Reference Card

Dyalog APL/W Version 10

¯	negative sign	B	boolean
''	quotes	Z	integer
[]	brackets	R	real number
()	parentheses	C	character
{}	braces		
α	left argument	A	array
αα	left operand	M	matrix
ω	right argument	V	vector
ωω	right operand	S	scalar
::	error guard		
#	root object	N	name of variable
##	parent object		
.	name separator	I	index specification
;	dimension separator		
:	label separator/guard		
⋄	statement separator		
⍝	comment symbol		
∇	function self		
∇∇	operator self		

NB colours proportional to name class ⎕NC

© Graeme Robertson Ltd. 2005

Primitive Functions

Function	Syntax	Result
and	BA ∧ BA	BA ⍝ logical and on scalars
assigned	N ← A	⍝ name is assigned array
binomial	RA ! RA	RA ⍝ {(!ω)÷(!α)×!ω-α}
branch	→ ZS	⍝ branched to line ⊃ω
catenate	A , A	A ⍝ join along last axis
catenate first	A ⍪ A	A ⍝ join along first axis
ceiling	⌈ A	ZA ⍝ {-⌊-ω} (⎕CT)
circle	ZA ○ RA	RA ⍝ trig function number α
deal	RS ? RS	ZV ⍝ random in ⍳ω (⎕IO,⎕RL)
decode	RA ⊥ RA	RA ⍝ ω in number system α
depth	≡ A	ZS ⍝ levels of nesting(⎕ML)
disclose	⊃ A	A ⍝ value of first item
divide	RA ÷ RA	RA ⍝ α divided by ω (⎕DIV)
drop	ZV ↓ A	A ⍝ elts removed from ω
enclose	⊂ A	S ⍝ single item is array ω
encode	RA ⊤ RA	RA ⍝ represent ω in radix α
enlist	∊ A	V ⍝ all elts unnested(⎕ML)
equal	A = A	BA ⍝ 1 if elts equal (⎕CT)
excluding	V ~ A	V ⍝ {(~α∊,ω)/α} (⎕CT)
execute	⍎ CV	A ⍝ result of last expr
execute (dyadic)	CV ⍎ CV	A ⍝ execute in namespace α
expand	ZV \ A	A ⍝ expansion of ω by α
expand first	ZV ⍀ A	A ⍝ expansion on 1st axis
exponential	* RA	RA ⍝ e to the power ω
factorial	! RA	RA ⍝ gamma function of ω+1
find	A ⍷ A	BA ⍝ α within ω (⎕CT,⎕IO)
floor	⌊ RA	ZA ⍝ integer part of ω (⎕CT
format	⍕ A	CA ⍝ char representation
format (dyadic)	ZV ⍕ RA	CA ⍝ represented by spec α
grade down	⍒ A	ZV ⍝ descending perm (⎕IO)
grade down(dyadic	CA ⍒ CA	ZV ⍝ perm of ⍳⊃⍴ω (⎕IO)
grade up	⍋ A	ZV ⍝ ascending perm (⎕IO)
grade up (dyadic)	CA ⍋ CA	ZV ⍝ perm of ⍳⊃⍴ω (⎕IO)
greater than	RA > RA	BA ⍝ α greater than ω (⎕CT)
greater or equal	RA ≥ RA	BA ⍝ α not less than ω (⎕CT
identity	+ A	A ⍝ result identical to ω
index generator	⍳ ZV	ZA ⍝ coords of ω shaped(⎕IO
index of	V ⍳ A	ZA ⍝ posn ω in α (⎕CT,⎕IO)
indexed assign	N[I]← A	⍝ var index I is ω (⎕IO)
indexed by	A[I]	A ⍝ elts of A index I(⎕IO)
intersection	V ∩ V	V ⍝ {(α∊ω)/α} (⎕CT)
less than	RA < RA	BA ⍝ α less than ω (⎕CT)

