PLACER

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The PLACER system is designed to facilitate preparation of programs for the Rice Computer.

Programs exist on paper tape in two forms:

symbolic -- in the assembly language or Genie language.

absolute -- in machine language, as translated from symbolic form from assembly or Genie language, ready to be loaded for execution.

PLACER operations which may be applied to program tapes are:

read symbolic tape -- forming "tape image" in memory

edit image -- change, insert, or delete lines in image, per edit instructions on paper tape

punch image -- on paper tape

list image -- on printer

check symbolic tape -- against image

translate image -- assemble or compile as appropriate, and produce absolute tape

back-translate absolute tape -- read absolute tape, "back translate" into symbolic assembly language, forming image as if symbolic tape had been read.

PLACER operations may also be applied to data tapes which are manually prepared on the flexowriter. In this case, the translation operations would not be meaningful.

When PLACER is read into memory from magnetic tape program *340 is executed, and the main PLACER stop

(I): 00 HTR CC

occurs. One or several PLACER operations may then be designated in the sense lights:

SL^1 --- read symbolic tape
SL^2 --- edit
SL^3 --- punch (edited) symbolic tape
SL^4 --- list (edited) symbolic tape
SL^5 --- check (edited) symbolic tape punched
SL^6 --- translate (edited) symbolic tape
SL^7 --- back-translate absolute tape
SL^{15} -- run with SPIREL
SL^{10}-SL^{15} --- run with specified system tape block

The original tape to be processed should be placed in the reader. SL^7 is used if this tape is absolute, and SL^1 is used if it is symbolic. It is not meaningful to elect both SL^7 and SL^1 operations in PLACER.

Pushing CONTINUE at the main PLACER stop with more than one operation designated causes the operations to be carried out in the following order:

SL^1 or SL^7 --- read symbolic tape or read absolute tape and back-translate to APl symbolic, forming symbolic image in the machine
SL^2 --- wait for edit tape, then edit image
SL^3 --- punch (edited) image, generating symbolic tape
SL^4 --- list (edited) image on the printer
SL^5 --- check symbolic tape against edited image if tape is ready in the reader; if tape is not ready and translation operation is designated, go on to translation and

return to check after translation; if tape is not ready and translation is complete or not designated, wait for tape; if tape does not check, do not exercise run option

SL^6 --- translate edited image, generating output on the printer and absolute tape

SL^{10}-SL^{15} --- obtain designated block from magnetic tape for running, SPIREL if only SL^{15}

If only one operation is designated in SL^1 through SL^7 at the main PLACER stop, pushing CONTINUE will cause a stop for that operation:

(I): 0i HTR CC

for SL^i on. Then options for the particular operation may be designated in the sense lights before pushing CONTINUE to cause the operation to be carried out.

The PLACER operations and the options available for each are explained in detail in the succeeding sections.

SL[1], READ

The symbolic tape to be read must begin with a carriage return. All characters beyond the last cr on the tape are ignored by the system. When the reading is complete, the system has in the machine a tape image.

Options

If only SL[1] is turned on at the main PLACER stop so that only the READ operation is designated, the stop

(I): 01 HTR CC

occurs. READ options may then be designated in the sense lights as follows:

SL[15] causes reading to terminate at the first double carriage return punch. A double carriage return is any two carriage returns not separated by a printable character. Here printable characters include those represented by a backward arrow; nonprintable characters include only the space, the tab, case punches, and the carriage return itself.

Pressing CONTINUE with no tape in the reader will cause exit to the console typewriter. A program may then be typed in, using exactly the format used on the flexowriter. The backspace key will not properly backspace over the characters "$\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$". It will not backspace beyond carriage returns. To erase a line, type a question mark (?). To erase the entire input text, type the sequence ???. Depressing the "index" key will cause exit of the read option.

SL^2, EDIT

The stop

(I): 02 HTR CC

occurs. The edit tape is placed in the reader.† Pushing CONTINUE causes this tape, which must contain only the corrections for the tape image in the machine, to be read. When reading is complete, PLACER's tape image in the machine is edited.

