriented nature of, 5, 11
packages, 19, 28–29, 67
platform neutrality of, 5–6
primitive types, 15, 16
reference types, 15, 16
robustness of, 6
security of, 6–7
simplicity/familiarity of, 5
source code, initial release of, 3
as a standard, 1
as strongly typed language, 15
types, 14–15, 24–25
versatility of, 7
- Java 1.0, 2–3
Java 1.1, 3
Java 1.2, 3–4
Java 1.3, 4
Java 1.4, 4
Java 2 Platform Enterprise Edition (J2EE), 3, 173
 downloading, 7
 SDK, 438
- Java 2 Platform Micro Edition (J2ME), 3, 173
 downloading, 7
- Java 2 Platform Standard Edition (J2SE), 3
 core J2SE libraries, 174–76
 java.io package, 174–75
 java.lang package, 174–75
 java.math package, 174–75
 java.util package, 175–76
- GUI libraries, 176–78
 java.awt package, 176
 java.awt.event package, 176
 javax.swing package, 177
 javax.swing.border package, 177
 javax.swing.event package, 177
 javax.swing.table package, 177
 javax.swing.text package, 177
 javax.swing.tree package, 177
- obtaining, 7
- Java 2 Software Development Kit (SDK), 4
- Java APIs, 28–29, 69
 collection classes in, 170–71
- Java Archive (JAR) files, 139, 145–49
 creating, 146–47
 extracting files from, 147–48
 jar utility, 145–49
 running an application from, 148
 viewing the contents of, 147
- Java Authentication and Authorization Service (JAAS), 4
- Java class libraries, 173–78
- Java Cryptography Extension (JCE), 4
Java Database Connectivity (JDBC), 3, 174
Java Event Handling (Palmer), 428
Java How-to Program (Deitel/Deitel), 124
Java Naming and Directory Interface (JNDI), 4
Java Native Interface (JNI), 3, 19
Java Print Service API, 4
Java programs, compiling/running, 8–9
Java Secure Socket Extension (JSSE), 4
Java servlets, *See* Servlets:
Java Virtual Machine (JVM), 6
 obtaining, 7
 options, 9
- Java Virtual Machine (JVM), 438
- Java web server, 437–38
- Java Web Start, 4
- java.awt package, 176, 420, 426
java.awt.event package, 140, 176
- JavaBeans, 3–4
- javac, 4, 8
javadoc, 43
java.io package, 174–75, 381–83, 417
java.io.package, 19
java.lang package, 174–75, 197–98
java.math package, 174–75, 197, 212
java.nio package, 417
- JavaServer Pages (JSPs), 30
- java.swing.table package, 140
java.util package, 137, 159, 175–76
- javaw, 4
- javax.swing package, 177
- javax.swing.border package, 177
- javax.swing.event package, 177
- javax.swing.table package, 177
- javax.swing.text package, 177
- javax.swing.tree package, 177
- JButton, 426, 428
JButton class, 177
- JComboBox, 423–24, 428–29
- JFrame, 427
- JPanel, 426–27
- JRadioButton class, 177
- JSplitPane class, 177
- JTabbedPane class, 177
- JTable class, 177–78
- JTextArea, 424, 426, 429
- JTextField, 423–24, 429
- JToggleButton class, 177
- JTree class, 177–78

K

- Keyboard I/O, 62–64
Keywords, 15

L

Layered panes, 420–21
Least squares fit to a polynomial equation, 366–68
`leastSquaresFit()` method, 354, 361, 363, 366, 368–69, 371, 374
Length, arrays, 169–70
`length()` method, 191
Levenberg-Marquadt methods, 378
LexComparator class, 191–92
Libraries:
 core J2SE libraries, 174–76
 generic class libraries, 355–63
 GUI libraries, 176–78
 Java class libraries, 173–78
 Java I/O libraries, 383
 moving from C to Java, 28–29
 moving from Fortran to Java, 18–19
LineDemo Class, 361–63
LinkedHashMap class, 170
LinkedHashSet class, 171
LinkedList class, 171
`loadArrays()` method, 368–70, 374
 Polynomial class, 359–60
`log()` method, 203–4, 217
`log10()` method, 216–18
LogDemo class, 203–4
`logX()` method, 216–18
Long class, 184–86
long data type, 14–15, 93, 208
Loops, 54–60
Lower-upper decomposition (LU), 250, 257–61
`luDecomp()` method, 259–61

