HOW TO:

A Blackbox Handbook
to

Synthetic Programming Techniques

with the

HP—41C

Written By:

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PREFACE.

This book is designed to teach the person who has neither the time nor the inclination to learn how the 41C goes about carrying out various non-standard techniques, but explains in detail (step by step instructions), how to use these techniques.

My sincere thanks go to Assoc. Prof. John McGeachie (3324), & Jim Trainor (1390) for passing on the knowledge that allows me to write this book & to Fred Roche (2324), Richard Collett (4523), Tom Steadman & George Seggie for proof reading & thoroughly testing the procedures herein. In both Tom & George's instance, neither gentleman was familiar with these procedures & consequently learnt from the text as they worked through it.

N.B.

This book requires the reader to have a copy of the following:
1. "KA" - A Key Assignment Program,
2. "NN" - A Non-Standard Character generator from Decimal Number inputs,
3. "little b2" - A routine that places non-standard text into programs,
4. "Hex Chart"; P.P.C. Journal V.6, N.5, P.22 & 23,

Copies of the above & any information relating to this book can be obtained from the author:

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A. Create a Byte - Jumper using "KA" a Key Assignment

Program 11 If you haven't a Card Reader see "Part 2".

XEQ "KA", when "Key 1" appears in display, key in 241
Enter up, 65 Enter up, & the keycode of the key you wish
to assign the Byte - Jumper to, e.g. key 11 = \( \Sigma \) + key,
key -11 = the shifted \( \Sigma \) + key, key 12 = 1/x key etc. then
press R/S. When "Key 2" appears in display, your first
assignment has been made; now proceed to one of the
following sections.

B. Create a Non - Standard Text Line using the Byte - Jumper 11

1. Have you carried out Section "A" if not go back & do so.
2. Go into program mode, at line where non-standard text
   is required.
3. Key in an \( \times >y \) instruction; then in Alpha mode the text
   "AB".
4. Go into run mode & in user mode, press the key to which
   you assigned the Byte - Jumper (hereafter referred to as
   "Byte - Jump").
5. Go back into program mode & see:
6. In Alpha mode, key "ABCDE" (No. of letters = No. of
   characters in required text line).
7. Come out of Alpha mode & BST, see \( \times >y \), SST, see "A<>".
8. SST 5 steps (= to the No. of letters keyed in, in step 6),
delete these steps placing the "A<>" in view.
9. Now refer to the Hex Chart, & select the "stand alone"
   instructions (directly below the centre character) that
   equal each character of your required text line.
10. Come out of user mode & key in your "stand alone"
    instructions, (if any deletions/changes are made you
    must then XEQ "PACK").
11. BST to the "A<>", then go into run mode & in user mode,
    Byte - Jump. Go back into program mode & see:
12. Key in a "+" instruction; BST, see \( \times >y \), SST, see "A\[A\]",
    SST again & see the required text line. BST & SST
deleting the unwanted instructions from around your non-
    standard text line.

N.B. Note that line numbers are disturbed by Byte - Jumping.

GTO Lbl or GTO.nnn will correct this.
C. Create a Null or Nulls in a Non-Standard Text Line using the Byte - Jumper

1. Have you carried out Section "A" if not go back & do so.
2. Go into program mode, at line where non-standard text is required.
3. Key in an \(\times y\) instruction; then in Alpha mode the text "AB".
4. Go into run mode & in user mode, press the key to which you assigned the Byte - Jumper (hereafter referred to as "Byte - Jump").
5. Go back into program mode & see:
6. In Alpha mode, key in "ABCD" (No. of letters = No. of characters in required text line, including null or nulls).
7. Then out of Alpha mode, BST, see \(\times y\), SST, see "AB".
8. SST 4 steps (= to the No. of letters keyed in, in step 6), then delete these steps, placing the "AB" in view.
9. Now refer to the Hex Chart, & select the "stand alone" instructions (directly below the centre character) that equal each character of your required text line.
10. Come out of user mode & key in your "stand alone" instructions, keying in a "+" instruction wherever a null (or nulls) is required, go into run mode & in user mode, Byte - Jump. If any deletions/changes are made you must then XEQ "PACK".
11. BST to the "AB", & as you go delete the "+" instructions where the null or nulls is required, go into run mode & in user mode, Byte - Jump.
12. Place the machine back into program mode & see:
13. Key in a "+" instruction; BST, see \(\times y\), SST, see "AB", SST again & see the required text line. BST & SST deleting the unwanted instructions around your non-standard text line.

