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# TECH MEMO



*a working paper*

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## LISP 2 PROJECT

### LISP 2 PRIMITIVES

A preliminary list and cursory description of LISP 2 primitives, to the extent known at this time, is provided in this document. This list is being expanded and modified during the implementation phase of LISP 2, and published periodically.

Final publication of these primitives with expanded descriptions will be released as part of the contract specified documentation. The purpose herein is to provide a concise, current status statement of requisite primitives for implementation personnel.

Your assistance in keeping it current is requested.

KEY ...

<u>ARG, VALUE TYPES</u>	<u>CODER</u>	<u>STATUS</u>	<u>NO. ARGS</u>
R=REAL	C=CLARK WEISSMAN	=NONE	0-9=COUNT
I=INTEGER	D=DONNA FIRTH	A=NOT IN NOV.17 LISP 2	I=INDEF
O=OCTAL	E=ERWIN BOOK	0=	
B=BOOLEAN	J=JEFF BARNETT	1=PARTIALLY SPECIFIED	
A=ARRAY	L=LOWELL HAWKINSON	2=SPECIFIED	<u>CODE TYPE</u>
S=STRING	R=BOB SAUNDERS	3=PARTIALLY CODED	=FUNCTION
D=IDENTIFIER	S=STAN KAMENY	4=CODED	I=INSTRUCTION
M=SYMBOL		5=PARTIALLY DEBUGGED	M=MACRO
F=FORMAL		6=DEBUGGED	O=OPEN
T=D/B/R/I/O		7=PARTIALLY DOCUMENTED	
N=NOVALUE		8=CODED, DEBUGGED,	
.=AND		DOCUMENTED	
,=OR			
C=MACRO			

FN NAME	S	FN	N	ARG	COMMENTS	FN CLASS	I	C	C	S
	E		O				N	D	O	T
	C	V		T				T	D	A
	T	A	A	Y			E	Y	E	T
	I	L	R	P			X	P	R	U
	O	U	G	E				E		S
	N	E	S	S						
ABS	R,I	1	R,I		FVAL IS SAME TYPE AS ARG	ARITH			J	8
AND	B	I	M		LEFT TO R EVAL OF ARGS UNTIL VAL DETER.	BOOL			R	8
APPEND	M	2	M		LIKE LISP 1.5 COUNTERPART	MISC.			S	6
ARCTAN	R	1	R		VALUE IN RADIANS, RANGE -PI/2 TO +PI/2	ARITH			S	A
ARRAYDIM	I	1	A		NUMBER OF DIMENSIONS	ARRAY			L	A
ARRAYSIZE	I	2	A.I		SIZE OF THE I TH DIMENSION	ARRAY			L	4
ARRAYTYPE	D	1	A		RETURNS ARRAY TYPE	ARRAY			L	2
ARRAYP	B	1	M		TRUE IF ARG IS A	CLASS			S	6
ARSIZE	SYS	O	1	O	EXTRACT OR GET SIZE OF ARRAY (= LEFTAD)	ARRAY	M		S	6
ATOM	B	1	M		TRUE FOR NON-LIST ARG	LISP			S	6