M

Maclaurin series, 216
`main()` method, 13, 42, 407–9
 general syntax, 119
 using command-line arguments in, 120
Math class, 197, 198–204
Math functions, *See* Built-in math functions:
Math2 class, 126–27
 compiling, 222
 final version of, 220–22
 methods, 222–23
Mathematical constants, 199
Matrix inversion, 261–63
`max()` method, 208–9
MaxDemo class, 208–9
Maximum methods, 208–9
Mean camber line, 327
Member hiding/member overriding, and inheritance, 86

Members:

 classes, 65
 interfaces, 133
Memory management, moving from C++ to Java, 35–36
META-INF directory, 146
Method arguments:
 arrays as, 167–69
 and inheritance, 85
Method chaining, 124–25
Method overloading, 126–27
Method overriding, 127–29
MethodArgDemo class, 85
Methods, 12–13, 111–30
 abstract, 123–24
 access modifiers, 114–16
 chaining, 124–25
 declaring, 70–71, 112–14
 final, 124
 input parameters, 121–23
 instance, 116–18
 `main()` method, 119–20
 moving from C to Java, 25–26
 moving from Fortran to Java, 15–16
 naming conventions/restrictions, 114
 native keyword, 124
 overloading, 126–27
 overriding, 127–29
 passing arguments to, 121–23
 return statement, 129–30
 signature, 40
 static, 118–19
 synchronized keyword, 124
 types of, 16
MethodsDemo class, 192
`midpoint()` method, 319–22
 source code, 320–21
 TestMidpoint class, 321–22
Midpoint rule, 318
`min()` method, 208–9
Minimum methods, 208–9
Miscellaneous operators, 51–53
MiscOpDemo class, 52–53
Monte Carlo algorithms, 378
Multiline comment, 13

N

N class, 241–42
N2 class, 240–41
Naming conventions:
 methods, 114
 variables, 101
native keyword, 124
Navier-Stokes equations, 271, 298

