ABSTRACT:

This memo is intended to explain the use of the LISP functions in the system file SYS: SMILE.LSP. These functions are a generally useful extension to the functions already defined in the LISP interpreter, and are discussed in six categories.

I. Functions for defining functions
II. Functions for debugging functions
III. Functions for printing the definitions of functions
IV. Functions for using output devices
V. Functions for disk input
VI. Other useful functions

To get these functions into the LISP interpreter, evaluate
(INC(INPUT SYS: SMILE))

I. FUNCTIONS FOR DEFINING FUNCTIONS

DE DF and DM are FEXPRS used to define EXPRS FEXPRS and MACROS. They have the side effect of ENTERing the name of the function into a list called ALLFNS. DE DF and DM also tell you when you have REDEFINED a function by returning the list (NAME <name> REDEFINED) instead of <name>. The calling sequence for DE is:

(DE <name> <variable list> <function body>)

Example:

To define an EXPR whose name is SIZE:

you type:
(DE SIZE (L) (COND ((ATOM L) φ) (T (PLUS 1 (SIZE (CAR L)) (SIZE (CDR L))))))

lisp types:
SIZE

the definition of SIZE is then:
(DEFPROP SIZE
(LAMBDA (L)
(COND ((ATOM L) φ) (T (PLUS 1 (SIZE (CAR L)) (SIZE (CDR L))))))
EXPR)

DF and DM behave similarly.
DV is a FEXPR useful for defining a VALUE. DV has the side effect of entering the name of the VALUE defined into a list called ALLVALUES.

The calling sequence for DV is:
(DV <name> <unquoted value>)

Example:
you type:
(DV X (VALUE OF X))

lisp types:
(VALUE OF X)

the definition of X is then:
(DEFPROP X
(NIL VALUE OF X)
VALUE)

See appendix I for definitions of DE DF DM and DV.

II. FUNCTIONS FOR DEBUGGING FUNCTIONS

Three different types of debugging aids are available: TRACE, TRACET and BREAK.

A) TRACE and its auxiliary functions UNTRACE and RESET allow one to monitor the entrance to and exit from "traced" functions. (Warning: use (NOUNO T) with compiled functions) when a "traced" function is entered,

(ENTERING <recursion depth> <function name>) <values of arguments>

is typed. When exited,

(LEAVING <recursion depth> <function name>) <result>

is typed. Appendix II contains an example of trace applied to the function SIZE.

(TRACE <list of names>) FEXPR causes all functions in list of names to be "traced." TRACE returns a list of names of those functions which were previously not traced.

(UNTRACE <list of names>) FEXPR is the inverse to TRACE, ie., it restores each function to its previous untraced state.

(RESET) FEXPR causes all recursion depth counters to be reset to zero. Only necessary when a traced function is abnormally exited.

B) TRACET and its auxiliary functions UNTRACET SLST and USLST allow one to monitor all SET's or SETQ's to atoms selected for by SLST. When such a SET or SETQ occurs,

(SE <atom name> <value>) or
(SEQ <atom name> <value>)
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is printed. (Warning - use (NOBOUND T) with compiled functions)

(TRACET) EXPR turns on SET-SETQ monitoring.

(UNTRACET) EXPR turns off SET-SETQ monitoring.

(SLST <list of atoms>) FEXPR Appends <list of atoms> to the list of monitored atoms.

(USLST <list of atoms>) FEXPR Removes each atom from list of monitored atoms.

C) (BREAK <break pt. #> <value>) EXPR is useful for observing the state of variable bindings within lambda expressions and progs. When BREAK is entered, (BREAK <break pt. #>) is printed. BREAK then enters a READ-EVAL-PRINT loop until semicolon is typed to READ. BREAK then exits with <value>.

III. FUNCTIONS FOR PRINTING DEFINITIONS OF FUNCTIONS AND OTHER PROPERTIES.

(GRINDEF <list of atoms?>) FEXPR is used to print properties of atoms in readable DEFPROP format. GRINDEF produces output in which parenthesis depth and matching is recognizable by line indentation.

The normal list of properties which GRINDEF prints is (EXPR FEXPR VALUE MACRO). Any non-atomic member of <list-or-atoms?> designates a different list of properties. Appendix I was produced by:

(GRINDEF DE DF DM DV ENTER)

(GRINL <atom>) FEXPR causes all atoms in the list (<atom> <value of atom> to be GRINDEFed.

For example, (GRINL ALLFNS) will cause ALLFNS and every function which has been defined by DE DF or DM to be GRINDEFed.

GRINDEF uses the auxiliary functions SPRINT HUNOZ PANL and PPOS.

IV. FUNCTIONS FOR USING OUTPUT DEVICES

(LPT) EXPR is used to start an output file on the line printer. It does

(PROG NIL (OUTC (OUTPUT LPT:) T) (LINELENGTH LPTLENGTH) (OUTTIME))

where OUTTIME prints a heading, time and date.
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(OFF) EXPR is used to end an output file. It does
(PROG NIL (PRINT T)
 (OUTC NIL T)
 (LINELENGTH TTYLENGTH))

(LPTOUT <expr-list>) FEXPR is used to create an entire output file on
the lineprinter. It does
(PROG NIL (LPT)
 (MAPC (FUNCTION EVAL) <expr-list>)
 (OFF))

Examples: (LPTOUT (GRINL ALLFNS))
(LPTOUT (PRINT OBLIST) (PRINT FOO))

(DSKOUT <file name> <expr-list>) FEXPR is used to create an entire output
file on disk file DSK: <file-name>.LSP. It sets linelength
to LPTLENGTH, and evaluates all expressions in <expr-list>,
then does (OFF).
Example: (DSKOUT NEWFNS (GRINL NEWFNS))

Appendix IV contains complete definitions.