B20.	O	1	B	BOOLEAN TO OCTAL	CHEAT	J	8
BIT	O	3		I.I.O. EXTRACT, OR SET SELECTED BITS OF WORD	MISC	J	8
BITS	SYS O	3		I.I.O. EXTRACTS SELECTED PORTION OF WORD	MISC	S	6
BITSET	SYS O	3		I.I.O.O SETS SELECTED PORTION OF WORD	MISC	S	6
BITTST	SYS B	2	I.I.	TESTS FOR BOUNDS ON BITS	MISC	S	6
BOOLP	B	1	M	TRUE IF ARG IS B	CLASS	S	6
BUCKET	SYS I	1	M	COMPILES BUCKET NUMBERS FOR PNAME	SYS	S	6
CAR	M	1	M	UNDEFINED FOR ATOMS	LISP	J	8
CDR	M	1	M	UNDEFINED FOR ATOMS	LISP	J	8
CH2OCT	O	1	D	ASCII TO OCT	CONV	S	6
CHAIN	SYS O	1	O	EXTRACT OR SET F-V-CHAIN POINTER	SYS	M S	4
CHARP	B	1	M	TRUE IF ARG IS 1 CHAR IDENTIFIER	CLASS	S	6
CLEAR	IO N	1	D	CLEARs IO FILE TO BLANKS OR ZERO (BINARY)	I/O	C	8
COLUMN	IO I	2	D.I	RETRNS CURRENT COL OF SPECIFIED IO FILE	I/O	C	4
COMPRESS	S	1	M	LIST OF CHARS TO STRING	CONV	S	6
CONS	M	2	M	LIKE LISP 1.5 CONS	LISP	S	6
CONVRT	SYS O	2	M.M	PRODUCES OCTAL DATUM CONTENTS FROM INPUT OF TYPE AND VALUE	CONV	S	6
COPYARRAY	M	1	M	COPIES ANY ARRAY	ARRAY	S	6
COS	R	1	R	ARG IN RADIANS	ARITH	S	2
CREATE	A	3	O.I,S.S	CREATES ARRAY OF SPECIFIED TYPE AND SIZE	ARRAY	S	6
CYCLE	O	2	O.I	BITS LEAVING 1 END ENTER OTHER, CYC L FOR +1	BIT F	S	6
DELETEL	M	2	M.M	LIKE LISP 1.5 COUNTERPART	LISP	S	5
DIFFERENCE	R,I	2	R,I	FVAL IS I, UNLESS ANY ARG IS R	ARITH	J	8
ENDIN	N	0		LIKE LISP 1.5 TEREAD, USES ENDINR IF FILE EMPTY	I/O	C	4

ENDINR	N	0		LOADS SELECTED IO FILE FROM EXTERNAL UNIT	I/O	C 4
ENDOUT	N	0		LIKE LISP 1.5 TERPRI, USES ENDOUTR IF FILE FULL	I/O	C 4
ENDOUTR	N	0		UNLOADS SELECTED IO FILE TO EXTERNAL UNIT	I/O	C 4
ENTIER	I	0	R	FVAL IS GREATEST INTEGER LQ ARG	ACONV	S 2
EQ	B	2	R,I,O,D,M,A,S,B	WILL DO TYPE CONV.	RELAT	J 8
EQL	SYS	B	3	M.M.B DOES THE WORK OF EQUAL. AND EQUALN.	SYS	S 6
EQN	B	2	D	IDENTICAL ADDRESS IN MACHINE	RELAT	J 8
EQUAL	B	2	R,I,O,D,M,A,S,B	WILL DO TYPE CONV.	RELAT	J 8
EQUAL.	SYS	B	2	M.M DOES EQ FOR SYMBOLS	RELAT	S 6
EQUALN	B	2	R,I,O,D,M,A,S,B	DOES NOT DO TYPE CONVERSION	RELAT	J 8
EQUALN.	SYS	B	2	M.M DOES EQUALN FOR SYMBOLS	RELAT	S 6
EQUIV	B	2	M	TRUE IF EQUALN ARG1 ARG2	BOOL	R 2
ERMSG1	N	1	M	CALLS ERROR	SYS	S 5
ERRMSG	N	2	M.M	ERROR MSG BY CONS-ING ARGS	SYS	S 5
ERRS2	FSM	N	2	S GENERATES ERROR BY SCONS-ING TWO STRINGS	MISC	S 5
EXP	R	1	R	E TO THE ARG	ARITH	S A
EXPLODE	M	1	S	STRING TO LIST OF CHARS	CONV	S 6
EXPT	R,I	2	R,I	AS AIGOL, WITH 2 EXTENSIONS	ARITH	S A
F2O.	O	1	F	FORMAL TO OCTAL	CHEAT	J 6
FCONC.	SYS	A	3	M.M.B DOES WORK OF SCONS AND NCONCS	SYS	S 5
FIND	S	2	M.M	SAME AS GET	LISP	S 6
FIXP	B	1	M	TRUE FOR 0 OR I	CLASS	S 6
FLOAT	T	1	I	CONVERTS INTEGER TO REAL	ACONV	S 6

