

# The Icon Program Library; Version 9.3.3

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## Introduction

The Icon program library consists of Icon programs, procedures, documentation, and data. Version 9.3 of Icon is required for some parts 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.

## Unloading the Library

Note: The complete library, when unloaded, requires about 12MB 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	
--mdata	as above, but for MT Icon
--mdocs	
--mincl	
--mpacks	
--mprocs	
--mprogs	
--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.

## 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.

## Installing the Library

Installing the Icon program library consists of two steps: (1) translating the procedure files to produce ucode files and (2) compiling 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 basic and graphics programs are compiled and linked using `icont` without the `-c` option, as in

```
icont deal
```

which compiles and links `deal.icn`, a program that produces randomly selected bridge hands. The MT Icon programs must be compiled with `mticont`, not `icont`.

The result of compiling 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 compiling 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.

## 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.

## 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.

## Contents

### Programs -- progs

<code>adlcheck</code>	check for bad address list data
<code>adlcount</code>	count address list entries
<code>adlfiltr</code>	filter address list entries
<code>adlfirst</code>	write first line of addresses
<code>adllist</code>	list address list fields
<code>adlsort</code>	sort address list entries
<code>allocwrl</code>	display storage allocation in VRML
<code>animal</code>	play "animal" guessing game
<code>applyfnc</code>	apply function to lines of a file
<code>banner</code>	display banner
<code>based</code>	do BASIC-style editing
<code>bfd</code>	compute best-fit-descending bin packing
<code>bj</code>	play blackjack game
<code>blnk2tab</code>	convert strings of 2 or more blanks to tabs
<code>c2icn</code>	assist C-to-Icon porting
<code>calc</code>	simulate desk calculator
<code>catlines</code>	concatenate lines of a file
<code>chars</code>	list the different characters in a file
<code>chkhtml</code>	check HTML files
<code>chop</code>	restrict numerical values
<code>colm</code>	arrange data into columns
<code>colorup</code>	produce a weave structure from unravel data
<code>comfiles</code>	list common files in two directories
<code>compare</code>	look for duplicates in a collection of files

comply83	check compliance with MS-DOS name restrictions
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
cwd	write current working directory
daystil	calculate the number of days until a given date
dd2draft	create draft information from drawdown
dd2res	compute loom resources needed from drawdown
dd2wif	produce a WIF from drawdown
ddfdump	print the contents of an ISO 8211 DDF file
deal	deal bridge hands
declchck	detect possible declaration errors
delam	delaminate file
delamc	delaminate file using tab characters
dellines	delete lines from a file
delta	list differences between successive numbers
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
digcol	produce nth column of digit data
diskpack	produce packing list for diskettes
drawup	create draft from drawdown
duplfile	find directories with same files
duplproc	find duplicate declarations
edscrip	produce script for ed(1)
empg	make expression-evaluation programs
envelope	address envelopes
evaluate	evaluate Icon expressions
extweave	extract weaving specifications from weave file
farb	generate Farberisms
farb2	generate Farberisms
filecnvt	convert line terminators
filehtml	create Web page with links to files
fileprep	prepare file information for IPL indexes
fileprnt	display characters in file
filerepl	replicate 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
floats	count floats
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
geddump	dump contents of GEDCOM file
gediff	"diff" for use with ged

gener	generate sequence from Icon expression
genfile	generate sequence from Icon expression in file
genqueen	solve arbitrary-size n-queens problem
getcol	extract column from data
getlines	extract lines from a file
gftrace	generating function tracing procedures
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
htget	get Web file using HTTP protocol
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
ifncsgen	generate procedure wrappers for functions
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
imaghtml	produce Web page for image files
indxcomp	assist in index compilation
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
iplindex	produce indexed listing of the program library
iplkwic	produce keywords in context for IPL
iplweb	generate web pages from IPL header comments
ipower	write sequence of powers
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
irsort	sort Icon record declaration
irunerr	print Icon runtime errors
isd2disd	show convert ISD draft to drawdown form
isd2wif	produce WIF from ISD
iseq	write sequence of integers
isize	measure size of an Icon program

