

# Index

## Symbols

- & (ampersand)
  - && operator, 98, 102
  - gsub/gensub/sub functions and, 153
- < (left angle bracket)
  - < operator, 95, 102
  - < operator (I/O), 53
  - <= operator, 95, 102
- > (right angle bracket)
  - > operator, 95, 102
  - > operator (I/O), 68
  - >> operator (I/O), 68, 102
  - >= operator, 95, 102
- \* (asterisk)
  - \* operator
    - as multiplication operator, 101
    - null strings, matching, 155
    - as regexp operator, 24
  - \*\* operator, 86, 101, 198
  - \*\*= operator, 90, 102, 198
  - \*= operator, 90, 102
- \ (backslash), 5, 7-8, 23
  - \< operator (gawk), 28
  - \> operator (gawk), 28
  - \' operator (gawk), 28
  - \' operator (gawk), 28
  - \ / escape sequence, 22
  - \ " escape sequence, 22
  - \ a escape sequence, 21
  - \ b escape sequence, 21
  - \ B operator (gawk), 28
  - in character lists, 26
  - continuing lines and, 15, 247
    - comments and, 16
    - in csh, 14, 16
  - in escape sequences, 21-22
    - POSIX and, 22
  - \ f escape sequence, 21
  - as field separators, 44
  - gsub/gensub/sub functions and, 153
  - \ n escape sequence, 21
  - \ nnn escape sequence, 21
  - \ r escape sequence, 21
  - regexp constants, 31
  - \ t escape sequence, 21
  - \ v escape sequence, 21
  - \ W operator (gawk), 28
  - \ w operator (gawk), 28
  - \ x escape sequence, 21
  - \ y operator (gawk), 28
- ! (exclamation point)
  - ! operator, 98, 101, 246
  - != operator, 95, 102
  - !~ operator, 20, 30-31, 80, 95-96, 102, 104
- | (vertical bar), 24
  - | operator (I/O), 54, 68, 102
  - |& operator (I/O), 56, 69, 102, 187, 287
    - pipes, closing, 77
    - two-way communications, 189
  - || operator, 98, 102
- { } (braces)
  - actions and, 110
  - pgawk program, 192

We'd like to hear your suggestions for improving our indexes. Send email to [index@oreilly.com](mailto:index@oreilly.com).

- { (braces) (continued)
  - statements, grouping, 111
- [ (square brackets), 24
- ^ (caret), 23, 28
  - ^ operator, 101, 198
  - ^= operator, 90, 102, 198
  - in character lists, 26
- , (comma), in range patterns, 106
- (hyphen)
  - operator, 90
  - operator, 92, 101-102
  - (decrement/increment) operator, 101
  - = operator, 102
  - in character lists, 26
  - filenames beginning with, 196
- \$ (dollar sign), 23
  - \$ field operator, 37, 101
  - incrementing fields and arrays, 92
- . (period), 23
- = (equals sign)
  - = operator, 88
  - == operator, 95, 102
- # (number sign)
  - #! (executable scripts), 6
  - portability issues with, 6
  - commenting, 6
- () (parentheses), 24
  - pgawk program, 192
- % (percent sign)
  - % operator, 101
  - %= operator, 90, 102
- + (plus sign), 25
  - + operator, 92, 101-102
  - += operator, 90, 102
  - ++ operator, 101
  - decrement/increment operators, 92
- ; (semicolon), 16
  - AWKPATH variable and, 345
  - separating statements in actions, 110-111
- / (forward slash), 19
  - / operator, 101
  - /= operator, 90, 102
  - vs. /=.../ regexp constant, 91
  - patterns and, 104
- ~ (tilde)
  - ~ operator, 20, 30-31, 80, 95-96, 102, 104
- \_ (underscore)
  - \_ C macro, 176, 178
  - in names of private variables, 208
- " (double quote), 5, 8
  - regexp constants, 31
- ' (single quote), 4, 6-9
  - vs. apostrophe, 7
  - with double quotes, 9

- ? (question mark), 25, 28
  - ?: operator, 102

## A

- account information, 228, 232
- actions, 110
  - control statements in, 111-119
  - default, 11
  - empty, 11
- adding
  - features to gawk, 351-353
  - fields, 40
  - functions to gawk, 354-364
- advanced features
  - buffering, 157
  - close function, 76
  - constants, values of, 80
  - datafiles as single record, 36
  - fixed-width data, 46
  - FNR/NR variables, 126
  - gawk, 185-193
    - BSD portals, 189
    - network programming, 188
    - nondecimal input data, 185
    - processes, communicating with, 186
  - network connections, 185, 288
    - (see also networks, connections)
  - null strings, matching, 155
  - operators, precedence, 93
  - pipng into sh, 70
  - regexp constants, 91
- alarm clock example program, 260-262
- alarm.awk program, 260
- algorithms, 369
- Alpha (DEC), xxi
- ampersand (&)
  - && operator, 98, 102
  - gsub/gensub/sub functions and, 153
- and function, 164
- AND operation, 164-166
- and operator, 97
- Apache server, 313
  - PUT method and, 319
- ARGC/ARGV variables, 123, 127
  - command-line arguments, 200
  - portability and, 6
- ARGIND variable, 123
  - command-line arguments, 200
- arguments
  - command-line, 123, 127, 200
  - invoking awk, 194
  - in function calls, 99

- arguments (continued)
    - processing, 222
    - retrieving, 357
  - arithmetic operators, 85
  - arrays, 129-141
    - associative, 130
      - clearing, 356
      - library functions and, 209
    - elements
      - assigning, 133
      - deleting, 135
      - installing, 356
      - order of, 135
      - referencing, 132
      - retrieving number of, 145
    - for statement and, 134
    - IGNORECASE variable and, 131
    - indexing, 130-132
    - merging into strings, 216
    - multidimensional, 138
      - scanning, 139
    - names of, 129
    - as parameters to functions, 171
    - scanning, 134
    - sorting, 140
      - IGNORECASE variable and, 141
    - sparse, 131
    - subscripts, 136
      - uninitialized variables as, 137
  - artificial intelligence, gawk and, 339
  - ASCII, 215
  - asort function (gawk), 145
    - arrays, sorting, 140
  - assert function
    - C library, 211-213
    - user-defined, 212
  - assertions, 211-213
  - assign option, 195
  - assignment operators, 88-91
    - evaluation order, 90
    - lvalues/rvalues, 89
  - assignments as filenames, 221
  - assoc\_clear/assoc\_lookup internal functions, 356
  - associative arrays, 130
  - asterisk (\*)
    - \* operator
      - as multiplication operator, 101
      - null strings, matching, 155
      - as regexp operator, 24
    - \*\* operator, 86, 101, 198
    - \*\*= operator, 90, 102, 198
    - \*= operator, 90, 102
  - atan2 function, 144
  - awk, xv
    - function of, 3
    - gawk and, xv, xviii
    - history of, xvi
    - implementation issues
      - pipes, 70
    - implementations, 348-349
      - limits, 56
    - invoking, 194
    - new vs. old, xvii
      - OFMT variable, 85
    - POSIX and, xv
      - (see also POSIX)
    - regexp constants and, 96
    - terms describing, xvii
    - uses for, xv, 3, 17
    - versions of, xvii, 327-330
      - changes between SVR4 and POSIX
        - awk, 329
      - changes between V7 and SVR3.1, 327-328
        - (see also Bell Laboratories awk)
      - (see also gawk)
  - awk programs, 3, 6, 13
    - complex, 18
    - documenting, 6, 208
    - examples of, 237-280
    - execution of, 117
    - internationalizing, 166, 177-182
    - lengthy, 5
      - assertions, 211
    - location of, 195
    - one-line examples, 11
    - profiling, 190-193
      - enabling, 198
    - running, 4-5
      - without input files, 4
      - from shell scripts, 4
      - shell variables in, 109
  - awka compiler, 349
  - awk.h file (internal), 355
  - AWKNUM type, 355
  - AWKPATH environment variable, 201, 345
  - awkprof.out file, 190
  - awksed.awk program, 273
  - awkvars.out file, 196
- ## B
- backslash (\), 5, 7-8, 23
    - \< operator (gawk), 28
    - \> operator (gawk), 28
    - \` operator (gawk), 28

- backslash (\) (continued)
    - \' operator (gawk), 28
    - \/ escape sequence, 22
    - \\" escape sequence, 22
    - \B operator (gawk), 28
    - in character lists, 26
    - continuing lines and, 15, 247
      - comments and, 16
      - in csh, 14, 16
    - in escape sequences, 21-22
      - POSIX and, 22
    - as field separators, 44
    - gsub/gensub/sub functions and, 153
    - \\n escape sequence, 21
    - \\nnn escape sequence, 21
    - \\r escape sequence, 21
    - regex constants, 31
    - \\t escape sequence, 21
    - \\v escape sequence, 21
    - \\w operator (gawk), 28
    - \\W operator (gawk), 28
    - \\x escape sequence, 21
    - \\y operator (gawk), 28
  - BBS-list file, 10
  - BEGIN pattern, 34, 42, 107-109
    - assert user-defined function and, 213
    - Boolean patterns and, 105
    - exit statement and, 119
    - getline and, 57
    - headings, adding, 60
    - next/nextfile statements and, 108, 117
    - OFS/ORS variables, assigning values to, 61
    - operators and, 107
    - pgawk program, 191
    - print statement and, 108
    - pwcat program, 230
    - running awk programs and, 239
    - TEXTDOMAIN variable and, 178
  - beginfile user-defined function, 220
  - Bell Laboratories awk extensions, 330
  - binary input/output, 120
  - bindtextdomain function
    - C library, 175, 178
    - gawk, 166
    - portability and, 181
  - BINMODE variable, 120, 345
  - bits2str user-defined function, 165
  - bitwise
    - complement, 164
    - operations, 164-166
    - shift, 164
  - body
    - in actions, 111
    - in loops, 112
  - Boolean expressions, 97-98
    - as patterns, 105
  - Boolean operators (see Boolean expressions)
  - Bourne shell
    - backslash continuation and, 16
    - quoting rules for, 7
  - braces ({} )
    - actions and, 110
    - pgawk program, 192
    - statements, grouping, 111
  - bracket expressions (see character lists)
  - break statement, 115
  - BSD portals, 189
  - buffering
    - input/output, 157, 187
    - interactive vs. noninteractive, 157
  - buffers
    - flushing, 156-157
    - operators for, 28
  - built-in functions, 142-166
    - evaluation order, 143
  - built-in variables, 120-123
    - conveying information, 123-126
    - user-modifiable, 120-123
    - v option, setting with, 195
- ## C
- C shell, backslash continuation and, 16
  - call by reference, 171
  - call by value, 170
  - caret (^), 23, 28
    - ^ operator, 101, 198
    - ^= operator, 90, 102, 198
    - in character lists, 26
  - case sensitivity
    - array indices and, 131
    - converting case, 152
    - example programs, 208
    - gawk, 30
    - regexps and, 29-30, 121
    - string comparisons and, 121
  - CGI (Common Gateway Interface)
    - dynamic web pages and, 293
    - files, 313
    - library, 298-301
  - character encodings, 215
  - character lists, 24, 26-28
    - character classes, 26

- character lists (continued)
    - collating elements, 27
    - complemented, 24
    - non-ASCII, 27
    - range expressions, 26
  - character sets, 24, 215
    - (see also character lists)
  - characters
    - counting, 256-259
    - transliterating, 262-264
    - values of as numbers, 214
  - chdir function, implementing in
    - gawk, 358-364
  - chr function, 215
  - Cliff random numbers, 214
  - cliff\_rand user-defined function, 214
  - close function, 54-55, 74, 155
    - return values, 76
    - two-way pipes and, 187
  - collating elements, 27
  - columns
    - aligning, 60
    - cutting, 238-243
  - comma (,), in range patterns, 106
  - command line
    - arguments, 123, 127, 200
    - formats, 4
    - FS on, setting, 44
    - invoking awk from, 194
    - options, 5, 44, 195-200
      - end of, 196
    - variables, assigning on, 83
  - command-line options
    - processing, 222-227
    - string extraction, 179
  - commenting, 6
    - backslash continuation and, 16
  - Common Gateway Interface (see CGI)
  - comparison expressions, 94-97
    - as patterns, 104
    - string vs. regexp, 96
  - compat option (gawk), 196
  - compatibility mode (gawk)
    - extensions, 331-335
    - filenames, 73
    - hexadecimal numbers, 80
    - octal numbers, 80
    - specifying, 196
  - compiled programs, 367
  - compl function (gawk), 164
  - comp.lang.awk newsgroup, 347
  - complement, bitwise, 164
  - compound statements, control statements
    - and, 111
  - concatenating, 87
  - conditional expressions, 99
  - configuration options, gawk, 342
  - constants
    - nondecimal, 185
    - types of, 79-80
  - continue statement, 116
  - control statements, 111-119
  - converting
    - case, 152
    - dates to timestamps, 160
    - during subscripting, 137
    - numbers, 84
      - to strings, 166
    - strings to numbers, 84
  - CONVFMT variable, 84, 120
    - array subscripts and, 136
  - coprocesses, 69, 187
    - closing, 74-77
    - getline from, 56
  - copyleft option, 196
  - copyright option, 196
  - cos function, 144
  - counting, 256-259
  - csh utility, 16
    - backslash continuation and, 14
    - coprocesses and, 187
    - POSIXLY\_CORRECT environment variable, 200
  - currency symbols, localization, 176
  - custom.h file, 343
  - cut utility, 238-243
  - cut.awk program, 239
- ## D
- dark corner, xxi, 44, 65, 93
    - array subscripts, 138
    - break statement, 115
    - close function, 76
    - command-line arguments, 84
    - continue statement, 116
    - CONVFMT variable, 85
    - escape sequences, 201
      - for metacharacters, 22
    - exit statement, 119
    - field separators, 46
    - FILENAME variable, 57, 124
    - FNR/NR variables, 126
    - format-control characters, 64
    - input files, 35

- dark corner (continued)
  - invoking awk, 194
  - multiline records, 49
  - NF variable, decrementing, 41
  - OFMT variable, 62
  - RAW protocol, 286
  - regexp constants, 81
    - /= operator and, 91
    - as arguments to user-defined functions, 82
  - split function, 148
  - strings, storing, 36
- dash (see hyphen)
- data, fixed-width, 46
- database
  - group, reading, 232-236
  - users, reading, 228-232
- data-driven languages, 369
- date utility
  - GNU, 159
  - POSIX, 163
- dates
  - converting to timestamps, 160
  - information related to, localization, 177
- d.c. (see dark corner)
- dcgettext function (gawk), 166, 177
  - portability and, 181
- deadlocks, 187
- debugging gawk, 203
  - bug reports, 346-347
- decrement operators, 92-93
- delete statement, 135
- deleting elements in arrays, 135
- /dev/. . . special files (gawk), 71
- differences in awk and gawk
  - ARGC/ARGV variables, 128
  - ARGIND variable, 123
  - array elements, deleting, 136
  - asort function, 146
  - asort function (gawk), 145
  - AWKPATH environment variable, 201
  - BEGIN/END patterns, 108
  - BINMODE variable, 120, 345
  - close function, 75-76
  - ERRNO variable, 124
  - error messages, 71
  - FIELDWIDTHS variable, 120
  - function arguments (gawk), 143
  - gensub function (gawk), 152
  - getline command, 51
  - IGNORECASE variable, 121
  - implementation limitations, 56, 70
  - input/output operators, 56, 69
  - line continuations, 99
  - LINT variable, 121
  - match function, 147
  - next/nextfile statements, 117
  - print/printf statements, 64
  - PROCINFO variable, 125
  - record separators, 35
  - regexp constants, 82
  - regular expressions, 30
  - RS/RT variables, 36
  - RT variable, 126
  - single-character fields, 43
  - split function, 148
  - strings, 79
    - storing, 36
  - strtonum function (gawk), 149
  - TEXTDOMAIN variable, 123
  - trunc-mod operation, 86
- directories
  - changing, 358-364
  - searching, 201, 280
- disable-nls configuration option, 342
- division, 86
- do statement, 20
- documentation
  - of awk programs, 208
  - GNU FDL, 382-389
  - GPL, 374-381
  - online, xxi
- documents, searching, 259
- dollar sign (\$), 23
  - \$ field operator, 37, 101
  - incrementing fields and arrays, 92
- double quote ("), 5, 8
  - regexp constants, 31
- double-precision floating-point, 370
- do-while statement, 113
- dump-variables option, 196, 209
- dupnode internal function, 356
- dupword.awk program, 259

## E

- EBCDIC, 215
- egrep utility, 26, 243
- egrep.awk program, 244
- elements in arrays, 132
  - assigning, 133
  - deleting, 135
  - order of, 135
  - scanning, 134
- ELIZA program, 302, 305
- email, 292

- embedded systems, remote configuration
  - of, 308-310
- empty pattern, 109
- empty programs, invoking awk with, 194
- empty strings (see null strings)
- enable-portals configuration option, 342
- enable-portals option, 189
- END pattern, 107-109
  - assert user-defined function and, 212
  - backslash continuation and, 247
  - Boolean patterns and, 105
  - exit statement and, 119
  - next/nextfile statements and, 108, 117
  - operators and, 107
  - pgawk program, 191
  - print statement and, 108
- endfile user-defined function, 220
- endgrent user-defined function, 236
- endpwent user-defined function, 232
- ENVIRON variable, 124
- environment variables, 124
- equals sign (=)
  - = operator, 88
  - == operator, 95, 102
- equivalence classes, 27
- EREs (Extended Regular Expressions), 26
- ERRNO variable, 51, 124, 357
- error handling, 71
  - ERRNO variable and, 124
- error output, 71
- escape processing, gsub/gensub/sub
  - functions, 153
- escape sequences, 21
  - unrecognized, 198
- evaluation order, 93
  - concatenation, 87
  - functions, 143
- exclamation point (!)
  - ! operator, 98, 101, 246
  - != operator, 95, 102
  - !~ operator, 20, 30-31, 95-96, 102, 104
- exit statement, 119
- exp function, 143
- expand utility, 12
- expressions, 78-102
  - assignment, 88-91
  - Boolean, 97-98
  - comparison, 94-97
  - conditional, 99
  - matching (see comparison expressions)
  - as patterns, 104
  - selecting, 99
- Extended Regular Expressions (EREs), 26
- extension function, 364

- extensions
  - Bell Laboratories awk, 330
  - in gawk, not in POSIX awk, 331-335
  - mawk, 349
- extract.awk program, 270

## F

- F option, 44, 195
  - Ft sets FS to tab, 199
  - troubleshooting, 203
- f option, 5, 195
  - on command line, 199
- false, logical, 93
- FDL (Free Documentation License), 382-389
- features
  - adding to gawk, 351-353
  - advanced (see advanced features)
  - deprecated, 202
- fflush function, unsupported, 198
- field numbers, 38
- field operators, dollar sign as, 37
- field separators, 40-46, 121-122
  - choice of, 42
  - on command line, 44
  - FIELDWIDTHS variable and, 120
  - in multiline records, 49
  - POSIX and, 36, 46
  - regular expressions as, 42-43
  - spaces as, 240
  - (see also OFS)
- fields, 33, 369
  - adding, 40
  - changing contents of, 39-41
  - cutting, 238-243
  - examining, 36-38
  - number of, 37
  - numbers, 38
  - printing, 59
  - separating, 41-46
  - (see also field separators)
  - single-character, 43
- field-separator option, 195
- FIELDWIDTHS variable, 47, 120
- file descriptors, 71
- file option, 195
- FILENAME variable, 33, 124
  - getline, setting with, 57
- filenames
  - assignments as, 221
  - in compatibility mode, 73
  - distinguishing, 124
  - for network access, 282-284

- filenames (continued)
  - standard streams in gawk, 71
- files
  - awk programs in, 5
  - awkprof.out, 190
  - awkvars.out, 196
  - CGI, 313
  - closing, 155
  - descriptors (see file descriptors)
  - /dev/. . . special files, 71
  - group, 232
  - /inet/ (gawk), 188, 282
  - /inet/raw (gawk), 286
  - /inet/tcp (gawk), 285
  - /inet/udp (gawk), 285
  - information about, retrieving, 358-364
  - initialization and cleanup, 219
  - input (see input files)
  - log, timestamps in, 158-163
  - managing, 218-222
    - datafile boundaries, 219
  - message object, 175
    - converting from portable object files, 183
    - specifying directory of, 175, 178
  - .mo, 175
    - converting from .po, 183
    - specifying directory of, 175, 178
  - multiple passes over, 201
  - multiple, duplicating output into, 251
  - output (see output files)
  - /p, 189
  - password, 228
  - .po, 175, 179
    - converting to .mo, 183
  - portable object, 175, 179
    - converting to message object files, 183
    - generating, 197
  - portal, 189
  - for process information, 72
  - processing, ARGIND variable and, 123
  - reading, 220
    - multiline records, 48-51
  - searching for regular
    - expressions, 243-247
  - as single records, 36
  - skipping, 221
  - source, search path for, 280
  - splitting, 249-251
  - Texinfo, extracting programs
    - from, 269-272
- finger utility, 290
- fixed-width data, 46
- flag variables, 98, 251
- floating-point, 372
  - numbers, 369
    - AWKNUM internal type, 355
- FNR variable, 33, 124
  - changing, 126
- for statement, 113
  - in arrays, 134
- force\_number internal function, 355
- force\_string internal function, 355
- format specifiers
  - mixing regular with positional specifiers, 180
  - printf statement, 63
  - strftime function (gawk), 160
- format strings, 62
- formats, numeric output, 61
- formatting output, 62
- forward slash (/), 19
  - / operator, 101
  - /= operator, 90, 102
    - vs. /= . . . / regexp constant, 91
  - patterns and, 104
- Free Documentation License (FDL), 382-389
- Free Software Foundation (FSF), xxi, 337
- free\_temp macro, 356
- FS variable, 41, 121
  - changing value of, 41, 203
  - field-separator option and, 195
  - as null string, 44
  - running awk programs and, 239
  - setting from command line, 44
  - as tab character, 198
- FSF (Free Software Foundation), xxi, 337
- function calls, 99
- functions, 17
  - arrays as parameters to, 171
  - built-in, 99, 142-166
    - adding to gawk, 354-364
    - evaluation order, 143
  - defining, 167-170
  - library, 207-236
    - assertions, 211-213
    - associative arrays and, 209
    - C library, 222-236
    - character values as numbers, 214
    - Cliff random numbers, 214
    - command-line options, 222-227
    - example program for using, 274-280
    - group database, reading, 232-236
    - managing datafiles, 218-222
    - managing time, 217
    - merging arrays into strings, 216
    - nextfile statement, 210-211



functions, library (continued)  
    rounding numbers, 213  
    user database, reading, 228-232  
names of, 129, 167  
recursive, 168  
return values, setting, 357  
string-translation, 166  
undefined, 171  
user-defined, 166-173  
    calling, 170-172  
    counts, 192  
    library of, 207-236  
    next/nextfile statements and, 117-118

## G

gawk, xv  
    awk and, xv, xviii  
    bitwise operations in, 164  
    break statement in, 115  
    built-in variables and, 120  
    character classes and, 28  
    coding style in, 351  
    command-line options, 29  
    comparison operators and, 95  
    configuring, 343  
        options, 342  
    continue statement in, 116  
    debugging, 203  
    distribution, 338-341  
    escape sequences, 22  
    extensions, disabling, 198  
    features  
        adding, 351-353  
        advanced, 185-193  
    fflush function in, 156  
    field separators and, 121  
    FIELDWIDTHS variable in, 120  
    filenames in, 70-74  
    format-control characters, 64  
    function arguments and, 143  
    functions, adding, 354-364  
    hexadecimal numbers and, 80  
    IGNORECASE variable in, 121  
    implementation issues, 350-366  
        debugging, 350  
        downward compatibility, 350  
        limits, 56  
        pipes, 70  
    installing, 337-349  
    internal expressions and, 25  
    internals, 355-358  
    internationalization and (see  
        internationalization)  
    interpreter, adding code to, 363, 366  
    line continuation in, 99  
    LINT variable in, 121  
    MS-DOS version of, 345  
    networking, 281-306  
        connections, 283, 287-289  
        filenames, 282-284  
        resources about, 323  
        service, establishing, 290  
        troubleshooting, 305  
        (see also email)  
    newlines in, 15  
    nextfile statement in, 118, 210  
    octal numbers and, 80  
    OS/2 version of, 345  
    regexp constants and, 81  
    regular expressions  
        case sensitivity, 30  
        operators, 28-29  
        precedence, 25  
    source code, obtaining, 337  
    splitting fields and, 48  
    string-translation functions, 166  
    timestamps, 158-163  
    uses for, xv  
    versions of  
        changes between SVR3.1 and  
        SVR4, 328  
        information about, printing, 199  
        web and (see web service)  
        word-boundary operator, 28  
        (see also awk)  
General Public License (see GPL)  
--gen-po option, 179, 197  
gensub function (gawk), 82  
    escape processing, 153  
get\_argument internal function, 357  
getgrent function  
    C library, 232, 236  
    user-defined, 232, 236  
getgrgid function  
    C library, 236  
    user-defined, 236  
getgrnam function  
    C library, 235  
    user-defined, 235  
getgruser function  
    C library, 236  
    user-defined, 236  
getline command, 33, 287  
    coprocesses, using from, 56, 74

getline command (continued)  
 deadlock and, 187  
 explicit input with, 51-57  
 FILENAME variable, 57  
 \_gr\_init user-defined function, 234  
 \_pw\_init function, 230  
 return values, 51  
 variants, 57  
getopt function  
 C library, 222, 225  
 user-defined, 222, 225  
getpwent function  
 C library, 228, 231  
 user-defined, 228, 231  
getpwnam function  
 C library, 231  
 user-defined, 231  
getpwuid function  
 C library, 231  
 user-defined, 231  
getservbyname function (C library), 189  
gettext function (C library), 176  
gettext library, 175-177  
 locale categories, 176  
gettimeofday user-defined function, 217  
GETURL program, 307  
GIF image format, 293  
 generating, 313-318  
GNITS mailing list, xxiii  
GNU awk (see gawk)  
GNU long options, 194-196  
 printing list of, 197  
GNU Project, xxi  
GNU/Linux, xxi  
GNUPlot utility, 298, 313-318  
GPL (General Public License), xxi, 374-381  
 printing, 196  
grcat program, 232  
\_gr\_init user-defined function, 234  
group database, reading, 232-236  
group file, 232  
groups, information about, 232  
gsub function, 82, 150  
 arguments of, 150  
 escape processing, 153

