MULTILISP DEBUGGING ENVIRONMENT

by

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Computer Sciences Technical Report #410

December 1980
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Revised December 1980

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Introduction:

The debugging environment for Multilisp is modelled after the Interlisp break package (Teitelman, 1974). It is also similar to the debug system of MTS/LISP (Hall, 1972). It provides interactive capabilities for error handling and algorithm debugging plus the addition from Multilisp of a single-step evaluation mode.

Once a break has been entered, the user can interrogate the state of the LISP, modify variable bindings on the stack, edit function definitions, continue the evaluation, single-step the interpreter through the evaluation of a form, restart the evaluation at some higher level on the control or access stacks, or return to top-level.

The system makes use of four special variables which can be accessed by the user:

@form: The form which caused the break to be entered called the breakform.

@frame: The control frame at the time the break was acknowledged.

@stack: Initially set to the value of @frame. Can be changed via stack searching commands.

@value: Initially @undef@. If @form is evaluated during the break, then @value is set to its value.

Entry into the System:

The debug system is entered in one of the following ways:

1: An error occurs.
2: The system is called explicitly on a form via debug.
3: The function break is called.
4: A breakpoint is encountered in a user-defined function.

Whenever an error occurs, an error message is printed, the form being evaluated at the time of the error is printed, and the break is entered.
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The debug system can be called explicitly via the following two functions:

(debug <form>)   type=noeval

Calls the debug system explicitly on <form>.

(break <flag> <mess>* )   type=eval

This function facilitates tracing program execution and handling user defined error conditions. It first evaluates and prints each form <mess> on a single line. If the global switch @break is true or if <flag> is true, then the debug system is entered with break as the Breakform. Otherwise, break returns nil.

Finally, the debug system is entered whenever a user defined breakpoint in an interpreted function is encountered. The name of the function broken is printed and the first form within the function body becomes the breakform @form. Breakpoints are set and removed from functions with the following operations:

(breakf <foo> <pred>)   type=noeval

Sets a breakpoint on the first form within the function definition of <foo>. Function definitions must be either lambda, nlambda, or qlambda-expressions. When the breakpoint is encountered, <pred> is evaluated which defaults to T. If the value of <pred> is non-NIL, the break is entered. Otherwise, it is ignored. Note that breakf actually modifies the function definition for <foo>.

(unbreakf <foo>)   type=noeval

Removes an existing breakpoint from the function <foo>. If no arguments are supplied, unbreakf removes all current global breakpoints. The atom @broken-fns contains a list of all functions currently containing breakpoints.

Debug Commands:

A summary of the commands recognized by the system follows:

args   Abbreviation: none
       Prints the argument names and current values of the function being evaluated at @stack.
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eval
  Abbreviation: e
  Evaluates @form and prints its value. @value is set to this value.

bk <n>
  Abbreviation: none
  Prints a backtrace of forms on the stack starting at @stack for length <n> which defaults to 10.

bka <n>
  Abbreviation: none
  Prints a backtrace of frames on the access stack starting at @stack for length <n> which defaults to 10.

bkc <n>
  Abbreviation: none
  Prints a backtrace of frames on the control stack starting at @stack for length <n> which defaults to 10.

pp
  Abbreviation: none
  Pretty-prints the form contained in the frame at @stack.

top
  Abbreviation: none
  Resets @stack to @frame which is always the top of the stack.

find <loc>
  Abbreviation: f
  Searches either the control or access stacks beginning at @stack looking for a locator <loc>. If found, @stack is set to that frame. <Loc> can be specified as a positive integer, negative integer, or the name of some function. <Loc> defaults to -1. Negative values, -<n>, cause @stack to be advanced <n>-frames up the control stack. Positive values for <n> cause @stack to be advanced <n>-frames up the access stack. If <loc> is specified as a literal atom, the control stack is searched for a frame created for a function of that name. Else the message ">> Not Found" is printed and @stack remains unchanged.

go
  Abbreviation: none
  Breaks on the form at the current value of @stack.

return <form>
  Abbreviation: ret
  Evaluates <form> and returns it as the value of the break.

restart <form>
  Abbreviation: res
  Restarts computation from where @stack points using <form>. If <form> is not coded, computation is restarted using the previous form on the stack at @stack.
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continue

Abbreviation:  c
Continues with @form. If @form has been previously evaluated by the eval command, it will not be re-evaluated.

step

Abbreviation:  s
Single-steps the interpreter causing a break on the next non-atomic form encountered by eval.

next

Abbreviation:  n
Evaluates @form and breaks on the next non-atomic form. If @form has been previously evaluated via the eval command, it will not be re-evaluated.

up <n>

Abbreviation:  |
Causes the debug system to ascend <n> levels. If there is no higher break level, control is returned to top-level. <n> defaults to 1.

stop

Abbreviation:  nil ||
Causes a return to top-level Multilisp.

findvar <var>

Abbreviation:  fvar
Finds frame containing <var> on control chain. @stack is set to this frame.

value <var>

Abbreviation:  v
Returns current value of <var> from access link starting at @stack, else error.

Any form typed at debug other than the above commands or there abbreviations will be evaled and its value printed.
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References:
