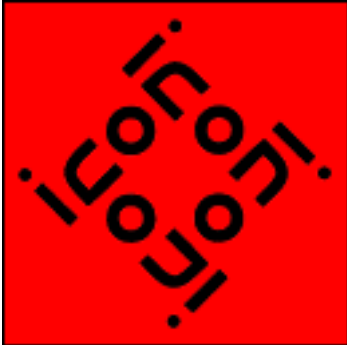# The Icon Program Library; Version 9.2

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http://www.cs.arizona.edu/icon/docs/ipd272.html

Note: This is the complete description with a contents listing. An abbreviated version without the contents listing is given in IPD274.

1. Introduction

The Icon program library consists of Icon programs, procedures, documentation, and data. Version 9.1 of Icon is required for graphics and some other parts of the library of the library [1,2].

Additional documentation about the Icon program library is available on the World Wide Web:

```
http://www.cs.arizona.edu/icon/
```

Look in the **Program Library** section.

2. Library Reorganization

With this release of the Icon program library, we are beginning to reorganize library procedures.

Historically, the Icon program library has grown rather haphazardly. New material often has been added without consideration of similar material already in the library. In the case of procedures, new files generally have been added as received, rather than putting new procedures in existing files with similar material. As a result, there are many files and it's difficult to find things.

Until Version 9 of Icon all the procedures in a linked file were included in the program that linked the file, even if some were not used by the program. This discouraged combining similar procedures in a single file. The Version 9 linker, however, only includes procedures that are referenced, so there no longer is a motivation for having files with only a few

procedures. There are, however, still good reasons for having separate procedure files, among them organization and ease of maintenance. It's just that the compromise now favors fewer files with more procedures. We have, therefore, reorganized files, combined procedures with related functionality, and deleted some files.

As a result, you may need make some changes in your programs that link library procedures. Here's a list of link changes:

```
old         new

binocoef    math
capt        capture
cat         strings
commaize    numbers
decipos     numbers
factorl     factors
gcd         numbers
gcdlcm      numbers
hyperbol    math
large       numbers
lcomb       lists
lmap        lists
lpermute    lists
lrotate     lists
lscan       lists
minmax      numbers
nxtprime    factors
permute     strings
prime       factors
primel      factors
radcon      convert
randomiz    random
randreal    random
randseq     random
ranrange    random
ranseq      random
real2int    numbers
shuffle     random
sign        numbers
tblset      tables
tblutil     tables
twt         tables
```

We've also moved some files from `procs` to `gprocs`:

```
clrnames.icn
curves.icn
curves1.icn
curves2.icn
distance.icn
fstars.icn
fstartbl.icn
gifsize.icn
glabels.icn
gtrace.icn
```

```
ifg.icn
imscanon.icn
imxform.icn
jolygs.icn
modlines.icn
orbits.icn
randarea.icn
patxform.icn
randfigs.icn
rpolys.icn
rstars.icn
rstartbl.icn
spirals.icn
spokes.icn
symrand.icn
twists.icn
xform.icn
```

Section 8 lists the contents of the library. More compete documentation is contained in comments in the program and procedure files. There also is separate documentation for some programs.

3. Unloading the Library

Note: The complete library, when unloaded, requires about 8.5MB of disk space. In particular, some documents in PostScript form are quite large. If your disk space is limited, take this into consideration before starting to unload.

The library is designed to be unloaded in a hierarchy that contains separate directories for different kinds of material. Material that requires graphics [2] is in separate directories whose names begin with g. If Icon doesn't support graphics on your platform, you can ignore these directories.

The directory structure for this version of the library is

```
          |--data                     data

          |--docs                     documentation

          |--incl                     include files

          |--packs                    packages

          |--procs                    procedures

          |--progs                    programs
|--ipl--|
          |--gdata                    as above, but for graphics

          |--gdocs

          |--gincl

          |--gpacks
```

```
|
|--gprocs
|
|--gprogs
|
|--cfuncs                          loadable C functions
```

The packages contain material that is too complex fit into other parts of the hierarchy or that does not conform to the library structure.

The loadable C functions are for platforms on which Icon supports the built-in function `loadfunc()`. See the README in that directory for more information.

The library files are packaged in different ways for different platforms. See the installation instructions for your platform.

4. Link and Include Search Paths

Many library programs link procedures. For example, `options()` is used by many programs for processing command-line options and is linked from "ucode" files obtained from translating `options.icn`.

Icon searches for ucode files first in the current directory and then in directories specified by the IPATH environment variable. IPATH consists of a sequence of blank-separated path names. The search is in the order of the names. For example, on a UNIX system running *csh*,

        setenv IPATH "../procs /usr/icon/ilib"

results in a search for file names in link declarations first in the current directory, then in `../procs`, and finally in `/usr/icon/ilib`.

Files included by the preprocessor directive `$include` are searched for on LPATH. It has the same form as IPATH.

The method of setting IPATH and LPATH varies from system to system.

Since the current directory always is searched first, IPATH and LPATH need not be set if ucode and include files are placed in the same directory as the program files. See the next section.

5. Installing the Library

Installing the Icon program library consists of two steps: (1) translating the procedure files to produce ucode files and (2) translating and linking the programs.

Ucode files are produced by translating the procedure files with the **-c** option to `icont`, as in

        icont -c options

which translates `options.icn`. The result is two ucode files named `options.u1` and `options.u2`. The `.u1` file contains the procedure's code and the `.u2` file contains global information about the procedure. It is these files that a link declaration such as

```
        link options
```

needs.

Scripts for translating the procedure files are provided with the distribution. Once the procedure files have been translated, the ucode files can be moved to any place that is accessible from `IPATH`.

The programs are translated and linked using icont without the `-c` option, as in

```
        icont deal
```

which translates and links `deal.icn`, a program that produces randomly selected bridge hands.

The result of translating and linking a program is an "icode" file. On some platforms, the name of the icode file is the same as the name of the program file with the `.icn` suffix removed (for example, `deal`). On other platforms, the icode file name has the suffix `.exe` in place of `.icn` (for example, `deal.exe`). Scripts for translating and linking the programs are provided with distributions for individual platforms. Instructions for building the programs contained in separate packages are included with those packages.

Some platforms (UNIX and MS-DOS, for example) support the direct execution of icode files. On such systems, an icode file can be run just by entering its name on the command line, as in

```
        deal
```

On other systems, it is necessary to run `iconx` with the icode file as an argument, as in

```
        iconx deal
```

(This also works on systems that support direct execution.) Note that the suffix (if any) need not be mentioned.

Many library programs take arguments and options from the command line. Options are identified by dashes. For example, in

```
        deal -h 10
```

the `-h 10` instructs `deal` to produce 10 hands.

Icode files can be moved to any location accessible from your `PATH`. Ucode and include files are needed only during linking. They need not be accessible when icode files are run.

6. Usage Notes

It is important to read the documentation at the beginning of programs and procedures in the library. It includes information about special requirements, limitations, known bugs, and so forth.

Some of the programs in the Icon program library are quite large and may require more

memory than is available on some platforms.

7. Disclaimer

The material in the Icon program library is contributed by users. It is in the public domain and can be freely copied, although author information should be left intact and any modifications should be properly attributed.
Neither the Icon Project nor the authors of material in the Icon program library assume any responsibility as to its correctness or its suitability for any purpose. The responsibility for use of the Icon program library lies entirely with the user.

8. Contents

8.1 Programs -- `progs`

```
adlcheck      check for bad address list data
adlcount      count address list entries
adlfiltr      filter address list entries
adlfirst      write first line of addresses
adllist       list address list fields
adlsort       sort address list entries
animal        play "animal" guessing game
banner        display banner
based         do BASIC-style editing
bj            play blackjack game
blnk2tab      convert strings of 2 or more blanks to tabs
c2icn         assist C-to-Icon porting
calc          simulate desk calculator
callcnt       count calls
chkhtml       check HTML files
cmpsum        tabulate comparisons
cnvsum        tabulate type-conversion activity
colm          arrange data into columns
comfiles      list common files in two directories
concord       produce concordance
conman        convert units
countlst      count items in a list
cross         display intersection of words
crypt         encrypt file
csgen         generate context-sensitive sentences
cstrings      print strings in C files
cvtsum        count conversion event tuples
cwd           write current working directory
daystil       calculate the number of days until a given date
deal          deal bridge hands
declchck      detect possible declaration errors
delam         delaminate file
delamc        delaminate file using tab characters
delta         first difference of sequence
detex         strip LaTeX commands
diffn         show differences among files
diffsort      reorder "diff" output
diffsum       count lines affected by a diff
diffu         show differences in files
```

```
diffword      list different words
diskpack      produce packing list for diskettes
duplfile      find directories with same files
duplproc      find duplicate declarations
edscript      produce script for ed(1)
empg          make expression-evaluation programs
envelope      address envelopes
evaluate      evaluate Icon expressions
events        show events
evstream      show events
evsum         tabulate event codes
exprsum       tabulate operator and function evaluation
farb          generate Farberisms
farb2         generate Farberisms
filecnvt      convert line terminators
fileprnt      display characters in file
filesect      produce section of a file
filexref      cross-reference files by components
filtskel      skeleton for generic filter
findstr       find embedded character strings
findtext      retrieve data from files indexed by idxtext
fixhqx        strip headers from BinHex files
fixpath       replace path in a binary file
fnctab        list function usage
fnctmpl       produce function templates
format        word wrap a range of text
former        format long string in fixed-length lines
fract         approximate real number as a fraction
fset          do set operations on file specifications
fuzz          perform fuzzy pattern matching
gcomp         produce complement of file specification
gediff        "diff" for use with ged
genqueen      solve arbitrary-size n-queens problem
getmail       parse a mail folder
graphdem      demonstrate simple bar graphics
grpsort       sort groups of lines
hcal4unx      Jewish/Civil calendar in UNIX
headicon      add header to Icon program
hebcalen      combination Jewish/Civil calendar
hebeng        print mixed Hebrew/English text
hotedit       edit a Mosaic hotlist
hr            play horse-race game
htprep        prepare HTML files
huffstuf      huffman coding
hufftab       compute Huffman state transitions
ibar          equalize comment bars in Icon programs
ibrow         browse Icon files for declarations
icalc         simulate infix desk calculator
icalls        tabulate Icon calls
icn2c         assist Icon-to-C porting
icontent      list Icon procedures
icvt          ASCII/EBCDIC program conversion
idepth        report maximum recursion depth
idxtext       creating indexed text-base
ifilter       filter lines of file
igrep         string search similar to egrep
```

```
iheader      list Icon program library headers
ihelp        give on-line help for Icon
iidecode     decode text in style of uudecode
iiencode     encode text in the style of uuencode
ilnkxref     produce Icon link cross reference
ilump        lump linked Icon source files
imagetyp     show types of image files
ineeds       print modules required by an Icon program
inter        find common values in two lists
interpe      interpret Icon expressions
interpp      interpret Icon programs
ipatch       patch iconx path in executable
ipldoc       collect library documentation
iplweb       generate web pages from IPL header comments
ipp          preprocess Icon programs
iprint       print Icon program
iprofile     profile Icon procedure usage
ipsort       sort Icon procedures
ipsplit      split Icon program into files
ipxref       cross reference Icon program
irunerr      print Icon runtime errors
isrcline     count code lines in Icon program
istrip       strip comments from Icon program
itab         entab an Icon program
itags        create tags file for Icon programs
itrbksum     give summary of traceback
itrcfltr     filter trace output
itrcsum      give summary of trace output
iundecl      find undeclared Icon identifiers
iversion     show icode version
iwriter      write Icon code to write input
knapsack     fill a container
krieg        play kriegspiel
kross        show intersections of strings
kwic         produce keywords in context
labels       format mailing labels
lam          laminate files
latexidx     process LaTeX idx file
lc           count lines in file
lcfile       convert file names to lowercase
lindcode     produce Icon code from L-system specifications
lineseq      write a sequence of values on a line
lisp         interpret LISP programs
listev       list events
listviz      visualize lists
literat      manage literature information
loadmap      show load map of UNIX object file
longest      write longest line in a file
lower        map file names to lowercase
makepuzz     make find-the-word puzzle
memsum       tabulate memory allocation
missile      play missile command game
miu          generate strings from MIU system
mkpasswd     make passwords
monkeys      generate random text
morse        convert string to Morse code
```

```
mr          read mail
mtf3        map tar file
newicon     produce new Icon program file
newsrc      organize UNIX .newsrc file
nim         play the game of nim
nocr        convert MS-DOS text files to UNIX
numsum      tabulate numerical computation
oldicon     update the date in an Icon program header
opersum     tabulate operation activity
ostrip      show virtual-machine op-code strip
pack        package multiple files
paginate    insert formfeeds
papply      apply procedure to lines of file
parens      produce random balanced strings
pargen      generate context-free parser
parse       parse simple statements
parsex      parse arithmetic expressions
patchu      implement UNIX-like patch
pbkdump     dump HP95 phone book file
pdecomp     list primes factors of an integer
playev      play back events
polydemo    demonstrate polynomial library
post        post news
press       archive files
procwrap    produce Icon procedure wrappers
profile     profile Icon programs
proto       show Icon syntactic forms
psrsplit    separate psrecord.icn output pages
pt          produce parse table generator
puzz        create word search puzzle
qt          announce time in English
queens      generate solutions to the n-queens problem
ranstars    display star field
recgen      generate context-free recognizer
recordev    record events
reply       reply to news-articles or mail
repro       self-reproduce
roffcmds    list roff commands and macros
rsg         generate randomly selected sentences
ruler       write a character ruler
scramble    scramble a document
setmerge    combine sets of text items
shar        create UNIX shell archive
shortest    write shortest line in a file
shuffile    shuffle lines in a file
sing        sing The Twelve Days of Christmas
snake       play the snake game
solit       play solitaire
sortname    order by last name
sortt       sort table into records
splitlit    create string literal
streamer    append lines of file into one long line
strpsgml    strip/translate SGML tags
strsum      tabulate string computation
tablc       tabulate characters in a file
tablw       tabulate words in a file
```

```
        textcnt      tabulate properties of text file
        textcvt      convert text file formats
        toktab       summarize Icon token counts
        trim         trim lines in a file
        ttt          play tic-tac-toe
        turing       simulate a Turing machine
        unique       delete identical adjacent lines
        unpack       unpackage files
        upper        map file names to uppercase
        utrim        remove unneeded procs from ucode
        verse        generate bizarre verses
        versum       produce versum sequence
        vmsum        tabulate virtual-machine operations
        vnq          display solutions to n-queens problem
        when         show file age
        wshfdemo     demonstrate weighted shuffle procedure
        xtable       show character code translations
        yahtz        play yahtzee
        yescr        convert UNIX files to DOS format
        zipsort      sort mailing labels by ZIP code
```

8.2 Programs -- `gprogs`

```
        autotile     produce tile from XBM image
        binpack      demonstrate some bin packing algorithms
        bitdemo      demonstrate bitplanes
        bme          edit bitmap
        ca21         investigate cellular automata
        calib        calibrate color monitor
        chernoff     imitate a Chernoff face
        coloralc     test color allocation
        colormap     display palette from color list
        colrbook     show the named colors
        colrname     browse color names
        colrpick     pick RGB or HLS colors
        concen       play solitaire card game Concentration
        cquilts      create "chaotic square quilts"
        design1      draw spokes design
        design2      draw circular design
        design3      draw square design
        drip         demonstrate color map animation
        etch         distributed Etch-A-Sketch
        facebend     generate caricatures
        fev          display text in fisheye view
        findrpt      find smallest repeat in a repeat pattern.
        flake        draw a fractal snowflake
        fontpick     show the characters of a font
        fract        demonstrate fractal lines
        fractclr     map Fractint color maps to Icon color lists
        fstarlab     draw fractal stars
        gallery      display many .gif/.xpm files at once
        giftoims     convert GIF files to image strings
        gpxtest      test graphics procedures
        gxplor       explore graphics facilities
        hb           Hearts & Bones game
```

```
hsvpick      pick RGB or HSV colors
hvc          pick colors for Tek HVC space
img          create images
imgcolrs     list colors in images.
imgpaper     tile images to form wallpaper
imgtolst     convert image to list of pixel colors
imlreduc     reduce bi-level image strings
imltogif     convert image strings to GIF files
ipicker      print name of selected images
iview        display image files
julia1       display the Julia set
kaleid       produce kaleidoscope
kaleido      produce kaleidoscopic display
keypunch     simulate a keypunch
koch         demonstrate Koch curves
lindcomp     compile 0L-systems
linddefs     produce table of L-systems
linden       generate sentences in 0L-systems
lorenz       display Lorenz strange attractor
lsys         experiment with Lindenmayer systems
mandel1      display the Mandelbrot set
mandel2      draw the Mandelbrot set
moire        display Moire patterns
offtiler     tile images with offset
orbit        display quadratic orbit
painterc     convert Painter color sets to Icon colors
palcheck     check palindromic sentences
palette      display an Icon image palette
patfetch     extract patterns from a file
penelope     edit graphic patterns
pextract     separate good and bad patterns
pgmtoims     make an image from a PGM file
picktile     pick a tile out of an image
plat         create image file with specified colors
pme          edit pixmaps
prompt       prompt in a window
randweb      draw random web design
recticle     draw rectangles recursively
rings        draw tiles of rings and circles
rolypoly     draw "abstract" art
rstarlab     draw regular stars
scroll       scroll image
seamcut      cut image for seamless tiling
sensdemo     demonstrate sensor routines
showcolr     list colors in Icon palettes
showtile     display tiles
sier         generalized Sierpinski's triangle
sier1        draw the Sierpinski triangle
sier2        display the Sierpinski fractal
snapper      display images
spectra      report color spectra in images
spiral       draw polygonal spirals
spiro        display spirograph lines
splat        drop paint splatters in a window
striper      make striped pattern from image edge
subdemo      show the turtle graphics subset
```

```
sym4mm          draw symmetrically
symdraw         draw symmetrically
sympmm          produce pmm symmetry composite images.
testpatt        show test patterns
textures        show various 4x4 patterns
tgdemo          demonstrate turtle graphics
travels         animate the traveling salesman problem
trycolor        investigate color specifications
tryfont         demonstrate X font rankings
uix             translate user interfaces
viewpane        view image through a "pane"
wevents         report Icon window events
wheel           show wheel of colors
xbm2pat         convert XBM file to pattern specification
xformpat        apply transformation to patterns
xgamma          configure X color correction
xpmtoims        make Icon images from XPM files
zoomtile        show a tile magnified
```