## H

--help option, 197  
hexadecimal  
 numbers, 79  
 values  
 enabling interpretation of, 197  
 POSIX and, 21

histsort.awk program, 268  
hostname field, 283  
HTML (Hypertext Markup Language), 293  
HTTP (Hypertext Transfer Protocol), 293  
 embedded systems, configuring, 308-310  
 record separators and, 293  
HTTP server, core logic, 295  
HUP signal, 193  
hyperlinks  
 extracting, 312  
 for gawk networking, 323  
Hypertext Markup Language (HTML), 293  
Hypertext Transfer Protocol (see HTTP)  
hyphen (-)  
 - operator, 90, 92, 101-102  
 -- (decrement/increment) operators, 101  
 -= operator, 102  
 in character lists, 26  
 filenames beginning with, 196

## I

id utility, 247  
id.awk program, 247  
if statement, 20  
 actions, changing, 106  
if-else statement, 111  
igawk.sh program, 276  
IGNORECASE variable, 30, 121  
 array sorting and, 141  
 array subscripts and, 131  
 in example programs, 208  
images  
 generating, 313-318  
 retrieving over networks, 293  
 in web pages, 298  
implementation issues, gawk, 350-366  
 debugging, 350  
 limits, 56, 70  
in operator, 95, 102, 249  
 arrays and, 132, 134  
increment operators, 92-93  
index function, 146  
indexing arrays, 130-132  
/inet/ files (gawk), 188, 282  
/inet/raw files (gawk), 286  
/inet/tcp files (gawk), 285  
/inet/udp files (gawk), 285  
initialization, automatic, 14  
input  
 data, nondecimal, 185  
 explicit, 51-57  
 files (see input files)

- input (continued)
  - multiline records, 48-51
  - redirection, 53
  - splitting into records, 33-36
  - standard, 4, 71
- input files, 33
  - closing, 74-77
  - counting elements in, 256-259
  - examples, 10
  - reading, 33-57
  - running awk without, 4
  - skipping, 210
  - variable assignments and, 200
- input pipeline, 54
- input/output
  - from BEGIN and END, 108
  - binary, 120
  - two-way, 187, 282
    - (see also gawk, networking)
- installing gawk, 337-349
- int function, 143
- integers, 369
  - unsigned, 370
- interacting with other programs, 156
- internationalization, 166, 174
  - localization, 123, 174-184
    - character classes, 27
    - gawk and, 174
    - locale categories, 176
    - marked strings, 177
    - portability and, 181
- Internet (see networks)
- interpreted programs, 367
- interval expressions, 25
- inventory-shipped file, 10

## J

- join user-defined function, 216

## K

- kill command, dynamic profiling, 193

## L

- labels.awk program, 265
- languages, data-driven, 369
- LC\_ALL locale category, 177
- LC\_COLLATE locale category, 176
- LC\_CTYPE locale category, 176
- LC\_MESSAGES locale category, 176
  - bindtextdomain function (gawk), 178
- LC\_MONETARY locale category, 176
- LC\_NUMERIC locale category, 177

- LC\_RESPONSE locale category, 177
- LC\_TIME locale category, 177
- left angle bracket (<)
  - < operator, 95, 102
  - < operator (I/O), 53
  - <= operator, 95, 102
- left shift, bitwise, 164
- leftmost longest match, 49
- length function, 146
- libraries of awk functions, 207-236
  - assertions, 211-213
  - associative arrays and, 209
  - character values as numbers, 214
  - command-line options, 222-227
  - example program for using, 274-280
  - group database, reading, 232-236
  - managing
    - datafiles, 218-222
    - time, 217
  - merging arrays into strings, 216
  - nextfile statement, 210-211
  - rounding numbers, 213
  - user database, reading, 228-232
- line breaks, 15
- line continuations, 98
  - with C shell, 14, 16
  - gawk, 99
  - in print statement, 60
- lines
  - blank, printing, 59
  - counting, 256-259
  - duplicate, removing, 268-269
  - matching ranges of, 106
  - skipping between markers, 106
- lint checking, 121
  - array elements, 135
  - array subscripts, 138
  - invoking awk with empty programs, 194
  - issuing warnings, 197
  - POSIXLY\_CORRECT environment variable, 200
  - undefined functions, 172
- lint option, 194, 197
- LINT variable, 121
- lint-old option, 197
- locale categories, 176
- localization (see internationalization, localization)
- localport field, 282
- log files, timestamps in, 158-163
- log function, 144
- logical false/true, 93
- logical operators (see Boolean expressions)

login information, 228  
 long options, 194  
 loops, 112  
   continue statements and, 114  
   count for header, 192  
   exiting, 115  
   (see also while statement)  
 ls utility, 14  
 lshift function (gawk), 165  
 lvalues/rvalues, 89

**M**

mailing labels, printing, 264-266  
 mailing list, GNITS, xxiii  
 make function, 357  
 make\_number internal function, 356  
 make\_string internal function, 356  
 mark parity, 215  
 marked strings, extracting, 179  
 match function, 147  
   RLENGTH/RSTART variables, 147  
 matching  
   expressions (see comparison expressions)  
   leftmost longest, 49  
   null strings, 155  
 mawk program, 348  
 memory  
   releasing, 356  
   setting limits, 195  
 message object files, 175  
   converting from portable object files, 183  
   specifying directory of, 175, 178  
 metacharacters, escape sequences for, 22  
 -mf/-mr options, 195  
 Microsoft Windows, networking, 289  
   ports, 291  
 MiniSQL, 310  
 minus sign (see hyphen)  
 mktime function (gawk), 159  
 .mo files, 175  
   converting from .po, 183  
   specifying directory of, 175, 178  
 MOBAGWHO program, 318-323  
 mobile agents, 318-323  
 modifiers, in format specifiers, 64  
 monetary information, localization, 176  
 msgfmt utility, 183