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
kwicprep	prepare information for IPL KWIC listings
la	give exponent approximation for large numbers
labels	format mailing labels
lam	lamine files
latexidx	process LaTeX idx file
lc	count lines in file
lcfile	convert file names to lowercase
lcn	tp convert file names to all lowercase
limitf	limit throughput
lindcode	produce Icon code from L-system specifications
lindsys	generate sentences in 0L-systems
linseq	write a sequence of values on a line
link2url	convert links to URLs
lisp	interpret LISP programs
lister	list files
listhtml	create Web page with links to listed files
listviz	visualize lists
literate	manage literature information
ll	list shortest and longest lines in a file
loadmap	show load map of UNIX object file
longest	write longest line in a file
lower	map file names to lowercase
lssum	sum the file sizes in an ls -l listing
lssystem	map L-system symbols
maccv	convert Macintosh special characters to ASCII
makepuzz	make find-the-word puzzle
mapcolrs	map colors in lists
midisig	show signature of a MIDI file
missile	play missile command game
miu	generate strings from MIU system
mkpasswd	make passwords
monkeys	generate random text
morse	convert string to Morse code
mover	move files from one name to another
mr	read mail
mszip	ZIP a directory for MS-DOS use
mtf3	map tar file
mtutils	fpr MT Icon
newicon	produce new Icon program file
newsr	organize UNIX .newsr file
nim	play the game of nim
nocr	convert MS-DOS text files to UNIX
normalize	normalize numeric channel
oldicon	update the date in an Icon program header
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
polydemo	demonstrate polynomial library
post	post news
press	archive files
pretrim	filter out first terms in an input stream
procprep	produce input to index for procedure comments
procrwrap	produce Icon procedure wrappers
proto	show Icon syntactic forms
psrsplit	separate psrecord.icn output pages
pt	produce parse table generator
puzz	create word search puzzle
qei	evaluate Icon expressions interactively
qt	announce time in English
queens	generate solutions to the n-queens problem
ranstars	display star field
rcat	output a file from back to front
recgen	generate context-free recognizer
repeats	repeat stream
reply	reply to news-articles or mail
repro	self-reproduce
revfile	reverse the order of lines in a file
revsort	sort strings backwards
roffcmds	list roff commands and macros
rsg	generate randomly selected sentences
ruler	write a character ruler
sample	"sample" input stream
scale	scale numeric values in visualization stream
scramble	scramble a document
setmerge	combine sets of text items
shar	create UNIX shell archive
shortest	write shortest line in a file
shuffle	shuffle lines in a file
sing	sing The Twelve Days of Christmas
slice	write long line as multiple short lines
snake	play the snake game
solit	play solitaire
sortname	order by last name
splitlit	create string literal
spread	format tab-separated data columns
streamer	append lines of file into one long line
strimlen	produce lengths of string images.
strpsgml	strip/translate SGML tags
tabexten	tabulate file extensions
tablc	tabulate characters in a file
tablw	tabulate words in a file
tabulate	tabulate lines in a file
textcnt	tabulate properties of text file
textcvr	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

url2link	convert bookmarked URLs to link references
utrim	remove unneeded procs from ucode
verse	generate bizarre verses
versum	produce versum sequence
vnq	display solutions to n-queens problem
vrepl	replicate input lines
weblinks	check links in HTML files
what	identify source-code information
when	show file age
wif2isd	convert WIFs to ISDs
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

## Programs -- gprogs

autotile	produce tile from XBM image
binpack	demonstrate some bin packing algorithms
bitdemo	demonstrate bitplanes
bme	edit bitmap
bpack	demonstrate some bin packing algorithms
browser	demonstrate file-navigation "dialog"
ca21	investigate cellular automata
calib	calibrate color monitor
cameleon	allow user to change colors in an image
chernoff	imitate a Chernoff face
clrs2pdb	create custom palettes from color lists
coloralc	test color allocation
colormap	display palette from color list
colorwif	a WIF from unravel data
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"
cw	manipulate color ways
design1	draw spokes design
design2	draw circular design
design3	draw square design
dlgvu	display USGS DLG map files
drawcolr	display color list
drip	demonstrate color map animation
etch	distributed Etch-A-Sketch
facebend	generate caricatures
fetti	explore families of confetti squares
fev	display text in fisheye view
fileimag	create GIF image of file text
findrpt	find smallest repeat in a repeat pattern.
findtile	find tiles in an image
flake	draw a fractal snowflake
flohistro	display float histograms
fmap2pdb	create custom palettes from color maps
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 images at once
gamma	perform gamma correction on images
gif2isd	produce a ISD from bi-level image