8.3 Procedures -- `procs`

```
abkform         process HP95LX appointment books
adjuncts        gettext and idxtext
adlutils        process address lists
allof           conjunction control operation
ansi            ANSI-based terminal control
apply           apply a list of functions to an argument
argparse        parse pseudo-command-line
array           n-dimensional arrays
asciinam        ASCII name of unprintable character
balq            scanning strings with quotes
basename        produce base name of file
binary          pack and unpack values
bincvt          convert binary data
binop           apply binary operation to list of values
bitint          convert integers and bit strings
bitstr          bits in Icon strings
bitstrm         read and write strings of bits in files
bkutil          HP95LX phone books and appointment books
bold            enbolden and underscore text
buffer          buffered input and output
bufread         buffered read and lookahead
calendat        get date from Julian Day Number
calls           calls as objects
capture         echo output to a second file
codeobj         encode and decode Icon data
colmize         arrange data into columns
complete        complete partial input string
complex         perform complex arithmetic
convert         various conversions
created         determine number of structures created
currency        formatting currency
date            produce date
datefns         dates
datetime        date manipulation
```

```
dif             check for differences
digitcnt        count number of digits in file
dopen           find/open file on search path
dos dir         obtaining MS-DOS directory listings
dosfiles        get MS-DOS file names
dosname         convert file name to MS-DOS 8.3 format
dpath           open file on search path
drivedir        get directories and drive
ebcdic          convert between ASCII and EBCDIC
empgsup         support empg
emptygen        meta-translation code generation
equiv           compare structures
escape          interpret Icon literal escapes
escapesq        deal with character string escapes
eval            evaluate string as a call
evallist        produce a list generated by expression
evaltree        maintain activation tree
eventgen        meta-variant code generation
everycat        generating all concatenations
evinit          event monitoring
evnames         map between event codes and names
evsyms          produce table of event codes and symbols
evtmap          map event code names to values
exists          determine if a file exists
exprfile        produce programs on the fly
factors         related to factors and prime numbers
fastfncs        integer functions using fastest method
fcopy           copy a file
feval           evaluate string as function call
filedim         compute file dimensions
filename        parse file names
filenseq        get highest numbered filename in a sequence
filepart        break down file names into components
filetext        read text file into a list
findre          find regular expression
ftype           produce type for file
full13th        full-moon Friday 13s
fullimag        produce complete image of structured data
gauss           compute Gaussian distributions
gdl             get directory lists
gdl2            get directory lists
gen             meta-variant code generation
gener           generate miscellaneous sequences
genrfncs        generate sequences
getchlib        getch for UNIX
getkeys         get keys for a gettext file
getpaths        generate elements in path
gettext         gettext (simple text-base routines)
graphpak        manipulating directed graphs
hexcvt          hexadecimal conversion
hostname        produce host name
ibench          support Icon benchmarking
ichartp         a simple chart parser
identgen        meta-translation code generation
identity        produce identities for Icon types
ifncs           wrappers for function tracing
```

```
iftrace       trace Icon function calls
image         produce images of Icon values
inbits        read variable-length characters
indices       produce indices
inserts       build tables with duplicate keys
intpdco       programmer-defined control operations
intstr        create string from bits
iolib         termlib support
iscreen       screen functions
isort         customizable sorting
ispf          communicate between Icon and ISPF
iterfncs      recursive functions using iteration
itlib         termlib-type tools
itlibdos      MS-DOS termlib-type tools
itokens       tokenizing Icon code
itrcline      filter out non-trace lines
ivalue        convert string to Icon value
julian        produce Julian Day Number
jumpque       jump element to head of queue
kmap          map keyboard letter forms into letters
labeler       produce successive labels
lastc         string scanning
lastname      produce last name
lcseval       evaluate linear congruence parameters
limatch       matching according to items in a list
list2tab      write list as tab-separated string
lists         manipulate lists