## N

names  
   arrays/variables, 129, 208  
   functions, 167, 208  
 namespace issues, 129, 208  
   functions, 167  
 nawk utility, xvii  
 negative zero, 372  
 networks, 306  
   gawk and, 281-306  
     connections, 283, 287-289  
     filenames, 282-284  
     resources about, 323  
     service, establishing, 290  
     troubleshooting, 305  
     (see also email)  
   ports  
     reserved, 291  
     specifying, 283  
   programming, 188  
   support for, 73  
   (see also web pages)  
 newlines, 15, 98, 198  
   in dynamic regexps, 32  
   as field separators, 42  
   printing, 59  
   as record separators, 34  
   in regexp constants, 32  
   separating statements in actions, 110-111  
 next file statement, 334  
   deprecated, 202  
 next statement, 98, 117  
   BEGIN/END patterns and, 108  
   user-defined functions and, 117  
 nextfile function, 210  
 nextfile statement, 117  
   BEGIN/END patterns and, 108  
   in gawk, 118  
   implementing, 210-211  
   next file statement and, 202  
   user-defined functions and, 118  
 NF variable, 37, 125  
   decrementing, 41  
 noassign.awk program, 222  
 NODE internal type, 355  
 nodes, duplicating, 356  
 --non-decimal-data option, 185, 197  
   strtonum function and, 186  
 not operator, 97  
 NR variable, 33, 125  
   changing, 126  
 null strings, 35, 43, 93, 370  
   array elements and, 135

- null strings (continued)
  - as array subscripts, 138
  - converting numbers to strings, 84
  - matching, 155
  - quoting and, 9
- number sign (#)
  - #! (executable scripts), 6
  - portability issues with, 6
  - commenting, 6
- numbers, 356
  - as array subscripts, 136
  - Cliff random, 214
  - converting, 84
  - to strings, 120, 122, 166
  - floating-point, 369
    - AWKNUM internal type, 355
  - hexadecimal, 79
  - NODE internal type, 355
  - octal, 79
  - random, 144
  - rounding, 213
  - as values of characters, 214
- numeric
  - constants, 79
  - output format, 61
  - strings, 94
  - values, 355

## O

- oawk utility, xvii
- obsolete features, 202
- octal numbers, 79
- octal values, enabling interpretation of, 197
- OFMT variable, 61, 85, 122
  - POSIX and, 62
- OFS variable, 40, 60, 122
- operating systems, 337
  - BSD-based, xxi, 189
  - PC, gawk on, 345-346
    - installing, 343
  - porting gawk to, 353
  - (see also GNU/Linux, PC operating systems, Unix)
- operations, bitwise, 164-166
- operators
  - arithmetic, 85
  - assignment, 88-91
  - evaluation order, 90
  - Boolean (see Boolean expressions)
  - decrement/increment, 92-93
  - GNU-specific, 28
  - input/output, 53, 56, 68-69, 102
  - logical (see Boolean expressions)

- precedence, 93, 101-102
- relational (see operators, comparison)
- short-circuit, 98
- string, 87
- string-matching, 20
  - for buffers, 28
- word-boundary (gawk), 28
- options
  - command-line, 5, 44, 195-200
  - end of, 196
  - invoking awk, 194
  - processing, 222-227
  - deprecated, 202
  - long, 194-196
  - printing list of, 197
- or function (gawk), 164
- OR operation, 164-166
- or operator, 97
- ord user-defined function, 215
- order of evaluation, concatenation, 87
- ORS variable, 61, 122
  - HTTP and, 293
  - POP and, 292
- output
  - buffering, 156-157
  - duplicating into files, 251
  - files, closing, 74-77
  - format specifier, OFMT, 61
  - formatted, 62
  - pipes, 68
  - printing (see printing)
  - records, 61
  - redirection, 68-70
  - standard, 71
- output field separator (see OFS variable)
- output record separator (see ORS variable)

## P

- /p files, 189
- PANIC program, 306
- param\_cnt internal variable, 355
- parameters, number of, 355
- parentheses (), 24
  - pgawk program, 192
- password file, 228
- patterns, 103-109
  - comparison expressions as, 104
  - counts, 192
  - default, 11
  - empty, 109
  - expressions as, 104
  - ranges in, 106

- patterns (continued)
  - regexp constants as, 105
  - types of, 103
- PC operating systems, gawk on, 345-346
  - installing, 343
- percent sign (%)
  - % operator, 101
  - %= operator, 90, 102
- period (.), 23
- Perl, gawk networking and, 281
- pgawk program, 190-193
  - awkprof.out file, 190
  - dynamic profiling, 193
- pipes
  - closing, 74-77
  - input, 54
  - networking and, 287
  - output, 68
- plus sign (+), 25
  - + operator, 92, 101-102
  - += operator, 90, 102
  - ++ operator, 101
  - decrement/increment operators, 92
- PNG image format, 293
  - generating, 313-318
- .po files, 175, 179
  - converting to .mo, 183
- POP (Post Office Protocol), 292
- portability, 22
  - \*\* operator and, 86
  - \*\*= operator and, 91
  - #! (executable scripts), 6
  - ARGV variable, 6
  - backslash continuation and, 15
  - backslash in escape sequences, 22
  - close function and, 75
  - datafiles as single record, 36
  - deleting array elements, 136
  - example programs, 207
  - fflush function and, 156
  - functions, defining, 168
  - gawk, 353
  - gettext library and, 175
  - internationalization and, 181
  - length function, 146
  - new awk vs. old awk, 85
  - next statement in user-defined functions, 172
  - NF variable, decrementing, 41
  - operators, 93
    - not specified by POSIX, 102
  - POSIXLY\_CORRECT environment variable, 200
  - substr function, 152
  - portable object files, 175, 179
    - converting to message object files, 183
    - generating, 197
  - portal files, 189
  - positional specifiers, printf statement, 64, 179
    - mixing with regular formats, 180
  - positive zero, 372
  - POSIX, xviii
    - < operator and, 53
    - \*\*= operator and, 91
    - | I/O operator and, 55
    - arithmetic operators and, 86
    - awk and, xv
    - backslashes in string constants, 22
    - BEGIN/END patterns, 108
    - break statement and, 115
    - changes in awk versions, 329
    - character lists and, 26
      - character classes, 26, 28
    - continue statement and, 116
    - CONVFMT variable and, 120
    - date utility and, 163
    - field separators and, 36, 46
    - FS variable and, 121
    - functions and
      - gsub/sub, 153
      - length, 146
    - gawk extensions not included in, 331-335
    - GNU long options and, 195
    - hexadecimal values in, 21
    - internal expressions and, 25
    - next/nextfile statements and, 117
    - numeric strings and, 94
    - OFMT variable and, 62, 85
    - operators not specified by, 102
    - period (.), using, 24
    - pipes, closing, 76
    - printf format strings and, 66
    - programs, implementing in awk, 238-259
    - regular expressions and, 25
    - timestamps and, 159
  - POSIX mode, 198, 200
    - posix option, 198
    - traditional option (gawk) and, 198
  - POSIXLY\_CORRECT environment variable, 200
  - Post Office Protocol (POP), 292
  - PostScript, generating files, 312-318
  - precedence, 93, 101-102
    - regexp operators, 25
  - print statement, 58-60, 68
    - BEGIN/END patterns and, 108