gif2wif	produce a WIF from black & white image
gifs2pdb	produce custom palettes from GIF images
giftoims	convert GIF files to image strings
giftopat	convert GIF image to hex-form pattern
gpctest	test graphics procedures
gridedit	create and edit binary arrays
gexplor	explore graphics facilities
hb	Hearts & Bones game
histo	display simple histogram
hsvpick	pick RGB or HSV colors
hvc	pick colors for Tek HVC space
img	create images
img2grid	convert images to grids
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
ims2pat	convert image string to bi-level pattern
imstogif	convert image strings to GIF files
ipicker	print name of selected images
isd2gif	create woven image from ISD
isd2grid	create grid plots for ISDs
isd2ill	create images from ISDs
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
linden	generate sentences in 0L-systems
lorenz	display Lorenz strange attractor
lsys	experiment with Lindenmayer systems
mandala	draw mandala design
mandell	display the Mandelbrot set
mandel2	draw the Mandelbrot set
mercator	display surface of HLS color cones
mirroror	mirror images given on command line
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
plotter	display planes of 3-space coordinates
pme	edit pixmaps
poller	record image as pixel coordinates.
procatcr	display concatenation sizes
profile	display scrolling histogram
profiler	display number magnitudes
prompt	prompt in a window
randweav	create random weavable patterns
randweb	draw random web design
recticle	draw rectangles recursively

rectile	extract portion of image
rects	tile window with colored rectangles
repeater	repeat image
rings	draw tiles of rings and circles
rolypoly	draw ``abstract`` art
rstarlab	draw regular stars
scroll	scroll image
scroller	scroll image
seamcut	cut image for seamless tiling
selecttle	select tile from an image
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
spokes	draw spokes design
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
tilescan	select tile from an image
travels	animate the traveling salesman problem
trycolor	investigate color specifications
tryfont	demonstrate X font rankings
uix	translate user interfaces
unravel	find thread colors for weaving
viewpane	view image through a "pane"
vqueens	display solutions to the n-queens problem
webimage	produce Web page for image files
wevents	report Icon window events
wheel	show wheel of colors
wifs2pdb	create palette database from WIFs
xbm2pat	convert XBM file to pattern specification
xformpat	apply transformation to patterns
xgamma	configure X color correction
xpmtioms	make Icon images from XPM files
zoomtile	show a tile magnified

## Programs -- mprogs

alcscope	visualize allocation as a kaleidoscopic display
alcview	display allocation events in various ways
algae	show expression evaluation as ``algae``
anim	show animated display of Icon source code
callcnt	count calls
cmpsum	tabulate comparisons
cnvsum	tabulate type-conversion activity
cvtsum	count conversion event tuples
events	show events
evstream	show events
evsum	tabulate event codes

exprsum	tabulate operator and function evaluation
listev	list events
locus	trace execution locus
memsum	tabulate memory allocation
mmm	show allocation as a miniature "MemMon"
napoleon	track memory usage by type
novae	show allocations as exploding stars
numsum	tabulate numerical computation
opersum	tabulate operation activity
ostrip	show virtual-machine op-code strip
playev	play back events
program	display portion of a program in a window
recordev	record events
roll	display the program counter on a stripchart
scat	produce call/result scatterplot
scater	display visualize string concatenation
strsum	tabulate string computation
strucget	collect SP structures
vc	coordinate visualization programs
vmsum	tabulate virtual-machine operations

## Procedures -- procs

abkform	process HP95LX appointment books
adjuncts	gettext and idxtext
adlutils	process address lists
allof	conjunction control operation
allpat	produce all n-character patterns of characters
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
base64	base64 encodings for MIME (RFC 2045)
basename	produce base name of a 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
bufread	buffered read and lookahead
calendar	data and time calculation and conversion
calendat	get date from Julian Day Number
calls	calls as objects
capture	echo output to a second file
cartog	cartographic projection
caseless	perform caseless scanning
codeobj	encode and decode Icon data
colmize	arrange data into columns
colrspec	produce VRML color specifications
complete	complete partial input string
complex	perform complex arithmetic
conffile	read files of directives for "initialization"
converge	produce continued-fraction convergents
convert	various conversions
created	determine number of structures created
currency	formatting currency
curves	generate points on plain curves