less or equal	RA ≤ RA	BA ⍝ {~α>ω} (⎕CT)
logarithm	RA ⍟ RA	RA ⍝ log ω base α
magnitude	| RA	RA ⍝ {ω⌈-ω}
match	A ≡ A	BS ⍝ α identical to ω (⎕CT)
matrix divide	RM ⌹ RM	RM ⍝ {(⌹ω)+.×α}
matrix inverse	⌹ RM	RM ⍝ inverse matrix
maximum	RA ⌈ RA	RA ⍝ {-(-α)⌊-ω}
member of	A ∊ A	BA ⍝ elt α found in ω (⎕CT)
minimum	RA ⌊ RA	RA ⍝ {(ω×ω<α)+α×ω≥α}
minus	RA - RA	RA ⍝ subtract ω from α
mix	↑ A	A ⍝ 1 less nest level(⎕ML)
nand	BA ⍲ BA	BA ⍝ {~α∧ω}
natural logarithm	⍟ RA	RA ⍝ log ω base e(e=2.71...
negate	- RA	RA ⍝ {0-ω}
nor	BA ⍱ BA	BA ⍝ {~α∨ω}
not	~ BA	BA ⍝ {1-ω}
not equal	A ≠ A	BA ⍝ {~α=ω} (⎕CT)
not match	A ≢ A	BS ⍝ {~α≡ω} (⎕CT)
or	BA ∨ BA	BA ⍝ logical or on scalars
partition	V ⊂ A	A ⍝ ω partitioned by α(⎕ML
pi times	○ RA	RA ⍝ π×ω (π=3.1459...)
pick	ZV ⊃ A	A ⍝ items from ω (⎕IO)
plus	RA + RA	RA ⍝ α added to ω
power	RA * RA	RA ⍝ α raised to power ω
ravel	, A	V ⍝ {(×/⍴ω)⍴ω}
reciprocal	÷ RA	RA ⍝ {1÷ω}
replicate	ZV / A	A ⍝ repeat last axis subs
replicate first	ZV ⌿ A	A ⍝ repeat first axis subs
reshape	ZV ⍴ A	A ⍝ reshape ω to shape α
residue	RA | RA	RA ⍝ {ω-α×⌊ω÷α+α=0} (⎕CT)
reverse	⌽ A	A ⍝ ω rot about last axis
reverse first	⊖ A	A ⍝ ω rot about first axis
roll	? ZA	ZA ⍝ random from ⍳ω(⎕IO,⎕RL
rotate	ZA ⌽ A	A ⍝ ω rot according to α
rotate first	ZA ⊖ A	A ⍝ ω rot according to α
selective assign	(Expr N)←A	⍝ select var assign ω
shape	⍴ A	ZV ⍝ dimensions of ω
signum	× RA	ZA ⍝ {(ω>0)-ω<0}
split	↓ A	A ⍝ enc items on last axis
take	ZV ↑ A	A ⍝ elements taken from ω
times	RA × RA	RA ⍝ α multiplied by ω
transpose	⍉ A	A ⍝ order of axes reversed
transpose(dyadic)	ZV ⍉ A	A ⍝ axes changed to α(⎕IO)
type	∊ A	A ⍝ 0 or space by type(⎕ML
union	V ∪ V	V ⍝ {α,ω~α} (⎕CT)
unique	∪ V	V ⍝ {((⍳⍴ω)=ω⍳ω)/ω} (⎕CT)
zilde	⍬	V ⍝ empty num vector 0⍴0