- print statement (continued)
  - commas, omitting, 59
  - I/O operators in, 102
  - line continuations and, 60
  - OFMT variable and, 122
  - sprintf function and, 213
  - (see also redirection, of output)
- printf statement, 58, 62-68
  - columns, aligning, 60
  - format-control characters, 63
  - I/O operators in, 102
  - modifiers, 64-66
  - positional specifiers, 64, 179
  - mixing with regular formats, 180
  - sprintf function and, 213
  - syntax of, 62
  - (see also redirection, of output)
- printing, 58-77
  - list of options, 197
  - mailing labels, 264-266
  - unduplicated lines of text, 252-256
  - user information, 247
- private variables, 208
- process information, files for, 72
- processes, two-way communications
  - with, 186
- processing data, 367
- PROCINFO array, 73, 125, 228, 232
- profile option, 190, 198
- profiling awk programs, 190-193
  - dynamically, 193
- profiling gawk (see pgawk program)
- programming
  - basic steps, 368
  - concepts, 367-373
- programming conventions
  - ARGC/ARGV variables, 123
  - exit statement, 119
  - function parameters, 172
  - functions
    - calling, 142
    - writing, 167
  - gawk internals, 361
  - nextfile statement, 210
  - non-decimal-data option, 186
  - private variable names, 208
- programming languages, data-driven vs. procedural, 3
- protocol field, 282
- pwdcat program, 228
- \_pw\_init user-defined function, 229
- Python, gawk networking and, 281

## Q

- question mark (?), 25, 28
  - ?: operator, 102
- quoting, 5, 7
  - rules for, 7
  - tricks for, 9

## R

- rand function, 144
- random numbers
  - Cliff, 214
  - rand/srand functions, 144
  - seed of, 144
- range expressions, 26
- range patterns, 106
- RAW protocol, 286
- raw sockets, 188
- readable datafiles, checking, 221
- readable.awk program, 221
- record separators, 34, 122
  - changing, 35
  - HTTP and, 293
  - with multiline records, 48
  - POP and, 292
  - regular expressions as, 35
- records, 33, 369
  - multiline, 48-51
  - printing, 59
  - splitting input into, 33-36
  - terminating, 35
  - treating files as, 36
- recursive functions, 168
- redirection
  - of input, 53
  - of output, 68-70
- reference counting, sorting arrays, 141
- regexp (see regular expressions)
- regexp constants, 20, 80-82, 97
  - /= ... /
  - /= operator and, 91
  - in gawk, 81
  - as patterns, 105
  - slashes vs. quotes, 31
  - vs. string constants, 32
- regular expressions, 19-32
  - anchors in, 23
  - case sensitivity, 29-30, 121
  - computed, 31-32
  - constants (see regexp constants)
  - dynamic, 31-32
    - with embedded newlines, 32
  - as field separators, 42-43

regular expressions (continued)  
 gawk, command-line options, 29  
 interval expressions and, 198  
 leftmost longest match, 31  
 operators, 20, 23-26  
   for buffers, 28  
   gawk, 28-29  
   precedence of, 25  
 as patterns, 19, 104  
 as record separators, 35  
 searching for, 243-247  
 --re-interval option, 198  
 relational operators (see comparison operators)  
 REMCONF program, 308-310  
 remoteport field, 282  
 return statement, user-defined  
   functions, 172  
 return values, close function, 76  
 rewind user-defined function, 220  
 right angle bracket (>)  
   > operator, 95, 102  
   > operator (I/O), 68  
   >> operator (I/O), 68, 102  
   >= operator, 95, 102  
 right shift, bitwise, 164  
 RLENGTH variable, 126  
   match function and, 147  
 rounding numbers, 213  
 RS variable, 34, 122  
   HTTP and, 293  
   multiline records and, 48  
   POP and, 292  
 rshift function (gawk), 165  
 RSTART variable, 126  
   match function and, 147  
 RT variable, 35, 51, 126  
 rvalues/lvalues, 89

**S**

scalar values, 369  
 search paths, 345  
   for source files, 201, 280  
 searching, 146  
   files for regular expressions, 243-247  
   for words, 259  
 sed utility, 273, 276  
   field separators and, 46  
 semicolon (;), 16  
   AWKPATH variable and, 345  
   separating statements in actions, 110-111

separators  
 field, 121-122  
   FIELDWIDTHS variable and, 120  
   POSIX and, 36  
 record, 122  
 for records, 34-35  
   regular expressions as, 35  
 for statements in actions, 110  
 subscript, 122  
 servers, 290  
   Apache, 313  
   as hosts, 283  
   HTTP, 295  
   web, 301-305  
 set\_value internal function, 357  
 shells  
   piping commands into, 70  
   quoting, 109  
   rules for, 7  
   scripts, 4  
   variables, 109  
 shift, bitwise, 164  
 short-circuit operators, 98  
 side effects, 87, 93  
   array indexing, 132  
   asort function, 141  
   assignment expressions, 88  
   Boolean operators, 97  
   conditional expressions, 99  
   decrement/increment operators, 92  
   FILENAME variable, 57  
   function calls, 100  
   statements, 110  
 signals  
   HUP/SIGHUP, 193  
   USR1/SIGUSR1, 193  
 Simple Mail Transfer Protocol (SMTP), 292  
 sin function, 144  
 single quote ('), 4, 6-9  
   vs. apostrophe, 7  
   with double quotes, 9  
 single-character fields, 43  
 single-precision floating-point, 370  
 sleep utility, 262  
 SMTP (Simple Mail Transfer Protocol), 292  
 sockets, 188  
 sort function  
   arrays, sorting, 140  
   coprocesses and, 187  
 sort utility, 267  
 sorting characters in different  
   languages, 176