V. FUNCTIONS FOR USING INPUT DEVICES

(DSKIN <list of file-names>) FEXPR reads function-definitions in
DEFFROP format from all designated disk files. It also
prints (<function name> REDEFINED) for any function which
is redefined. DSKIN returns ***.
Example: (DSKIN SYS: SMILE ALVINE DSK: NEWFNS)

(GETDEF <device name> <file name> <list of function names>) FEXPR
needs selected function definitions from specified disk
file, and prints the names of those found. GETDEF returns
***.
Example: (GETDEF DSK: NEWFNS SIZE FOOBAZ)

VI. OTHER USEFUL FUNCTIONS

(TIMER <expression list>) FEXPR returns the execution time in milli-
seconds of the expressions in the expression list.
Example: (TIMER (GC) (GC)) returns the number of milli-
seconds necessary to do 2 garbage collections.

(EDIT <atom> <old> <new>) FEXPR cues all occurrences of <OLD> s-expression
to be replaced by <new> s-expression in some property of <atom>. The
property to change is selected as follows:
(1) EXPR
(2) FEXPR
(3) first property on property list.

Example: (EDIT OFF TTYLENGTH 105)
Would charge OFF to:
(DEFPROP OFF
 (LAMBDA NIL (PROG NIL (PRINT T) (OUTC NIL T) (LINELENGTH 15)))
EXPR)

EDIT returns T if a change was made. Otherwise NIL.

'(<sexpr>) MACRO is the same as (QUOTE <sexpr>)

(INITF) EXPR is a function which is useful to restore the initial
states of global variables such as linelength, TTY
i/o modes, etc.

(INITFN (QUOTE INITF)) will cause INITF to be executed
whenever bell is typed, or a LISP error return to the
outer level occurs. This is useful when using (ED)
to restore teletype input mode to (DDTIN NIL).
APPENDIX I

(DEFPREF DE
(LAMBDA (L) (DEFP (CAR L) (CADR L) (CADDR L) (QUOTE EXPR)))
EXPR)

(DEFPREF DF
(LAMBDA (L) (DEFP (CAR L) (CADR L) (CADDR L) (QUOTE FEXPR)))
EXPR)

(DEFPREF DM
(LAMBDA (L) (DEFP (CAR L) (CADR L) (CADDR L) (QUOTE MACRO)))
EXPR)

(DEFPREF DV
(LAMBDA (%%L)
(PROG2 (SETQ ALLVALUES (ENTER (CAR %%L) ALLVALUES))
(SET (CAR %%L) (CADR %%L)))
EXPR)

(DEFPREF ENTER
(LAMBDA (X L) (COND ((MEMBER X L) L) (T (CONS X L))))
EXPR)

(DEFPREF DEFIN
(LAMBDA (X V F P)
(PROG (R)
(SETOQ R
(COND
(((GETL X (QUOTE (EXPR FEXPR SUBR FSUBR LSUBR MACRO)))
(LIST X (QUOTE REDEFINED)))
(T X))))
(SETQ ALLFNS (ENTER X ALLFNS))
(PUTPROP X
(LIST (QUOTE LAMBDA)
V
(SUBST (QUOTE QUOTE) (QUOTE ') F))
P)
(RETURN R)))
EXPR)

APPENDIX II

(SIZE (QUOTE (COND (X Y) (T Z))))
(ENTERING 1 SIZE) ((COND (X Y) (T Z)))
(ENTERING 2 SIZE) (COND)
(LEAVING 2 SIZE) Ø
(ENTERING 2 SIZE) (((X Y) (T Z)))
(ENTERING 3 SIZE) ((X Y))
(ENTERING 4 SIZE) (X)
(LEAVING 4 SIZE) Ø
(ENTERING 4 SIZE) ((Y))
(ENTERING 5 SIZE) (Y)
(LEAVING 5 SIZE) ()
(ENTERING 5 SIZE) (NIL)
(LEAVING 5 SIZE) ()
(LEAVING 4 SIZE) 1
(LEAVING 3 SIZE) 2
(ENTERING 3 SIZE) (((T Z)))
(ENTERING 4 SIZE) (((T Z)))
(ENTERING 5 SIZE) (T)
(LEAVING 5 SIZE) ()
(ENTERING 5 SIZE) ((Z))
(ENTERING 6 SIZE) (Z)
(LEAVING 6 SIZE) ()
(ENTERING 6 SIZE) (NIL)
(LEAVING 6 SIZE) ()
(LEAVING 5 SIZE) 0
(LEAVING 4 SIZE) 2
(ENTERING 4 SIZE) (NIL)
(LEAVING 4 SIZE) ()
(LEAVING 3 SIZE) 3
(LEAVING 2 SIZE) 6
(LEAVING 1 SIZE) 7

APPENDIX IV

(DEFPROP LPT
  (LAMBDA NIL
    (PROG NIL (OUTC (OUTPUT LPT:) T) (OUTTIME) (LINELENGTH LPTLENGTH)))
  EXPR)

(DEFPROP OFF
  (LAMBDA NIL (PROG NIL (PRINT T) (OUTC NIL T) (LINELENGTH TTYLENGTH)))
  EXPR)

(DEFPROP LPTOUT
  (LAMBDA (L) (PROG NIL (LPT) (MAPC (FUNCTION EVAL) L) (OFF)))
  FEXPR)

(DEFPROP DSKOUT
  (LAMBDA (L)
    (PROG NIL
      (EVAL (LIST (QUOTE OUTPUT) (QUOTE DSK:) (CAR L)))
      (LINELENGTH LPTLENGTH)
      (OUTC T T)
      (MAPC (FUNCTION EVAL) (CDR L))
      (OFF)))
  FEXPR)