GNU APL Reference Card

(for GNU APL version 1.8)

Emacs mode

Interaction mode:

beginning of defun	C-M-a
end of defun	C-M-e
find function at point	M-.
apropos symbol	C-c C-a
edit function	C-c C-f
show help for symbol	C-c C-h
finnapl list	C-c TAB
show keyboard	C-c C-k
plot line	C-c RET
edit variable	C-c C-v
trace	C-c C-.

Edit mode:

go to beginning of defun	C-M-a
go to end of defun	C-M-e
find function at point	M-.
apropos symbol	C-c C-a
interactive send current function	C-c C-c
help for symbol	C-c C-h
finnapl list	C-c TAB
show keyboard	C-c C-k
interactive send buffer	C-c C-l
interactive send region	C-c C-s
switch to interactive	C-c C-z
trace	C-c C-.
indent	C-M-q

System

Notation for commands:

F	filename	L	library	P	path
G	logging facility	O	object	S	symbol
W	workspace				

APL standard commands

check workspace intergity	)CHECK
clear workspace	)CLEAR
save workspace as CONTINUE and exit	)CONTINUE
copies objects from given workspace	)COPY [L] W [O ...]
remove W	)DROP [L] W
dump W (readable, HTML escaped)	)DUMP-HTML [[L] W]
dump W (readable APL)	)DUMP [[L] W]
dump W (readable APL, verbose)	)DUMPV [[L] W]
erase symbol(s)	)ERASE S ...
show functions	)FNS [from-to]
help	)HELP [primitive]
history	)HIST [CLEAR]
runs command on host	)HOST command ...
loads workspace (IBM .atf format)	)IN F [O ...]
show libraries and paths	)LIBS [[L] path]
show saved workspaces	)LIB [L|P] [from-to]
load workspace W	)LOAD [L] W
show more error info	)MORE
lists symbols matching name	)NMS [from-to]
quit APL	)OFF
show operators	)OPS [from-to]
dump workspace (IBM .atf format)	)OUT name [O ...]
protects during copying	)PCOPY [L] W [O ...]
protects during loading	)PIN F [O ...]
quiet load	)QLOAD [[L] W]
reset state indicator	)RESET
save workspace as W	)SAVE [[L] W]
clear suspended functions	)SIC
see suspended functions and locals	)SINL
see suspended functions	)SIS
state indicator	)SI
show symbol count	)SYMBOLS [count]
show values in use by interpreter	)VALUES
show variables	)VARS [from-to]
get/set workspace ID	)WSID [W]

GNU extension commands (mostly for debugging)

toggles boxing of values when printing	]BOXING [OFF|num]
toggle colored output	]COLOR [ON|OFF]
dump W in HTML file	]DOXY [path]
expected error count in test suite	]EXPECT error_count
help	]HELP [primitive]
show keyboard layout	]KEYB
as)LIB, but shows fil eextensions	]LIB [L|P] [from-to]
show/set logging facilities	]LOG [G [ON|OFF]]
next testcase file	]NEXTFILE
FIXME:	]OWNERS
performance statistics	]PSTAT [CLEAR|SAVE]
as)SIS, with more details	]SIS
as)SI, with more details	]SI
shared variables	]SVARS
describe internal details of symbol S	]SYMBOL S
define user command	]USERCMD [...]
toggle output coloring on console	]XTERM [ON|OFF]

System variables:

character input/output	⍞
evaluated input/output	□
account information	□AI
command line arguments	□ARG
atomic vector	□AV
comparison tolerance	□CT
event message	□EM
event type	□ET
format control	□FC
index origin (indexes start: 1, can be set to 0)	□IO
left argument	□L
line counters	□LC
latent expression (executed when workspace is loaded)	□LX
print precision (number of digits)	□PP
print style	□PS
print width (max characters in each printed line)	□PW
right argument	□R
random link	□RL
shared variable event	□SVE
system limits	□SYL
terminal control characters	□TC
time stamp (current time)	□TS
time zone (offset from GMT)	□TZ
user load	□UL
axis argument	□X
workspace available (bytes for workspace)	□WA
dfn axis argument	X
dfn result	λ
dfn left value arg	α
dfn left function arg	$\underline{\alpha}$
dfn right value arg	ω
dfn right function arg	$\underline{\omega}$

System functions:

atomic function	□AF
attributes	□AT
char representation	□CR
delay	□DL
D. Knuth's dancing links	□DLX
execute alternate	□EA
execute both	□EB
execute controlled	□EC
environment	□ENV
event simulate	□ES
expunge	□EX
fast Fourier transform	□FFT
file I/O	□FIO
FiX (FFI/call native functions)	□FX
Gtk GUI	□GTK
MAP ravel elements	□MAP
input from script	□INP
name association	□NA
name class	□NC
name list	□NL
plot a graph	□PLOT
regular expression, regex □RE string	□RE
random APL value	□RVAL
state indicator	□SI
SQL functions	□SQL
shared variable control	□SVC
shared variable offer	□SVO
shared variable query	□SVQ
shared variable retraction	□SVR
shared variable state	□SVS
STOP vector	□STOP
transfer form	□TF
TRACE vector	□TRACE
unicode character	□UCS