- source code
    - awka, 349
    - Bell Laboratories awk, 348
    - gawk, 337
    - mawk, 348
    - mixing, 199
  - source files, search path for, 280
  - source option, 199
  - SPAK utility, 286
  - sparse arrays, 131
  - split function, 148
    - array elements, deleting, 136
  - split utility, split.awk program, 249
  - sprintf function, 61, 149
    - OFMT variable and, 122
    - print/printf statements and, 213
  - square brackets ([ ]), 24
  - square root (sqrt) function, 143
  - srand function, 145
  - standard input, 4, 71
  - standard output, 71
  - stat function, implementing in
    - gawk, 358-364
  - statements
    - compound, control statements and, 111
    - control, in actions, 111-119
    - multiple, 16
  - STATIST program, 313-318
  - stlen internal variable, 355
  - stptr internal variable, 355
  - stream editors, 273, 276
    - field separators and, 46
  - strftime function (gawk), 159-163
  - string constants, 79
    - vs. regexp constants, 32
  - string operators, 87
  - string-matching operators, 20
  - strings, 356
    - converting, 84
      - numbers to, 120, 122, 166
    - empty (see null strings)
    - extracting, 179
    - length of, 79
    - for localization, 177
    - merging arrays into, 216
    - NODE internal type, 355
    - null, 43
    - numeric, 94
    - splitting, 148
    - value of, retrieving, 149
  - strtonum function (gawk), 149
    - non-decimal-data option and, 186
  - sub function, 82, 149
    - arguments of, 150
    - escape processing, 153
  - subscript separators, 122
  - subscripts in arrays
    - multidimensional, 138
    - scanning, 139
    - numbers as, 136
    - uninitialized variables as, 137
  - SUBSEP variable, 122
    - multidimensional arrays, 138
  - substr function, 152
  - system function, 156
  - systemtime function (gawk), 159
- ## T
- Tcl/Tk, gawk and, 281, 306
  - TCP (Transmission Control Protocol), 282, 285
    - connection, establishing, 287-289
    - UDP and, 290
  - TCP/IP, 188-189
    - protocols, selecting, 282
    - sockets and, 282
    - support for, 73
  - tee utility, tee.awk program, 251
  - terminating records, 35
  - testbits.awk program, 165
  - Texinfo, 340
    - chapter beginnings in files, 23
    - extracting programs from source files, 269-272
  - text, printing, 59
    - unduplicated lines of, 252-256
  - textdomain function (C library), 175
  - TEXTDOMAIN variable, 123, 177
    - BEGIN pattern and, 178
    - portability and, 181
  - tilde (~)
    - ~ operator, 20, 30-31, 95-96, 102, 104
  - time
    - alarm clock example program, 260-262
    - localization and, 177
    - managing, 217
    - retrieving, 159
  - timestamps, 158-163
    - converting dates to, 160
    - formatted, 217
  - tmp\_number/tmp\_string internal functions, 356
  - tolower/toupper functions, 152
  - tr utility, 262
  - traditional option (gawk), 196
    - posix option and, 198

translate.awk program, 263  
 Transmission Control Protocol (see TCP)  
 troubleshooting
 

- == operator, 95
- division, 86
- F option, 203

 fatal errors
 

- field widths, specifying, 47
- printf format strings, 66

 fflush function, 156  
 function call syntax, 100  
 gawk, 203, 350
 

- bug reports, 346-347
- fatal errors, function arguments, 143
- networks, 305

 gensub/sub functions, 150  
 getline function, 221  
 match function, 148  
 networks, connections, 288  
 --non-decimal-data option, 197  
 print statement, omitting commas, 59  
 printing, 70  
 quotes with filenames, 72  
 readable datafiles, 221  
 string concatenation, 87  
 substr function, 152  
 system function, 157  
 typographical errors, global
 

- variables, 197

 true, logical, 93  
 trunc-mod operation, 86  
 truth values, 93  
 type conversion, 84

## U

UDP (User Datagram Protocol), 285
 

- TCP and, 290

 undefined functions, 171  
 underscore (\_)
 

- \_ C macro, 176, 178
- in names of private variables, 208

 uninitialized variables as array
 

- subscripts, 137

 uniq utility, 252
 

- uniq.awk program, 253

 Unix
 

- awk scripts and, 6
- backslashes in escape sequences, 22
- close function and, 76
- network ports and, 291
- password files, field separators and, 45

 unsigned integers, 370  
 update\_ERRNO internal function, 357

URLCHK program, 310  
 --usage option, 197  
 user database, reading, 228-232  
 User Datagram Protocol (see UDP)  
 user-defined
 

- functions, 166-173
  - counts, 192
  - variables, 82

 user-modifiable variables, 120-123  
 users, information about
 

- printing, 247
- retrieving, 228

## V

-v option, 195
 

- variables, assigning, 83

 values
 

- numeric, 369
- string, 369

 variable typing, 94-97  
 variables, 17, 369
 

- assigning on command line, 83
- built-in, 83, 120-123
  - conveying information, 123-126
- v option, setting with, 195
- flag, 98
- getline command into, using, 52, 54-56
- global
  - for library functions, 208
  - printing list of, 196
- initializing, 83
- names of, 129
- private, 208
- setting, 195
- shadowing, 168
- types of, 89
  - comparison expressions and, 94-97
- uninitialized, as array subscripts, 137
- user-defined, 82

 --version option, 199  
 vertical bar (|), 24
 

- | operator (I/O), 54, 102
- |& I/O operator (I/O), 187
- |& operator (I/O), 56, 102, 287
  - two-way communications, 189
- || operator, 98, 102

 vname internal variable, 356

**W**

- W option, 196
- w utility, 47
- warnings, issuing, 197
- wc utility, 256
  - wc.awk program, 257
- web browsers (see web service)
- web pages, 293
  - extracting links from, 312
  - images in, 298
  - retrieving, 307
- web robots, 312
- web servers, 301-305
- web service, 294-301, 306
- web sites, checking for changes to, 310
- WEBGRAB program, 312
- while statement, 20, 112
- whitespace
  - as field separators, 42
  - functions, calling, 142
  - newlines as, 198
- with-included-gettext option, 184
  - configuring gawk with, 342
- word boundaries, matching, 28
- word-boundary operator (gawk), 28
- wordfreq.awk program, 267
- words
  - counting, 256-259
  - duplicate, searching for, 259
  - usage counts, generating, 266-268

**X**

- XBM image format, 298
- xgettext utility, 179
- xor function (gawk), 164
- XOR operation, 164-166

**Z**

- zero, negative vs. positive, 372