Each edit of a tape image requires specification of a range of lines in the tape image to be affected by the edit. The carriage return numbers for the original image are used for this purpose. A line in a symbolic tape is terminated by a carriage return, these being numbered from 1 on the listing. The edit range is specified by initial carriage return i and final carriage return f, interpreted as from and not including carriage return i through carriage return f. Such a range will be denoted (i,f) here.

Each edit is one of the following:

- replacement of lines (i,f) in the image with n (octal) symbolic lines read from the edit tape. The specification is punched

(l.c.)i(sp)f(sp)n(cr)

The n lines of the replacement follow the specification on the edit tape, and each line is terminated by a carriage return.

- deletion of lines (i,f) in the image. The specification is punched

(l.c.)i(sp)f(sp)0(cr)

No symbolic lines accompany this specification on the edit tape. Deletion is just the case of replacement with n = 0.

- insertion in the image after carriage return i of n (octal) symbolic lines read from the edit tape. The specification is punched

(l.c.)i(sp)i(sp)n(cr)

Insertion is just the case of replacement with i = f, a null range to designate position only.

- "move" for replacement of lines (i_1,f_1) in the image with lines (i_2,f_2) in the image. The specification is punched

(l.c.)i_1(sp)f_1(sp)i_2(sp)f_2(cr)

No symbolic lines accompany this specification on the edit tape. The lines (i_2,f_2) are deleted from their former position.

o "move" for insertion in the image after carriage return i_1 of lines (i_2,f_2) in the image. The specification is punched

$$(l.c.)i_1(sp)i_1(sp)i_2(sp)f_2(cr)$$

No symbolic lines accompany this specification on the edit tape. The lines (i_2,f_2) are deleted from their former position.

Edit specifications may overlap since the carriage return numbers are preserved in all edit operations internally. Numerous edits of the tape image are possible using the latest carriage return numbers.

There are no EDIT options.

†Pressing CONTINUE with no tape in the reader at the edit halt will cause exit to the console typewriter. Edits may then be typed exactly in the format used on the flexowriter, being certain to type an initial carriage return before the first edit specification. If this option is reached accidently, depressing the index key immediately will cause the edit halt to reappear. The index key is used also to exit the edit mode. As in the read option a question mark (?) will erase a line. Do not, however, use the 3 question mark sequence.

SL^3, PUNCH

The tape image (symbolic version) is punched out on paper with corrections if editing was done. It is advised that the CHECK option always be used with this operation.

There are no PUNCH options.

SL^{4}, LIST

The tape image in the machine is listed on the printer with carriage return numbers. If the tape begins with 'DEFINE' (as do Genie program tapes), superscript and subscript lines will be printed above and below the base line. Other tapes will be listed with more lines per page, one line per carriage return number with superscript printed as the character '↑' and subscript as '↓'. A lower case Roman letter after f is printed as '. upper case letter'.

If a line ends in a superscript or subscript position, it is followed by a message noting the displacement.

Options

If only SL^{4} is turned on at the main PLACER stop so that only the LIST operation is designated, the stop

(I): 04 HTR CC

occurs. LIST options may then be designated in the sense lights as follows:

SL^{13} forces printing of separate superscript and subscript lines.

SL^{15} causes double spacing on the listing.

SL[5], CHECK

If the tape to be checked is not in the reader, the stop

(I): 05 HTR CC

occurs. Pushing CONTINUE causes the tape that is read to be compared to the tape image in the machine. An error print is given if the comparison fails.

There are no CHECK options.

SL^6, TRANSLATE

The tape image in the machine is translated, by the Genie compiler if it begins with 'DEFINE', by the assembly program otherwise.

Both translation procedures produce output on the printer and absolute program tapes. Details are given in the literature on the assembly and Genie languages.

Assembly Options

If only SL^6 is turned on at the main PLACER stop so that only the TRANSLATE operation is designated, the stop

(I): 06 HTR CC

occurs. TRANSLATE options for assembly may then be designated in the sense lights as follows:

SL^9 causes assembly output on the printer to be double spaced.

SL^{11} suppresses punching of the absolute tape.

SL^{13} causes punching of a self-loading absolute tape. Such a tape will load by using the LOAD switch on the console. See assembly language literature for more details.

Note that SL^{14} and SL^{15} are turned on automatically and should be left on.