Notation

comment	⍝
statement separator	⋄
assignment	A← ...
assignment	(A B C)← ... ...
function definition	∇
zilde (empty vector)	⍬

a	`+ a`
a + b	`a + b`
- a	`- a`
a - b	`a - b`
magnitude of a	`| a`
b mod a	`a | b`
signal (-1, 0, +1)	`× a`
ab	`a × b`
1/a	`÷ a`
a/b	`a ÷ b`
floor of a	`⌊a`
min(a,b)	`a⌊b`
ceiling of a	`⌈a`
max(a,b)	`a⌈b`
e^a	`* a`
a^b	`a * b`
log(a)	`⍟ a`
log_{b}(a)	`b ⍟ a`
first n non-negative integers	`⍳ n`

a = b	`a = b`
a < b	`a < b`
a > b	`a > b`
a ≤ b	`a ≤ b`
a ≥ b	`a ≥ b`
expression max depth	`≡ a`
match (value and type)	`a ≡ b`
expression min depth	`≢ a`
not match	`a ≢ b`
not a	`~ a`
a or b	`a ∨ b`
a and b	`a ∧ b`
a nor b	`a ⍱ b`
a nand b	`a ⍲ b`
a ∈ b ?	`a ∈ b`
find a in b (binary index)	`a ⍷ b ?`

a!	`! a`
$\binom{b}{a}$	`a ! b`

aπ	`○a`
circle (trig) function	`a ○ b`
random integer in [1,a]	`? a`
a distinct random integers in [1,b]	`a ? b`

makes a vector out of A	`, A`
append B to A	`A , B`
number of components in each dimension of A	`⍴ A`
array with shape A and data elements B	`A⍴ B`
inverse matrix of A	`⌹ A`
B^{-1}A (solution to $Bx = A$)	`A⌹B`
reverse elements of A (1^{st} index)	`⊖A`
rotate B by A positions	`A⊖B`
reverse elements of A (last index)	`⌽A`
rotate B by A positions (last index)	`A⌽B`
drop first A elements of B	`A↓B`
select first A elements of B	`A↑B`
intersection	`A∩B`
set (remove duplicates)	`∪A`
union	`A∪B`
identity	`⊢A`
take right hand side (B)	`A⊢B`
null	`⊣A`
take left hand side (A)	`A⊣B`
i-th element of A	`A[i]`
elements of A with indices i, j, k, ...	`A[i j k ...]`
element of A w/indices i, j, ... in 1^{st} dimension, k, l, ... in second, ...	`A[i ...; k ...; ...]`

transpose of A	`⍉A`
transpose of B, axes ordered by A	`A⍉B`
maps A: 1 for a∈ B, 0 for a∉ B	`A∈B`
grade up A	`⍋A`
grade up B with elements of A as top priority	`A⍋B`
grade down A	`⍒A`
grade down B with elements of A as low priority	`A⍒B`
transpose of A	`⍉A`
enclose A	`⊂ A`
enclose B with selected elements given the binary vector A	`A⊂ B`
disclose A	`⊃ A`
recursively pick elements of B given the indices in A	`A⊃ B`

Decode single digits of B with respect to base A	`A⊥B`
Encode B with respect to bases given by A	`A⊤B`

line label A	`A:`
branch to line A	`→A`

execute APL expression A	`⍎A`
format A as chars	`⍕A`

user input	`□`

system var/function	`□`

reduce `op` over array A	`op/A`
compress: select B using A as mask	`A/B`
A/B on last dimension	`A⌿B`
expand: insert zeros in B using A as mask	`A\B`
A\B on last dimension	`A⍀B`
inner product with functions f, g	`Af.gB`
outer product with function f	`A∘.fB`
for each b∈B, apply: Ab	`A"B`
axis: AfC, over Bth axis	`Af[B]C`
duplicate/commute	
compose	`A∘B`

□CR, □FIO, □PLOT, □SQL

When called with an empty string as right argument, these will show a table with all their possible uses.

Circle function

`A`	`A∘B`	`A`	`A∘B`
0	$\sqrt{1-B \times B}$		
−1	arcsin `B`	1	sin `B`
−2	arccos `B`	2	cos `B`
−3	arctan `B`	3	tan `B`
−4	$\sqrt{-1+B \times B}$	4	$\sqrt{1+B \times B}$
−5	arcsinh `B`	5	sinh `B`
−6	arccosh `B`	6	cosh `B`
−7	arctanh `B`	7	tanh `B`
−8	`-(8∘B)`	8	$\pm\sqrt{-1+B \times B}$
−9	`B`	9	real part of `B`
−10	`+B`	10	`|B`
−11	`0J1×B`	11	imag part of `B`
−12	`*0J1×B` (e^{iB})	12	arc `B` (phase of `B`)

For `A`= 8, the sign before the square root is opposite of B.

Function Definition

Example: $f(d, v) = \left(v_1^d + \cdots + v_n^d\right)^{1/d}$

Dynamic function definition (dfn):

α is the left argument, ω is the right argument.

`f ← { ( +/ω*α ) * (÷α) }`

Traditional function definition (tradfn):

∇: begin/end defun. "`∇R ← A f B ;U ;V`" is "`f` takes left arg `A`, right arg `B`, has local vars `U`, `V`, and returns result in `R`".

```
∇res ← d f v ;sq ;sum
  sq ← v * 2
  sum ← +/sq
  res ← sum*(÷d)
∇
```