loadfile      produce and load program on the fly
longstr       match longest string
lu            LU manipulation
mapbit        map string into bit representation
mapstr        map() for strings
matchlib      lexical matching
math          mathematical computations
matrix        matrix manipulation
memlog        log memory usage
memrfncs      recursive functions using memory
models        model Icon functions
morse         convert string to Morse code
mset          multi-sets
namepfx       produce prefix portion of name
ngrams        generate n-grams
noncase       case-independent matching
numbers       related to numbers
openchk       aid in open/close debugging
opnames       produce opcode/names table
opsyms        produce table to map opcodes to symbols
options       get command-line options
outbits       write variable-length characters
packunpk      pack and unpack decimal strings
parscond      condense parse tree
partit        partition integer
pascal        write Pascal triangles
pascltri      compute a row of Pascal's Triangle
patch         UNIX-like patch(1)
pathfind      find files on a Unix path
```

```
patterns      SNOBOL4-style pattern matching
patword       find letter patterns
pbkform       process HP95 phone book files
pdae          programmer-defined argument evaluation
pdco          programmer-defined control operations
phoname       generate letters for phone numbers
plural        produce plural of English noun
polystuf      manipulating polynomials
pom           compute phase of the moon
popen         pipes
printcol      format columnar data
printf        printf-style formatting
prockind      indicate kind of procedure
procname      produce name of procedure
progary       place program in a array
pscript       explicitly writing PostScript
random        related to random numbers
rational      arithmetic on rational numbers
readcpt       read produce "carpet" from file
readline      read and write lines in pieces
readtbl       read user-created stripsgml table
rec2tab       write record as string
recog         recognition
recrfncs      recursive functions
recurmap      map recurrence declarations to procedures
reduce        perform operation on list of arguments
regexp        regular-expression pattern matching
repetit       find smallest repetition pattern in list
revadd        generate reverse-summed integers
rewrap        advanced line rewrap
rexx          communicate between Icon and Rexx
rng           generate random numbers
sandgen       "evaluation sandwiches" code
saytime       produce the time in English
scanmodl      model string scanning
scanset       setup for string scanning procedures
segment       segment string
senten1       generate sentences
sentence      generate sentences in file
seqimage      produce string image of Icon result sequence
serial        return serial number of structure
sets          set manipulation
showtbl       show contents of a table
shquote       quote word for UNIX-like shells
signed        put bits into signed integer
slashbal      balanced scanning with backslashes
slshupto      upto() with backslash escaping
snapshot      show snapshot of Icon string scanning
sortff        sortf with multiple field arguments
sortgen       produce different sorted orders
soundex       produce Soundex code for name
soundex1      Soundex algorithm
speedo        indcate percentage of completion
spin          spin cursor
statemap      table of states and abbreviations
step          generate in real increments
```

```
      str2toks      convert string to tokens
      strings       manipulating strings
      strip         strip characters from a string
      stripcom      strip comments from Icon line
      stripunb      strip unbalanced material
      tab2list      put tab-separated strings in list
      tab2rec       put tab-separated strings in records
      tables        table manipulation
      tclass        classify values as atomic or composite
      tempfile      produce a temporary file for writing
      tempname      get temporary file name
      title         produce title portion of name
      titleset      produce set of titles
      tokgen        token counting
      trees         manipulating trees and dags
      tuple         process n-tuples
      typecode      produce letter code for Icon type
      typesyms      map type codes to event codes
      unsigned      put bits unsigned integer
      usage         service functions
      varsub        perform UNIX-shell-style substitution
      version       produce Icon version number
      walltime      produce wall-clock time
      wdiag         write values with labels
      weighted      shuffle list with randomness
      wildcard      UNIX-like wild-card pattern matching
      word          scan UNIX-style command line words
      wrap          wrap output lines
      writecpt      write a "carpet" file
      xcode         save and restore Icon data
      ximage        produce string image of structured data
      xrotate       rotate values in list or record
```