Also, if TRANSLATE is selected with other operations at the main PLACER stop, assembly options may be designated in the indicator lights (IL^9, IL^{11}, IL^{13} as above).

Compilation Options

If only SL^6 is turned on at the main PLACER stop so that only the TRANSLATE operation is designated, the stop

(I): 06 HTR CC

occurs. TRANSLATE options for compilation may then be designated

in the sense lights as follows:

SL[12] punches the internal portion of the Symbol Table, including internal names and statement labels, as a program tail. See SPIREL-CONSOL COMMUNICATION for details on use.

SL[13] suppresses output of absolute tape.

SL[14] provides condensed compilation on the printer -- only the first instruction of each command sequence and no Symbol Table.

SL[15] causes output during compilation of intermediate code forms -- sets and phase 1 code. This is rarely of interest to the general user.

Also, if TRANSLATE is selected with other operations at the main PLACER stop, compilation options may be designated in the indicator lights (IL[12], IL[13], IL[14], IL[15] as above).

SL[7], BACK-TRANSLATE

If the absolute tape to be translated is not in the reader, the stop

(I): 07 HTR CC

occurs. Pushing CONTINUE causes the absolute tape to be read, and a symbolic tape image of an equivalent AP1 program is constructed in memory. This image is no different from one generated by the READ operation.

Details of Back-Translation

Several types of program tapes are recognized by the back-translator which generates an appropriate ORG pseudo-order in each case:

program to be loaded by SPIREL at a fixed location

program to be loaded by SPIREL with numbered or named codeword

program to be loaded by SPIREL as an element of a numbered or named array

program to be loaded with the console LOAD switch at a fixed location or at the setting of B6

In normal use, the process of back-translation takes place in two phases:

1) flow analysis from word 1 of the program to determine which words may be executed as instructions and which are internal data words or constants

2) construction of a symbolic tape image to represent the program, with OCT pseudo-orders for constants and symbolic labels only on lines which are referenced by instructions within the program

Information is passed from the first phase to the second by tagging the words of the program as they are classified. The tag conventions are:

no tag on data words not explicitly referenced in the program

tag 1 on data words explicitly referenced in the program and on all cross-reference words

tag 2 on instructions not explicitly referenced in the program

tag 3 on instructions referenced in the program

Tag 0 may also indicate an instruction which cannot be identified as such.

It is possible for a program to be written in such a way that the flow analysis will not distinguish properly between instructions and constants. Three of the most common programming situations which cause analysis problems are:

- entry points at other than the first instruction of a program
- use of transfer vectors or computed transfers within a program (e.g., TRA CC+B3)
- use of the X register, as in JMP in the operation field or CC+X in the auxiliary field

BACK-TRANSLATE options (discussed below) make it possible to specify as executable instructions those words which would not otherwise be identified as such.

Options

If only SL^{7} is turned on at the main PLACER stop so that only the BACK-TRANSLATE operation is designated, the stop

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(I):   07     HTR     CC
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occurs. BACK-TRANSLATE options may then be designated in the sense lights as follows:

SL^{12} suppresses flow analysis; tape image construction is performed on the basis of the tags on the program as read.

SL^{13} causes the back-translator to accept a list of words which must be identified as instructions. Immediately after the program tape is read, the stop

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(I):   13     HTR     CC
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occurs. A tape listing words to be identified as instructions is read. The format is

[cr] AAAAA [cr] BBBBB [cr] CCCCC .....

where [cr] is a 'carriage return' punch and AAAAA, BBBBB, CCCCC, ... are five-digit (octal) relative locations in the program. Note that it is only necessary to specify the first word of a block of instructions and analysis will find the others; a block is ended by an unconditional transfer instruction, either explicit or implicit.

SL[14] causes punching of the program with tags after flow analysis.

SL[15] suppresses construction of the symbolic tape image.

SL^{10}-SL^{15}, RUN

After options designated by SL^{1} through SL^{7} are complete, the octal number NN in SL^{10}-SL^{15} designates that block NN is to be loaded from the system tape. The following is a special case:

NN = 1, or SL^{15} only, for the closest SPIREL

In any case, the system obtained from magnetic tape is "fresh"; the program operated on by other PLACER options is not loaded.