Primitive Operators

Operator	Syntax	Derived Function
axis	ƒ[ZS]	ƒ on ω axis ZS(⎕IO)
axis (dyadic operand)	ƒ[ZS]	αƒω on axis ZS(⎕IO)
commute	ƒ⍨	ωƒα
composition form I	ƒ∘g	ƒgω
composition form II	A∘g	Agω
composition form III	ƒ∘A	ωƒA
composition form IV	ƒ∘g	αƒgω
each	ƒ¨	ƒ on each item of ω
each (dyadic operand)	ƒ¨	ƒ on items of α ω
inner product	ƒ.g	ƒ/αgω for adj vecs
modified assign	Nƒ←	N←Nƒω
modified indexed assign	N[I]ƒ←	N[I]←N[I]ƒω
modified selective assign	(Expr N)ƒ←	mod assign Expr N
outer product	∘.g	all combs of αgω
reduce	ƒ/	ƒ between items ω
reduce first	ƒ⌿	ƒ between items ω
reduce n-wise	ƒ/	ƒ/ on length α subs
scan	ƒ\	successive ƒ/
scan first	ƒ⍀	scan on first axis
spawn	ƒ&	ƒω in a new thread
spawn (dyadic operand)	ƒ&	αƒω in a new thread

System Commands

Workspace	Global Names	Program Control
)LOAD {ws}	)VARS {nm}	)ED nms
)XLOAD {ws}	)FNS {nm}	)SI
)COPY {ws {nms}}	)OPS {nm}	)SINL
)PCOPY {ws {nms}	)OBS {nm}	)RESET
)CLEAR	)PROPS {nm}	)CMD {cmd}
)DROP {ws}	)EVENTS {nm}	)SH {cmd}
)LIB {dir}	)METHODS {nm}	)CONTINUE
)WSID {ws}	)TID {tid}	)OFF
)SAVE {ws}	)HOLDS	
)NS {nm}	)ERASE nms	
)CS {nm}		

Control Structures

```
:For..    :In|:InEach..           ⋄..              ⋄:EndFor
:Hold..                           ⋄:Else..        ⋄:EndHold
:If..       ⋄:AndIf|:OrIf..       ⋄:Else|:ElseIf.. ⋄:EndIf
:Repeat..   ⋄:EndRepeat|:Until..  ⋄:AndIf|:OrIf..
:Select..   ⋄:Case|:CaseList..    ⋄:Else..      ⋄:EndSelect
:Trap..     ⋄:Case|:CaseList..    ⋄:Else..        ⋄:EndTrap
:While..⋄:AndIf|:OrIf..⋄:EndWhile|:Until..⋄:AndIf|:OrIf..
:With..                                           ⋄:EndWith
      (See also :GoTo :Return :Continue :Leave)
```

System Variables & Functions

account information	R←⎕AI	extended state indictr	R←⎕XSI
account name	R←⎕AN	external variable	{R}←{α}⎕XTω
alphabet 1	R←⎕A	file apnd cpt	{R}←α⎕FAPPENDω
alphabet 2	R←⎕Ⓐ	files available	R←⎕FAVAIL
arbitrary input	R←{α}⎕ARBINω	file create	{R}←α⎕FCREATEω
arbitrary output	{α}⎕ARBOUTω	file drop cpt	{R}←⎕FDROPω
atomic vector	R←⎕AV	file erase	{R}←α⎕FERASEω
attributes	R←{α}⎕ATω	file hold	{R}←⎕FHOLDω
canonical representn	R←⎕CRω	file library	R←⎕FLIBω
change space	{R}←{α}⎕CSω	file names	R←⎕FNAMES
character I\O	⍞	file numbers	R←⎕FNUMS
clear workspace	⎕CLEAR	file read access	R←⎕FRDACω
comparison tolerance	⎕CT	file read cpt info	R←⎕FRDCIω
copy workspace	{α}⎕CYω	file read component	R←⎕FREADω
cross references	R←⎕REFSω	file rename	{R}←α⎕FRENAMEω
data representation	R←{α}⎕DRω	file repl cpt	{R}←α⎕FREPLACEω
delay	{R}←⎕DLω	file resize	{R}←{α}⎕FRESIZEω
dequeue events	{R}←⎕DQω	file set access	{R}←α⎕FSTACω
diagnostic message	R←⎕DM	file share tie	{R}←α⎕FSTIEω
digits	R←⎕D	file size	R←⎕FSIZEω
division method	⎕DIV	file tie	{R}←α⎕FTIEω
dos command/AP	{R}←{α}⎕CMDω	file untie	{R}←⎕FUNTIEω
dotnet exception	R←⎕EXCEPTION	fix definition	{R}←⎕FXω
edit object	R←{α}⎕EDω	format	R←{α}⎕FMTω
enqueue event	{R}←{α}⎕NQω	index origin	⎕IO
evaluated I\O	⎕	key label	R←⎕KLω
event message	R←⎕EMω	latent expression	⎕LX
event number	R←⎕EN	line counter	R←⎕LC
export object	{R}←{α}⎕EXPORTω	load workspace	⎕LOADω
expunge object	{R}←⎕EXω	lock definition	{α}⎕LOCKω