FLUIDP	B	1	M	TRUE IF ARG IS FLUID VARIABLE	CLASS	S 6
FMTRAP	SYS N	0		TRAPS AN UNSET FORMAL	ARRAY	L 2
FNTRAP	SYS N	0		TRAPS AN UNSET FUNCTION	ARRAY	L 2
FOR	SYS				CMPLR	I J 8
FORM2SYM	M	1	F	BOXT	SCONV	S 6
FORMALP	B	1	M	TRUE IF ARG IS F	CLASS	S 6
FROMCHARS	T	1	M	T = D,B,R,I,O LIST OF CHARS TO TOKEN	CONV	E 2
FROMSTRG	T	1	S	T = D,B,R,I,O STRING TO TOKEN	CONV	E 2
GENID	D	0		LIKE LISP 1.5 GENSYM, MAKES UP TRIPLE CELL	MISC	S 6
GENIDP	B	1	M	TRUE IF ARGUMENT IS GENID	CLASS	S 6
GENPNAME	D	0		MAKES PNAME FOR A GENID	MISC	S 3
GET	M	2	M.M	GETS PAIR IN ARG1 WHOSE CAR IS EQUAL TO ARG2	MISC	C 4
GETARRAY	SYS M	1	O	GETS NEW UNSET OCTAL ARRAY OF SIZE=ARG	ARRAY	S 6
GETCHAR	IO D	2	O.I	GETS I TH CHAR ID AT STRING LOC O	I/O	C 7
GETFREE	SYS M	2	D	FINDS A VARIABLE CELL	SYS	S 4
GETID	D,B	1	S	FVAL IS ID OR FALSE	CONV	S 6
GQ	B	2	R,I,O	TRUE IF ARG1 EXACTLY GR OR = TO ARG2	RELAT	R 8
GR	B	2	R,I,O	TRUE IF ARG1 EXACTLY GREATER THAN ARG2	RELAT	R 8
HORIZONTAL	D,B	2	D.M	SETS IMG,RMG,AND RMG OVERFLOW FUNCTIONS	I/O	C 4
I20.	O	1	I	INTEGER TO OCTAL	CHEAT	J 8
IDP	B	1	M	TRUE IF ARG IS D	CLASS	S 6
IMPLIES	B	2	M	TRUE IF ARG1 IMPLIES ARG2	BOOL	R 2
INPUT	D	1	D	READ SELECTS IO FILE, RETURNS PRIOR FILE NAME	I/O	C 4

INT2OCT	O	1	I	-O INTO O	SCONV	S	6	
INT2SYM	M	1	I	BOXT	SCONV	S	6	
INTP	B	1	M	TRUE IF ARG IS I	CLASS	S	6	
INVERT	O	1	O	L's COMPLEMENT	BIT F	M J	8	
IOSTATUS	O	0		GIVES STATUS OF PRIOR IO XFER, RESOLVES EOF	I/O	C	2	
IQUOTIENT	I	2	I	ENFTIER(ARG1)/ENFTIER(ARG2)	ARITH	J	8	
LEFTAD	SYS	O	1	O	EXTRACT OR SET LEFT ADDRESS OF WORD	MISC	M	5
LENGTH	I	1	M	LIKE LISP 1.5 COUNTERPART	MISC	S	2	
LINE	I	2	D.I	RETRNS CURRENT LINE NO OF SPECIFIED IO FILE	I/O	C	4	
LINK	SYS	O	1	O	LINK POINTER OF TRIPLE	SYS	M S	6
LIST	M	I	M	LIKE LISP 1.5(TEMPORARILY A MACRO)	LISP	J	8	
LOCSET	SYS	2	D		CMPLR	I J	8	
LOG	R	1	R	BASE E.	ARITH	S	A	
LQ	B	2	R,I,O	TRUE IF ARG1 EXACTLY LS OR = TO ARG2	RELAT	R	8	
LS	B	2	R,I,O	TRUE IF ARG1 EXACTLY LESS THAN ARG2	RELAT	R	8	
MAKEEREE	SYS	M	5	D.D.D.M.O.B	MAKES A NEW VARIABLE CELL	SYS	S	4
MAKEID	D	1	S	STRING TO IDENTIFIER	CONV	S	6	
MAKIDS	FSM	M	0		DOES THE WORK OF MAKEID	I/O	S	6
MAP	M	2	M.F		LISP	S	5	
MAPCAR	M	2	M.F	LIKE LISP 1.5 COUNTERPART	LISP	S	6	
MAPFN	M	2	M.F	GENERALIZED FAST VERSION OF MAPCON		S	6	
MAPLIST	M	2	M.F	LIKE LISP 1.5 COUNTERPART		S	5	
MEMBER	M	2	M	LIKE LISP 1.5 COUNTERPART	MISC	S	6	
MGENID	FSM	D	0		MAKES UP A GENID FROM INPUT	I/O	S	6