datefns	dates
datetime	date and time operations
ddfread	reading ISO 8211 DDF files
dif	check for differences
digitcnt	count number of digits in file
divide	perform long division
ebcdic	convert between ASCII and EBCDIC
empgsup	support emp
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
eventgen	meta-variant code generation
everycat	generating all concatenations
expander	convert character pattern expressions
exprfile	produce programs on the fly
factors	related to factors and prime numbers
fastfncs	integer functions using fastest method
feval	evaluate string as function call
filedim	compute file dimensions
filenseq	get highest numbered filename in a sequence
filesize	get the size of a file
findre	find regular expression
ftype	produce type for file
fullimag	produce complete image of structured data
gauss	compute Gaussian distributions
gdl	get directory lists
gdl2	get directory lists
gedcom	reading GEDCOM files
gen	meta-variant code generation
gener	generate miscellaneous sequences
genrfncs	generate sequences
geodat	geodetic datum conversion
getchlib	getch for UNIX
getkeys	get keys for a gettext file
getmail	parse mail file
getpaths	generate elements in path
gettext	gettext (simple text-base routines)
graphpak	manipulating directed graphs
hetero	test structure typing
hexcvt	hexadecimal conversion
hostname	produce host name
html	parsing HTML
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
intstr	create string from bits
io	input and output
iolib	termlib support
iscreen	screen functions
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
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
lindgen	rewriting 0L-systems
lindstrp	interpret L-system output as striped pattern
list2tab	write list as tab-separated string
lists	manipulate lists
loadfile	produce and load program on the fly
longstr	match longest string
lrgapprx	approximate integer values
lu	L <sub>U</sub> manipulation
makelsys	convert L-Systems to records
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
mixsort	sort tables with case mixing
models	model Icon functions
morse	convert string to Morse code
mset	multi-sets
namepfx	produce prefix portion of name
ngrams	produce 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)
patterns	SNOBOL4-style pattern matching
patword	find letter patterns
pbkform	process HP95 phone book files
pdco	programmer-defined control operations
phoname	generate letters for phone numbers
plural	produce plural of English noun
polystuf	manipulating polynomials
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
ptutils	relating to objects in 3-space

random	related to random numbers
rational	arithmetic on rational numbers
readcpt	read produce "carpet" from file
readtbl	read user-created stripsgml table
reassign	access RE groupings and format into a string
rec2tab	write record as string
recog	recognition
records	manipulate records
recrfncs	recursive functions
recurmap	map recurrence declarations to procedures
reduce	perform operation on list of arguments
regex	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
scan	related to scanning
scanmodl	model string scanning
scanset	setup for string scanning procedures
segment	segment string
sentenl	generate sentences
sentence	generate sentences in file
seqfncs	designing with sequences
seqimage	produce string image of Icon result sequence
seqops	perform operations on finite sequences
serial	return serial number of structure
sername	produce serialized names
sets	set manipulation
showtbl	show contents of a table
shquote	quote word for UNIX-like shells
signed	put bits into signed integer
skelproc	Procedure
sort	sorting
sortt	sort table into records
soundex	produce Soundex code for name
soundexl	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
tieutils	related to weaving tie-ups
title	produce title portion of name
titleset	produce set of titles
tmpname	get temporary file name
tokgen	token counting
trees	manipulating trees and dags
tuple	process n-tuples
typecode	produce letter code for Icon type
unsigned	put bits unsigned integer
usage	service functions

varsub	perform UNIX-shell-style substitution
verncnt	compute number of n-digit versum numbers
version	produce Icon version number
vhttp	validating an HTTP URL
vrml	support creation of VRML files
vrml1lib	support construction of VRML 1.0 files
vrml2lib	support construction of VRML 2.0 files
wdiag	write values with labels
weavgenr	Links to procedures related to sequence drafting
weaving	implement weaving expressions
weavutil	support numerical weavings
weighted	shuffle list with randomness
wifisd	convert WIF to xencoded ISD
wildcard	UNIX-like wild-card pattern matching
word	scan UNIX-style command line words
wrap	wrap output lines
wrotecpt	write a "carpet" file
xcode	save and restore Icon data
xcodes	save and restore Icon data
xforms	do matrix transformations
ximage	produce string image of structured data
xrotate	rotate values in list or record
zipread	reading files from ZIP archives