map file	R←{α}⎕MAPω	session namespace	⎕SE
migration level	⎕ML	shadow name	⎕SHADOWω
monitor	{R}←{α}⎕MONITORω	shared var control	R←{α}⎕SVCω
name associate	{R}←{α}⎕NAω	shared var offer	R←{α}⎕SVOω
name class	R←⎕NCω	shared variable query	R←⎕SVQω
name list	R←{α}⎕NLω	shared var retract	R←⎕SVRω
namespace indicator	R←⎕NSI	shared variable state	R←⎕SVSω
namespace	{R}←{α}⎕NSω	shell command/AP	{R}←{α}⎕SHω
native append	{R}←α⎕NAPPENDω	sign off APL	⎕OFF{ω}
native create	{R}←α⎕NCREATEω	signal event	{α}⎕SIGNALω
native erase	{R}←α⎕NERASEω	size of object	R←⎕SIZEω
native lock	{R}←α⎕NLOCKω	state indicatr stack	R←⎕STACK
native file names	R←⎕NNAMES	state indicator	R←⎕SI
native file numbers	R←⎕NNUMS	state of object	R←⎕STATEω
native file read	R←⎕NREADω	stop control	{R}←{α}⎕STOPω
native rename	{R}←α⎕NRENAMEω	terminal control	R←⎕TC
native repl	{R}←α⎕NREPLACEω	thread child nums	R←⎕TCNUMSω
native resize	{R}←α⎕NRESIZEω	thread identity	R←⎕TID
native file size	R←⎕NSIZEω	thread kill	{R}←{α}⎕TKILLω
native file tie	{R}←α⎕NTIEω	thread numbers	R←⎕TNUMS
native transl	{R}←{α}⎕NXLATEω	threads synchronize	R←⎕TSYNCω
native untie	{R}←⎕NUNTIEω	time stamp	R←⎕TS
nested representation	R←⎕NRω	trace control	{R}←{α}⎕TRACEω
null item	R←⎕NULL	trap event	⎕TRAP
object representation	R←⎕ORω	using .net path	⎕USING
print precision	⎕PP	vector representation	R←⎕VRω
print width	⎕PW	verify & fix input	R←{α}⎕VFIω
program fn key	R←{α}⎕PFKEYω	window child names	R←{α}⎕WNω
random link	⎕RL	window create obj	{R}←{α}⎕WCω
response time limit	⎕RTL	window expose names	⎕WX
save workspace	{R}←{α}⎕SAVEω	window get property	R←{α}⎕WGω
screen dimensions	R←⎕SD	window set property	{α}⎕WSω
screen map	⎕SM	workspace available	R←⎕WA
screen read	R←{α}⎕SRω	workspace identificn	⎕WSID
search path	⎕PATH		