MINSYM	M	1	M	IF SYMBOL IS A NUMB, THEN -SYMBOL . ELSE ERROR	ARITH	S 6	
MINUS	R,I	1	R,I	FVAL IS SAME TYPE AS ARG.	ARITH	J 8	
NCONC	M	2	M	LIKE LISP 1.5 COUNTERPART	LISP	S 6	
NCONCS	A	2	M.M	PUTS TWO ARRAYS OR STRINGS TOGETHER, COPY IF NECESSARY	ARRAY	S 6	
NILF	B	0		DO NOTHING FUNCTION, RETURN NIL	MISC	C 7	
NOF	N	0		DO NOTHING FUNCTION	MISC	C 7	
NORMSP	SYS	B	1	M	TESTS FOR NORMAL SPELLING OF IDENTIFIER	SYS	S 6
NOT, NULL	B	1	M	LIKE LISP 1.5 NULL	BOOL	R 8	
NQ	B	2	R,I,O	TRUE IF ARG1 EXACTLY NOT = TO ARG2	RELAT	J 8	
NULL, NOT	B	1	M,B	TRUE IF ARG = NIL, FALSE, ( )	LISP	R 8	
NUMBP	B	1	M	TRUE IF ARG IS O,R,I	CLASS	S 6	
NUMERR	N	1	M	ERROR: IS NOT A NUMBER	SYS	S 5	
NUMSTR	SYS	S	1	M	CONVERTS NUMBER INTO STRING	CONV	S 3
O2B.	B	1	O	OCTAL TO BOOLEAN	CHEAT	J 8	
O2F.	F	1	O	OCTAL TO FORMAL	CHEAT	J 8	
O2I.	I	1	O	OCTAL TO INTEGER	CHEAT	J 8	
O2R.	R	1	O	OCTAL TO REAL	CHEAT	J 8	
O2S.	M	1	O	DANGEROUS	CHEAT	J 8	
OCT2CH	D	1	O	OCT TO ASCII	CONV	S 6	
OCT2SYM	M	1	O	BOXT	SCONV	S 6	
OCTALP	B	1	M	TRUE IF ARG IS O	CLASS	S 6	
OCTROUND	O	1	R	CONVERTS REAL TO OCTAL	SCONV	J 5	
OPEN	M	2	D.M	FILE D OPENED WITH FILE DESCRIPTION M	I/O	C 4	
OR	B	1	M	LEFT TO R EVAL OF ARGS UNTIL VAL DIRM	BOOL	R 8	