## 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
cells	creating and coloring panels of cells
clip	clipboard operations
clipping	clipping lines
clrnames	generate color names
clrutils	convert color formats
color	dealing with colors
colorway	manipulate color ways
colrlist	produce list of colors
colrmodl	convert between color models
curves	generate points on plain curves
cwutils	support color ways
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
event	produces events from a window event history
evmux	window event multiplexor
evplay	"play back" recorded window events
evrecord	record window events
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
glabls	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
imrutils	deal with image records
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
isdplot	create grid plots for ISDs
joinpair	connect pairs of points
jolygs	produce traces of "jolygons"
linddefs	produce table of L-systems
linddraw	draw L-System strings
lindgen	rewriting 0L-systems
lindrec	L-systems
lindinterp	interpret and draw L-System strings
lssystem	Lindenmayer systems support
mirror	mirror tile
modlines	produce trace of modular lines
navitrix	perform file navigation
optwindw	open window with standard options
orbits	produce traces of orbits
overlay	overlay an image in a window
palettes	programmer-defined palettes
patutils	manipulate patterns
patxform	transform patterns in row form
pixelmap	create image from pixel list
popular	show "popularity" of colors in image string
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
repeats	repeat image
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
select	get selection from window
slider	slider sensors
spirals	produce traces of fractal stars
spokes	draw spokes
strpchr	dynamic stripchart for windows
subturtle	turtle-graphics (subset version)
symrand	generate random points
tieedit	create and edit binary arrays
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
vfilter	change filter mode in sliders and scrollbars
vframe	pane frame widgets
vgrid	widget grids
widgets	widgets
viewpack	visualize color streams
viface	interfacing widgets
vlist	a scrollable list widget
vmenu	widget menus
vpane	widget panes
vquery	window queries
vradio	radio buttons
vscroll	scrollbars
vsetup	widget application setup
vslider	sliders
vstd	standard lookups
vstyle	drawing buttons
vtext	textual widgets
wattrib	attributes
weavegif	produce a woven image from a draft
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
xforming	transform image
xgtrace	draw traces of points
xio	link window I/O
xplane	link bitplane
xputpixl	link putpixel
xqueue	link enqueue
xutils	graphics utilities

## Procedures -- mprocs

colormap	map type event to color
colortyp	produce table of colors for Icon types
em_setup	set up execution monitors
emutils	support MT-Icon monitors
evaltree	maintain activation tree
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
evutils	support event monitoring
hexlib	hexagons
opname	map VM opcodes to their names
typebind	produce table of graphic contexts for type
typesyms	map type codes to event codes
viewpack	visualize color streams
visprocs	visualization code

## Include files -- incl

invkdefs	operator symbols
lshade	VRML 1.0 ornament
opdefs	Icon virtual-machine instructions

## Include files -- gincl

keysyms	event key symbols
maccolor	Macintosh color mappings
vdefs	visual interface
xcolors	X color names
xnames	graphic procedure names

## Include files -- mincl

etdefs	artificial event codes
evdefs	event codes

## Loadable C Functions -- cfuncs

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

## 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
hebcapi.hlp	data read by ProIcon version of hebcalen.dat
icon.wrd	English words containing the substring ``icon``
ihelp.dat	data for ihelp.icn
noci.wrd	English words containing the substring ``noci``
palin.sen	Palindromic sentences
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

## Data -- gdata

*.gif	GIF image files
*.ims	image strings in Icon code format
*.lch	data for gpacks/tiger/tgrmap.icn
*.pts	data for facebend.icn
clr.pack	"pack" containing Icon's color palettes
gpctest.gif	GIF image from gpctest.icn
gxplor.dat	test script for gxplor.icn
iml.pak	image strings in "pack" format
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

## Data -- mdata

There presently are no data files for MT-Icon.

## 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

## Documentation -- gdocs

gprocs.pdx	index to procedures
gtrace.doc	documentation for graphic traces
linden.dat	input to linden.icn
penelope.ps	PostScript documentation for penelope.icn
vib.ps	PostScript documentation for interface builder
widgets.ps	PostScript documentation for widgets
*.fdx	indexes to files

## Documentation -- mdocs

mprocs.pdx	procedure indexes
*.fdx	file indexes

## Packages -- packs

euler	Euler compiler and interpreter
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
tc111	parser-generator and parser

## **Packages -- gpacks**

carpets	numerical carpets
drawtree	tree-drawing package
ged	text editor
htetris	Tetris game
tiger	map drawing from Census TIGER data
vib	graphics interface builder
weaving	programs and procedures related to weaving
xtiles	game

## **Packages -- mpacks**

There are no MT-Icon packages at present.

## **Contributions to the Icon Program Library**

New material for the Icon program library always is welcome. See Reference 4 for guidelines and submission instructions.

## **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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## **References**

1. R. E. Griswold, C. L. Jeffery and G. M. Townsend, *Version 9.3 of the Icon Programming Language*, The Univ. of Arizona Icon Project Document IPD278, 1996.

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3. C. L. Jeffery, *The MT Icon Interpreter*, The Univ. of Arizona Icon Project Document IPD169, 1993.
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