APL Error Codes

0 Any 1-999	10 LIMIT ERROR	1000 Any 1001-1006
1 WS FULL	11 DOMAIN ERROR	1001 STOP VECTOR
2 SYNTAX ERROR	12 HOLD ERROR	1002 WEAK INTERRUPT
3 INDEX ERROR	16 NONCE ERROR	1003 INTERRUPT
4 RANK ERROR	18 FILE TIE ERROR	1005 EOF INTERRUPT
5 LENGTH ERROR	19 FILE ACCESS ERROR	1006 TIMEOUT
6 VALUE ERROR	20 FILE INDEX ERROR	1007 RESIZE
7 FORMAT ERROR	21 ...	1008 DEADLOCK

GUI Object Types

ActiveXContainer	Font	NetType	StatusField
ActiveXControl	Form	OCXClass	SubForm
Animation	Grid	OLEClient	SysTrayItem
Bitmap	Group	OLEServer	TabBar
BrowseBox	Icon	Poly	TabBtn
Button	Image	Printer	TabButton
Calendar	ImageList	ProgressBar	TabControl
Circle	Label	PropertyPage	TCPSocket
Clipboard	List	PropertySheet	Text
ColorButton	ListView	Rect	Timer
Combo	Locator	RichEdit	TipField
ComboEx	Marker	Root	ToolBar
CoolBand	MDIClient	Scroll	ToolButton
CoolBar	Menu	Separator	ToolControl
Cursor	MenuBar	SM	TrackBar
DateTimePicker	MenuItem	Spinner	TreeView
Edit	Metafile	Splitter	UpDown
Ellipse	MsgBox	Static	
FileBox	NetClient	StatusBar	

Object Property Hints

```
Accele..Accept..Active..Align ..AlignC..AlphaB..APLVer..ArcMod..
Array ..Attach..AutoAr..AutoBr..AutoCo..AutoEx..AutoPl..BandBo..
BCol  ..Bits  ..Border..Browse..BtnPix..Btns  ..Calend..Cancel..
Captio..CaseSe..CBits ..CellFo..CellHe..CellSe..CellSe..CellTy..
CellWi..Change..CharFo..CheckB..Checke..ChildE..ChildL..Circle..
ClassI..ClassN..ClipCe..CMap  ..Collat..ColLin..ColorM..ColTit..
ColTit..ColTit..ColTit..ColTit..ColTit..Column..Contai..Coord ..
Copies..CurCel..Curren..Curren..Cursor..Custom..Custom..Data  ..
DblCli..Decima..Defaul..Defaul..Depth ..DevCap..Direct..Divide..
Dragab..DragIt..DrawMo..EdgeSt..EditLa..End   ..EnterR..Event ..
EventL..Export..Export..FCol  ..FieldT..File  ..FileMo..FillCo..
Filter..FirstD..Fixed ..FixedO..FlatSe..FontOb..FontLi..Format..
Format..FStyle..FullRo..GridBC..GridFC..GridLi..GridLi..GridLi..
Grippe..HAlign..Handle..HasApp..HasBut..HasHel..HasLin..HasTic..
HasTod..Header..HelpBu..HelpFi..Hint  ..HintOb..HotSpo..HotTra..
HScrol..IconOb..ImageC..ImageI..ImageL..Index ..Input ..InputM..
InputM..InputP..Instan..Interv..Italic..Items ..Justif..KeepBi..
KeepOn..LastEr..Licens..Limits..LocalA..LocalA..Locale..LocalP..
LocalP..LStyle..LWidth..MapCol..Mask  ..Masked..MaxBut..MaxDat..
MaxLen..MaxSel..MDIAct..MDIMen..Metafi..Method..MinBut..MinDat..
```



```
MonthD..Moveab..MultiC..MultiL..MultiS..NewLin..OKButt..OLECon..
OLESer..OnTop ..Orient..OtherB..Overfl..PageAc..PageWi..ParaFo..
Passwo..Pictur..PName ..Points..Popup ..Posn  ..PrintL..Progre..
PropLi..QueueE..Radius..Range ..ReadOn..RealSi..Remote..Remote..
Remote..Remote..Report..Resize..Resize..Resize..Resize..Rotate..
RowLin..Rows  ..RowTit..RowTit..RowTit..RowTit..RowTit..RTFTex..
RunMod..Scroll..SelDat..SelIma..SelIte..SelRan..SelTex..Server..
ShowCa..ShowDr..ShowIn..ShowSe..ShowTh..Single..SIPMod..SIPRes..
Size  ..Sizeab..Socket..Socket..SortIt..SplitO..SplitO..Start ..
State ..Step  ..Style ..SysMen..TabFoc..TabJus..TabObj..TabSiz..
Text  ..TextSi..Thumb ..ThumbR..TickAl..TickSp..Tip   ..TipObj..
TitleH..TitleW..Today ..Toolbo..TrackR..Transl..Transp..Type  ..
TypeLi..TypeLi..TypeLi..Underl..UpperC..ValidI..VAlign..Value ..
Values..Variab..View  ..Visibl..VScrol..WantsR..WeekNu..Weight..
WordFo..Wrap  ..XRange..Yield ..YRange..
```