8.4 Include files -- `incl`

```
      etdefs        artificial event codes
      evdefs        event codes
      invkdefs      operator symbols
      opdefs        Icon virtual-machine instructions
```

8.5 Procedures -- `gprocs`

```
      attribs       set attributes via dialog
      autopost      activate PostScript recorder
      barchart      dynamically growing barchart
      bevel         drawing beveled objects
      bitplane      bitplane manipulation
      button        pushbutton sensors
      cardbits      constructing playing card images
      clip          clipboard operations
      clrnames      generate color names
      color         dealing with colors
      colrlist      produce list of colors
      colrmodl      convert between color models
      curves        generate points on plain curves
```

```
curves1      generate points on plain curves
curves2      generate points on plain curves
decay        decaying-displays for windows
dialog       dialogs
dialogs      link to dialog
distance     compute distance in n-dimensions
drag         dragging rectangles
drawcard     draw a playing card
drawlab      draw figures
dsetup       creating dialog boxes
enqueue      queued events
evmux        window event multiplexor
fetchpat     fetch a pattern specification
fstars       produce traces of fractal stars
fstartbl     produce calls for fractal stars
gdisable     disable graphics functions
getcolrs     getting color palette
gifsize      return size of GIF file
glabels      produce graph ticks
glib         graphics
gobject      geometrical objects
gpxlib       graphics tasks
gpxop        graphics operations
graphics     graphics
grecords     graphics
gtrace       process graphic traces
ifg          tell if graphics are running
imagedim     getting image dimensions
imageseq     write sequences of images
imgcolor     produce table of colors in area
imscanon     put bi-level image string in canonical form
imscolor     manipulating images
imsutils     manipulate image specifications
imutils      link graphics utilities
imxform      transform image matrices
interact     support interactive applications
joinpair     connect pairs of points
jolygs       produce traces of "jolygons"
linddraw     draw L-System strings
lindgen      rewriting 0L-systems
lindrec      L-systems
lindterp     interpret and draw L-System strings
lsystem      Lindenmayer systems support
modlines     produce trace of modular lines
optwindw     open window with standard options
orbits       produce traces of orbits
overlay      overlay an image in a window
patutils     manipulate patterns
patxform     transform patterns in row form
pixelmap     create image from pixel list
psrecord     PostScript record of window
putpixel     write quantized, processed pixel
randarea     generate random points in areas
randfigs     generate random figures
rawimage     write and read images in raw format
rgbcomp      perform computations on RGB values
```

```
rgbrec        produce RGB record from color specification
rpolys        produce traces of regular polygons
rstars        generate traces of regular stars
rstartbl      produce calls for regular stars
slider        slider sensors
spirals       produce traces of fractal stars
spokes        draw spokes
strpchrt      dynamic stripchart for windows
subturtl      turtle-graphics (subset version)
symrand       generate random points
tile          tile window
tiler         tile window with image
turtle        turtle-graphics interface
twists        produce traces of "twists"
vbuttons      buttons
vcoupler      coupler variables
vdialog       dialog boxes
vframe        pane frame vidgets
vgrid         vidget grids
vidgets       vidgets
viface        interfacing vidgets
vmenu         vidget menus
vpane         vidget panes
vquery        window queries
vradio        radio buttons
vscroll       scrollbars
vsetup        vidget application setup
vslider       sliders
vstd          standard lookups
vstyle        drawing buttons
vtext         textual vidgets
wattrib       attributes
win           open bare-bones window
window        opening window
winsnap       take snapshot of a portion of a window
wipe          wipe window area
wopen         graphics input/output
xbfont        X font selection
xcolor        link color
xcompat       compatibility with 8.10 graphics
xform         transform points
xformimg      transform image
xforms        do matrix transformations
xgtrace       draw traces of points
xio           link window I/O
xplane        link bitplane
xputpixl      link putpixel
xqueue        link enqueue
xutils        graphics utilities
```

8.6 Include files -- `gincl`

```
keysyms       event key symbols
maccolor      Macintosh color mappings
vdefns        visual interface
```

```
        xcolors        X color names
        xnames         graphic procedure names
```

8.7 Loadable C functions -- `cfuncs`

```
        bitcount.c     count bits in an integer
        files.c        manipulate file attributes
        fpoll.c        poll file for input
        internal.c     access Icon internals
        lgconv.c       convert large integer to string
        osf.c          return OSF system table value
        pack.c         pack and unpack binary data
        ppm.c          manipulate PPM files in memory
        process.c      manipulate UNIX processes
        tconnect.c     open TCP connection
```