OUTPUT	D	1	D	WRITE SELECTS IO FILE, RETURNS PRIOR FILE NAME	I/O	C 4
OWNP	B	1	M	TRUE IF ARG IS OWN CELL	CLASS	S 6
PLUS	R,I	1	R,I	FCAL IS I, UNLESS ANY ARG IS R. (OR SYM)	ARITH	J 8
POSITION	D,I	2	D,I	APPROPRIATELY POSITIONS IO FILE	I/O	C 2
PRIN	M	1	M	LIKE PRINT, BUT NO ENDOUT	I/O	C 4
PRINCH	D	1	D	ENTERS CHAR ID IN NEXT COL OF SELECTED IO FILE	I/O	C 4
PNAME	SYS O	1	O	PNAME POINTER OF TRIPLE (MAY BE GARBAGE)	SYS	M S 6
PREFIX	SYS O	1	O	EXTRACT OR SET PREFIX OF WORD	MISC	M S 6
PRINSTRING	S	1	S	ENTERS STRING IN SELECTED IO FILE, NO ENDOUT	I/O	C 4
PRINT	M	1	M	PRINTS S-EXP IN SELECTED IO FILE, WITH ENDOUT	I/O	C 4
PRINTOKEN	T	1	T	PRINTS ANY TOKEN IN SELECTED IO FILE, NO ENDOUT	I/O	C 4
PRINWORD	O	1	O	ENTERS BINARY WORD IN SELECTED IO FILE	I/O	C 4
PROP	M	1	D	EXTRACT OR SET PROPERTY LIST OF ID ARG	MISC	J 8
QUOTIENT	R	2	R	ARG2 NON=0	ARITH	J 8
R20.	O	1	R	REAL TO OCTAL	CHEAT	J 8
RDLIST	M	0		READS ONE LIST (LIKE LISP 1.5 READ1)	I/O	S 6
READ	M	0		READS NEXT S-STEP IN SELECTED IO FILE, NO ENDIN	I/O	S 6
READCH	D	0		RETURNS NEXT CHAR ID IN SELECTED IO FILE, OR NIL	I/O	C 4
READWORD	O	1	O	READS NEXT BINARY WORD OF SELECTED IO FILE	I/O	C 4
REAL2SYM	M	1	R	BOXT	SCONV	S 6
REALP	B	1	M	TRUE IF ARG IS R	CLASS	S 6
RECIP	R	1	R	FOR ARG $\neq$ 0, =QUOTIENT (1,ARG)	ARITH	J 8
REMAINDER	I	2	I	FVAL SIGN IS SAME AS ARG1	ARITH	J 7



RGHTAD	SYS O	1 O	EXTRACT OR SET RIGHT ADDRESS OF WORD	MISC	M 5
ROUND	I	1 R	=ENTIER(ARG=.5).	ACONV	S 2
S2O.	O	1 M	SYMBOL TO OCTAL	CHEAT	J 8
SCALE	I	2 I	SIM TO SHIFT, BUT SIGN EXTENSION IS PERFORMED	BIT F	S 6
SET	SYS	2 D.	EXPRESSION	CMPLR	J 8
SETCHAR	IO D	3 M.O.I	SETS M AS I TH CHAR ID AT STRING LOC O	I/O	C 7
SHIFT	O	2 O.I	SHIFT LFT(+1), R(-1). VACATED POS FILLED O.	BIT F	S 6
SCONCS	A	2 M.M	PUTS TWO ARRAYS OR STRINGS TOGETHER, COPY IF NECESSARY	ARRAY	S 6
SHUT	M	2 D.M	FILE D SHUT WITH FILE DISPOSITION M.	I/O	C 2
SIGN	I	1 R,I	FVAL IS -1,0,+1 APPROPRIATELY	ARITH	J 8
SIN	R	1 R	ARG IN RADIANS.	ARITH	S A
SMINI	SYS M	2 M.I	M-1 RUN TIME ERR IF SYMBOL NOT A NUMBER	CMPLR	J 8
SMINR	SYS R	2 M.R	M-R RUN TIME ERR IF SYMBOL NOT A NUMBER	CMPLR	J 8
SMINS	SYS M	2 M	M-M RUN TIME ERR IF SYMBOL NOT A NUMBER	CMPLR	J 8
SPACEP	SYS B	1 M	TESTS FOR ADDRESS IN INTERVAL CHO-LSO	CLASS	S 4
SPACEP.	SYS B	1 M	TESTS FOR STRUCTURE POINTER	SYS	S 6
SPELLP	FSM B	1 M	TESTS A SINGLE CHARACTER FOR NUMBER, LETTER OR .	I/O	S 6
SPLJI	SYS M	2 M.I	M+1 RUN TIME ERR IF SYMBOL NOT A NUMBER	CMPLR	J 8
SPLJR	SYS R	2 M.R	M+R RUN TIME ERR IF SYMBOL NOT A NUMBER	CMPLR	J 8
SPLJS	SYS M	2 M	M+M RUN TIME ERR IF SYMBOL NOT A NUMBER	CMPLR	J 8
SQRT	R	1 R	ARGS LS O IS AN ERROR	ARITH	S A
STIMI	SYS M	2 M.I	M*1 RUN TIME ERR IF SYMBOL NOT A NUMBER	CMPLR	J 8
STIMR	SYS R	2 M.R	M*R RUN TIME ERR IF SYMBOL NOT A NUMBER	CMPLR	J 8
STIMS	SYS M	2 M	M*M RUN TIME ERR IF SYMBOL NOT A NUMBER	CMPLR	J 8