- Nested classes, 77–81
 anonymous inner classes, 77, 80–81
 defined, 77–78
 instance (inner) nested classes, 77, 78–80
 static nested classes, 77, 78
- Newton's second law, 281
- NitrogenGas class, 242–45
- Nonpolynomial equations, fitting to, 373–74
- Nonstatic fields, 69–70
- Nyquist sampling frequency, 345–46
- O**
- Oak, 2
- Object-oriented programming, 37–40
 classes, 37
 encapsulation, 37–38
 inheritance, 39, 67
 interfaces, 67
 objects, 37–38
 polymorphism, 40
- ObjectInputStream class, 384, 388–89
- ObjectOutputStream class, 393–95
- Objects, 13, 37–38, 68–69
 copying, 75–77
- ODE class, 273–75
- ODEshooter () method, 294–96, 303–4
- ODESolver class, 279–80, 356
- One-dimensional arrays, 160–61
- Open formulas, 318
- Operators, 44–54
 arithmetic operators, 44–45
 assignment operators, 45–46
 bitwise operators, 50–51
 boolean operators, 48–50
 increment/decrement operators, 46–47
 miscellaneous operators, 51–53
 precedence, 53–54
 relational operators, 47–48
- OpPrecedence class, 53
- Ordinary differential equations (ODEs), 271, 272–73
 first-order ODE, 272–73
 second-order ODE, 272
- Output streams, 382–83
- OutputStream class, 390–91
 close() method, 391
- OutputStreamWriter class, 401–2
- OverrideDemo class, 129
- P**
- Packages, 19, 28–29, 67, 139–48
 and access control, 144
 bytecode files of, 140
- CLASSPATH environment variable, 143–44
 defining, 140–42
 definition of, 139
 import declarations, 142–43
 including classes in, 141–42
 user-defined package, importing, 142–43
- Palmer, Grant, 428
- Panes, 420–21
- ParallelPlate class, 135
- parse() methods, 185–86
- ParseDemo class, 195–96
 parseDouble() method, Double class, 195
- Partial differential equations (PDEs), 271, 306
- Partial pivoting, 250–51
 partialPivot() method, 251–54
- Passing arguments to methods, 121–23
- Passing arrays as method arguments, 168–69
- Passing exceptions to methods, 156–57
- PerfectGas class, 227–28, 230–33
 getDensity() method, 230
 getEnthalpy() method, 230
 getEntropy() method, 230
 getViscosity() method, 230
- PipedInputStream class, 389
- PipedReader class, 399
- PipedWriter class, 403
- Pivoting, 250–53
 full, 250–51
 partial, 250–51
 partialPivot() method, 251–54
- Pointers:
 moving from C to Java, 25
 moving from C++ to, Java, 3
- Polymorphism, 40, 111–12
- Polynomial class, 358–61, 369–70
 pow() method, 201–2
- PowDemo class, 202
- Power class, 374–78
 PowerDemo class, 376–77
- Prandtl number, 299
- Precedence, 53–54
 operators, 53–54
- Preprocessor directives, moving from C++ to, 32–33
- Primitive types, 15, 16
 converting to strings, 193
 input arguments, 122–23
- Primitive variable wrapper classes, 179–81
 constructors, 182
 objects:
 converting to a primitive value, 184–85
 creating, 181–84
 parse() methods, 185–86

- p**
print() method:
 PrintStream class, 393
 PrintWriter class, 402–3
printArray() method, 168
PrinterWriter class, 402–3
Printing, 62–64
println () method, 42
println() method:
 PrintStream class, 394
 PrintWriter class, 402–3
PrintOutputStream class, 395–96
PrintStream class, 390
PrintWriter class, 399
private access, 67–68
 variables, 102
Program structure:
 moving from C to Java, 22
 moving from Fortran to, 12–13
Proper integrals, 308
protected access, 67–68, 144
 variables, 102
public access, 67–68
 variables, 102
Public interface, 133
PushbackReader class, 399
- Q**
Query string, 441
- R**
Random number generator methods, 211–12
RandomDemo class, 211–12
read() method:
 InputStream class, 385
 Reader class, 396–97
Reader class, 396–97
 close() method, 396–97
readFully() method:
 DataInputStream class, 387
 ObjectInputStream class, 388–89
readLine() method, 396
 BufferedReader class, 398–99, 412
readObject() method, ObjectInputStream
 class, 389, 416
Real gas viscosity method, 265–69
RealGas class, 227–28, 234–38
 getDensity() method, 235
 getPressure() method, 235
 getTemperature() method, 235
 getViscosity() method, 236
RealGasDriver class, 244–45
Rectangle class, 176
- Reference types, 15, 16
 converting to strings, 193
 input arguments, 122–23
Relational operators, 47–48
RelationalOpDemo class, 48
Remainder methods, 209–11
Remote Method Invocation (RMI), 3
RestoreObject class, 416–17
return statements, 62, 129–30, 218
Return types, arrays as, 167–69
ReturnDemo class, 130
rint() method, 209
rmic, 4
round() method, 209
RoundDemo class, 210–11
Rounding methods, 209–11
Runge-Kutta schemes, 276–80, 356
 orders of accuracy, 277–78
rungeKutta4() method, 279–84, 290
- S**
Sampling theory, 345–47
 aliasing, 346–47
SaveObject class, 415–16
Scope, variables, 108–10
ScopeDemo class, 109
Second-order ODE, 272
SequenceInputStream class, 389
Servlets:
 creating Web-based applications using, 435–48
 defined, 437
 and Java web server, 437
 required libraries/tools, 438
setContentPane() method, 426
setInitialConditions() class, ODE class,
 282, 301
setLayout() method, 426
Shadowed variables, 108, 121
Shape class, 88
Shooting, 292
ShootingCompress class, 303–5
Short class, 184–86
short data type, 14–15, 24, 93
Signature, methods, 40
Simple Java program, 42–43
SimpleGas class, 70
SimpleGas2 class, 71
SimpleGas3 class, 73
SimpleGas4 class, 75–76
SimpleGas5 class, 94–95
SimpleGas6 class, 100–101
SimpleProgram class, 42