Event & Method Hints

```
Abort ..Activa..AddChi..AddCol..AddCom..AddIte..AddRow..Ambien..
Animat..AnimCl..AnimOp..AnimPl..AnimSt..AnimSt..AnimSt..BadVal..
BeginE..Browse..Calend..Calend..Calend..Calend..Cancel..CellCh..
CellCh..CellDb..CellDo..CellEr..CellFr..CellMo..CellUp..Change..
Choose..ClickC..ClipCh..Close ..CloseU..ColorC..Column..ColCha..
Config..Contex..Create..DateTi..DateTo..Delete..Delete..Delete..
DelCol..DelCom..DelRow..Detach..Displa..DockAc..DockCa..DockEn..
DockMo..DockRe..DockSt..DragDr..DropDo..DropFi..DropOb..Duplic..
Duplic..Dyalog..DDE   ..EndEdi..EndSpl..Event ..ExitAp..ExitWi..
Expand..Expose..FileBo..FileBo..FileRe..FileWr..Flush ..FontCa..
FontOK..FrameC..GetBui..GetCel..GetCom..GetCom..GetCom..GetDay..
GetEnv..GetEve..GetFoc..GetIte..GetIte..GetIte..GetMet..GetMin..
GetPar..GetPro..GetTex..GetTyp..GetVis..GotFoc..GreetB..GridCo..
GridCu..GridDe..GridDr..GridKe..GridPa..GridPa..GridSe..Help  ..
HideCo..HScrol..Idle  ..IndexC..ItemDb..ItemDo..ItemUp..IDNToD..
KeyErr..KeyPre..ListTy..Locato..LockCo..LockRo..LostFo..MakeGI..
MakePN..MouseD..MouseD..MouseE..MouseL..MouseM..MouseU..MouseW..
MsgBtn..MsgBtn..MsgBtn..MDIAct..MDIArr..MDICas..MDIDea..MDITil..
NameFr..NewPag..OLEAdd..OLEDel..OLELis..OLEQue..OLEReg..OLEUnr..
PageAc..PageAp..PageBa..PageCa..PageCh..PageDe..PageFi..PageHe..
PageNe..PreCre..Print ..Progre..Protec..Retrac..RowCha..RTFPri..
RTFPri..Scroll..Select..SelDat..Setup ..SetCel..SetCel..SetCol..
SetEve..SetFin..SetFnI..SetIte..SetIte..SetIte..SetMet..SetPro..
SetRow..SetSpi..SetVar..SetWiz..ShowCo..ShowHe..ShowIt..ShowPr..
ShowSI..Spin  ..Splitt..StartS..StateC..SysCol..ThumbD..Timer ..
TCPAcc..TCPClo..TCPCon..TCPErr..TCPGet..TCPGot..TCPGot..TCPRea..
TCPRec..TCPSen..TCPSen..Undo  ..VScrol..Wait  ..WinIni..
```

© Graeme Robertson Ltd. 2005