8.8 Data -- `data`

```
        *.csg          data for csg.icn
        *.krs          data for kross.icn
        *.lbl          data for labels.icn
        *.rsg          data for rsg.icn
        *.tok          sample output of syntactic token counting
        *.tur          data for turing.icn
        *.txt          plain text
        chart.gmr      data for ichartp.icn
        conman.sav     data for conman.icn
        farber.sen     "Farberisms"
        header         skeleton header for Icon program files
        hebcalen.dat   data read by hebcalen.dat
        hebcalen.hlp   help file for hebcalen.dat
        hebcalpi.hlp   data read by ProIcon version of hebcalen.dat
        icon.wrd       English words containing the substring "icon"
        ihelp.dat      data for ihelp.icn
        linden.dat     input to xlinden.dat
        noci.wrd       English words containing the substring "noci"
        palin.sen      Palindromic sentences
        pas128.cpt     Pascal triangle carpet to 128
        pt*.gmr        data for pt.icn
        sample.grh     sample data for graphpak.icn
        skeleton.icn   skeleton used to create/update Icon programs
        termcap.dos    termcap data for MS-DOS
        termcap2.dos   alternative termcap data for MS-DOS
        verse.dat      vocabulary for verse.icn
```

8.9 Data -- `gdata`

```
        *.clr          color lists, mostly from Icon palettes as named
        *.gif          GIF images
        *.iml          lists of image strings
        *.ims          image strings in Icon code format
        *.lch          data for gpacks/tiger/tgrmap.icn
        *.pts          data for facebend.icn
        gpxtest.gif    GIF image from gpxtest.icn
        gxplor.dat     test script for gxplor.icn
```

```
        linden.dat     input to linden.icn
        uix.dat        data for testing XIB-to-VIB conversion
        vibapp.icn     sample VIB application
        xibapp.icn     sample XIB application
        xnames.ed      ed(1) script to convert 8.10 function names to 9.0
```

8.10 Documentation -- `docs`

```
        address.doc    documentation for address procedures
        hebcalen.hlp   documentation for hebcalen.icn
        hebcalpi.hlp   documentation for hebcalpi.icn
        iconmake.doc   make skeleton for Icon
        ipp.doc        supplementary documentation for ipp.icn
        mr.man         manual page for mr.icn
        post.1         manual page source for post.icn
        polywalk.txt   description of polynomial programs
        procs.pdx      index to procedures
        pt.man         manual page for pt.icn
        *.fdx          indexes to files
```

8.11 Documentation -- `gdocs`

```
        gprocs.pdx     index to procedures
        gtrace.doc     documentation for graphic traces
        penelope.ps    PostScript documentation for penelope.icn
        vib.ps         PostScript documentation for interface builder
        vidgets.ps     PostScript documentation for vidgets
        *.fdx          indexes to files
```

8.12 Packages -- `packs`

```
        debug          Icon debugger
        ftrace         function tracing
        ibpag2         LR-based parser generator
        idol           Idol; object-oriented Icon written in Icon
        itweak         interactive debugger
        loadfunc       C functions loaded dynamically
        skeem          Scheme language, implemented in Icon
```

8.13 Packages -- `gpacks`

```
        ged            window-based editor
        tiger          map drawing from Census TIGER data
        vdemo          demonstration programs for vidgets
        vib            graphics interface builder
```

9. Contributions to the Icon Program Library

New material for the Icon program library always is welcome. See Reference 3 for guidelines and submission instructions.

10. Feedback

If you encounter problems with material in the Icon program library, please let us know. If

you can provide corrections or improvements to library material, please send them by electronic mail or on a diskette.

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Acknowledgements

Dozens of persons have contributed material to this release of the Icon program library. See the program material itself for authorship information.

References

1. R. E. Griswold, C. L. Jeffery and G. M. Townsend, *Version 9.1 of the Icon Programming Language*, The Univ. of Arizona Icon Project Document <u>IPD267</u>, 1995.

2. G. M. Townsend, R. E. Griswold and C. L. Jeffery, *Graphics Facilities for the Icon Programming Language; Version 9.1*, The Univ. of Arizona Icon Project Document <u>IPD268</u>, 1995.

3. R. E. Griswold, *Icon Program Library Submissions*, The Univ. of Arizona Icon Project Document <u>IPD151</u>,1996.

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