- Simpson's rule:
- shared characteristic with trapezoidal algorithm, 315
 - TestSimpson* class, 316–17
 - simpsonsRule()* method, 315–19, 326, 329
 - source code, 316
 - sin()* method, 205
 - Single-line comments, 13
 - size()* method, *ByteArrayOutputStream* class, 391–92
 - Software Development Kit (SDK), 4, 7, 173
 - obtaining, 8
 - SolverDemo* class, 263–65
 - Sonine polynomial expansion, 266
 - Species* class, 83–84, 238–40
 - class hierarchy, 228
 - Species2* class, 87
 - SpeciesDriver* class, 142–43
 - Spectral leakage, 347–49
 - split()* method, 191
 - sqrt()* method, 201–2
 - SqrtFunction2* class, 321
 - Stack* class, 171
 - Static fields, 69–70
 - Static initialization blocks, 74
 - Static methods, 16, 70, 118–19
 - Static nested classes, 77, 78
 - StaticDemo* class, 118–19
 - StaticInitDemo* class, 74
 - StdIDemo* class, 410–11
 - Stream-based I/O system, 20
 - Streams, 381
 - StrictMath* class, 197, 198–204
 - String* class, 14–15, 20, 186–87
 - concatenating strings, 189–90
 - constructors, 187
 - converting primitive and reference types to strings, 193
 - creating strings, 188–89
 - methods, 190–92
 - string objects, obtaining, 187–89
 - StringBufferInputStream* class, 389
 - StringReader* class, 399
 - Strings:
 - concatenating, 189–90
 - converting primitive and reference types to, 189–90
 - converting to primitive values, 193–96
 - creating, 188–89
 - moving from C to Java, 29
 - moving from C++ to Java, 35
 - StringWriter* class, 403
 - struct type, 24
- Structures, moving from C++ to Java, 4
- Subroutines, moving from Fortran to Java, 15–16
- substring()* method, 191
- super* keyword, 86
- Swing containers, 420–21
- Swing GUI components, 421
- Swing GUI libraries, 4
- Swing packages, 4
- switch* statement, 14
- switch* statements, 59–60
- SwitchDemo* class, 60
- synchronized* keyword, 124
- synchronized* keyword, 133
- Syntax, 41–64
 - general syntax, 41–43
 - keyboard I/O, 62–64
 - loops/control statements, 54–62
 - do-while* loops, 56–57
 - if-else* statements, 54–55
 - for* loops, 57–58
 - switch* statements, 59–60
 - while* loops, 55–56
 - moving from C to Java, 23
 - moving from C++ to Java, 32
 - moving from Fortran to, 13–14
 - operators, 44–54
 - arithmetic operators, 44–45
 - assignment operators, 45–46
 - bitwise operators, 50–51
 - boolean operators, 48–50
 - increment/decrement operators, 46–47
 - miscellaneous operators, 51–53
 - precedence, 53–54
 - relational operators, 47–48
 - printing, 62–64
 - simple Java program, 42–43
- Systems of equations:
- EqnSolver* class, 249
 - methods, testing, 263–65
 - Gauss-Jordan elimination, 253–55
 - Gaussian elimination, 255–57
 - general considerations, 248
 - lower-upper decomposition, 257–61
 - matrix inversion, 261–63
 - pivoting, 250–53
 - real gas viscosity method, 265–69
 - solving, 247–70
 - test case, 249–50
- T**
- tan()* method, 205
- TechJava.Gas* package, 229, 231–33