STRINGL	I	1	S	NUMBER OF CHARACTERS IN THE STRING	STRING	S 6
STRINGP	B	1	M	TRUE IF ARG IS S	CLASS	S 6
STYPE	SYS M	1	M	RETURNS TYPE OF STRUCTURE	SYS	S 6
SYM2BOOL	B	1	M	FVAL IS TRUE IF M NOT NIL, ELSE FALSE	SCONV	O D 5
SYM2FORM	F	1	M	POSSIBLY 2 ARGS NEEDED, ONE TO TELL TYP OF F	SCONV	S 6
SYM2INT	I	1	M	UNBOXT	SCONV	S 6
SYM2OCT	O	1	M	UNBOXT	SCONV	S 6
SYM2REAL	R	1	M	UNBOXT	SCONV	S 6
SYMABS	SYS M	1	M	/M/ RUN TIME ERR IF SYMBOL NOT A NUMBER	CMPLR	J 8
SYMPRINT	S	1	S	SYMPRIN PLUS ENDOUT	I/O	C 4
SYMPRIN	S	1	S	PRINSTRING FOR UNUSUAL SPELLINGS, READ SYMMETRY	I/O	C 4
SYMSGN	SYS I	1	M	SGN, RUN TIME ERR IF SYMBOL NOT A NUMBER	CMPLR	J 8
TAB	I	2	D.I	TABS NEXT LINE OF SPECIFIED IO FILE TO COL N	I/O	C 4
TAG	SYS O	1	O	EXTRACT OR SET TAG OF WORD	MISC	M S 6
TIMES	R,I I	R,I		FVAL IS I, UNLESS ANY ARG IS R.	ARITH	I J 8
TOCHARS	M	1	D,B,R,I,O	GENERALIZED EXPLODE	CONV	E 2
TOSTRG	SYS S	1	M	CONVERTS IDENTIFIER OR NUMBER INTO STRING	CONV	S 6
TRIPLE	SYS M	0		CREATES A NEW TRIPLE CELL	SYS	S 6
TRMOVE	SYS N	0		MOVES TRP WHEN NECESSARY	SYS	S 6
TRUNC	A	2	A.I	TRUNCATES ARRAY TO SPECIFIED SIZE	ARRAY	S 5
TYPE	M	1	M	RETURNS PARAMETER TYPE OF VARIABLE	MISC	L 2
VERTICAL	D,B	2	D.M	SETS TOP,BOT,PAGE, AND 2 OVERFLOW FNC	I/O	C 4
WORD1	SYS O	1	O	FIRST WORD OF TRIPLE	MISC	M S 6

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WORD2	SYS	0	1	0	CONTENTS OF SECOND WORD OF TRIPLE	SYS	M	S	6
WORD3	SYS	0	1	0	THIRD WORD OF TRIPLE	MISC	M	S	6
WORDAND		0	I	0	LIKE LISP 1.5 LOGAND	BIT	F	J	8
WORDOR		0	I	0	LIKE LISP 1.5 LOGOR	BIT	F	J	8
WORDXOR		0	I	0	LIKE LISP 1.5 LOGXOR	BIT	F	J	8
XOR	B		I	M	EVAL ALL ARGS	BOOL		R	2
XXRDR	FSM	M		0	READS ONE CHARACTER, USING ESCAPELOGIC	I/O		S	6