- TechJava.MathLib package, 249, 273, 311, 313, 321
Ternary operators, 44
TestComplex class, 344–45
TestDFT class, 340–41
TestFFT class, 353–54
TestGauss class, 325–26
TestMidpoint class, 321–22
TestPoint class, 321–22
TestSimpson class, 316–17
TestTrap class, 314
Thermal boundary layer, 298
Thin airfoil theory (example), 326–31
ThinAirFoil class, 330
Thinking in Java (Eckel), 225
this keyword, 86–87
throw and throws keywords, 155–57
ThrowDemo class, 157
Tomcat server, 438
toString() method, 193
Transcendental math functions, 203–4
transient keyword, 133
Transient variables, 106
Trapezoidal algorithms, 309–14
Trapezoidal method, 310
trapezoidal() method, 311–14, 317, 319
 source code, 311–12
TreeMap class, 171
TreeSet class, 171
TrigDemo class, 205
Trigonometric methods, 204–6
trim() method, 191
try keyword, 152
try statements, 151–55
 catch clause, 152–53
 finally clause, 153
 try keyword, 152
 using, 154–55
TryDemo class, 154–55
Two-dimensional arrays, 161–64
Two-point boundary problems, 292, 305–6
TwoDimDemo class, 163–64
Types, 14–15
- U**
Unary operators, 44
Under-relaxation procedure, 293–94
union type, 24
Unions, moving from C++ to Java, 34
Universal Gas Constant, 226–27
USatm76 class, 404–7, 438
User-defined math functions, 215–24
- basic plan of attack, 216
comparing Java/C/Fortran values, 223–24
gamma function, 219–20
hyperbolic trigonometric methods, 218–19
logarithm methods, 217–18
Math2 class, 216–17
 compiling, 222
 final version of, 220–22
 methods, 222–23
User-defined package, importing, 142–43
UserMathDemo class, 222–23
 source code, 223
- V**
valueOf() class, Double class, 185–86
Variables, 12, 24–25, 91–110
 access modifiers, 102–3
 casting, 106–8
 class, 69–70, 91, 95–98, 99
 creating, 98–101
 defined, 91
 final, 105–6
 free, 273
 initializing, example of, 100–101
 instance, 70, 91, 95–98
 moving from C to Java, 24–25
 moving from Fortran to Java, 14–15
 naming conventions/restrictions, 101
 primitive type, 92–95, 98
 reference type, 92–95, 98
 scope, 108–10
 shadowed, 108, 121
 transient, 106
 values, accessing, 103–5
 visible, 108
 volatile, 106
Vector class, 171
ViscosityDemo class, 268–69
volatile keyword, 133
Volatile variables, 106
Volterra integrals, 326
- W**
Web-base applications:
 moving from C to Java, 30
 moving from Fortran to Java, 20
Web-based applications:
 AtmServlet class, 443–47
 basics of, 436–37
 client machine, sending output back to, 443
 creating using servlets, 435–48
 deploying, 447–48

- Web-based applications (*cont.*)
 HttpServlet class, 439–40
 subclass, general form of, 440–41
 input parameters, extracting, 441
 server-based applications, running, 442
 web-based atmosphere modeling tool, 438
- Weights, 322
- while loops, 55–56
- while statement, 14
- write()** method:
 OutputStream class, 391
 Writer class, 400
- writeBytes()** method, **DataOutputStream** class, 393
- writeChars()** method, **DataOutputStream** class, 393
- writeObject()** method, **ObjectOutput-Stream** class, 393, 415
- Writer** class, 399–400
 close() method, 400
- writeUTF()** method, **DataOutputStream** class, 393