D. Create a 1 Byte NOP using the Byte - Jumper

1. Have you carried out Section "A" if not go back & do so.
2. Go into program mode, at line where 1 Byte NOP is required.
3. Key in an \(\times y\) instruction, then in Alpha mode the text "AB". Go into run mode & in user mode, press the key to which you assigned the Byte - Jumper.
4. Come back into program mode, see: , key in "RCL IND T" instruction, BST, see \(\times y\), SST, see "AB", SST again to see , "a null string" = 1 Byte NOP.
D. N.B. This one Byte Null String does not change the contents of the Alpha register.
5. BST & SST deleting the unwanted instructions around the 1 Byte NOP.

E. Create a Non - Standard Alpha Local Label using the Byte - Jumper II

1. Have you carried out Section "A" if not go back & do so.
2. Go into program mode, at line where Non - Standard Alpha Label is required.
3. Key in an x\(<\)>y instruction, then in Alpha mode the text "AB".
4. Go into run mode & in user mode, press the key to which you assigned the Byte - Jumper, (hereafter written as "Byte - Jump").
5. Go back into program mode & see:
6. Key in "Lbl 55" instruction, BST, see x\(<\)>y, SST see "AB".
7. Then out of user mode key the "stand alone" instruction that is equal to the Alpha character required in your local label (you will find these instructions directly below the centre character on the Decimal 112 - 122 row on the Hex Chart).
8. BST, placing the "AB" in view, go into run mode & in user mode, Byte - Jump.
9. Come back into program mode, see:
10. Key in a "=" instruction, then SST to see your Non - Standard Alpha Local Label.
11. BST & SST deleting the unwanted instructions around your local label.

F. Create a 3 Byte - Non - Standard Instruction using the Byte - Jumper II (e.g. GTO 99).
1. Have you carried out Section "A" if not go back & do so.
2. Go into program mode, where the 3 Byte instruction is required.
3. Key in an x\(<\)>y instruction, then in Alpha mode the text "AB".
4. Go into run mode & in user mode, press the key to which you assigned the Byte - Jumper (hereafter written as "Byte - Jump"). Go back into program mode & see:
5. Key in "GTO 99" instruction, BST, see x\(<\)>y, SST, see "AB", SST again, see x \(\neq\) ? (= to 99).

cont' o/leaf.
F. 6. Delete the \( x \neq \emptyset \) & insert a 1 Byte filler e.g. \( (x \times y) \), then key in "RON" instruction (= to \( m \)).

BST & delete the 1 Byte filler \( (x \times y) \), thus placing the "\( m \)" in view.

7. Go into run mode & in user mode, Byte - Jump, come back into program mode, see:

8. Key in a "+" instruction, BST, see \( x \times y \), SST to see "A[ ]", SST again to see "GTO M".

9. BST & SST deleting the unwanted instructions around your 3 Byte instruction.

N.B. Many instructions on the HP 41C are made from a number of "pieces", e.g. a 2 Byte store instruction (as defined in the operating manual) is made of a Prefix (STO), & a postfix (i.e. 25 or IND 21). The same coding can mean different things when the machine interprets it as a prefix or a postfix for example, if the coding for "STO" is immediately followed by the coding for \( x \neq \emptyset \), then the two codes are interpreted as the instruction "STO 99" because the "stand alone" instruction "\( x \neq \emptyset \)" is equal to the postfix "99" in terms of machine coding. The whole aim of synthetic programming is to place "Non - Normal" (i.e. not normally keyable) postfixes after standard prefixes to create synthetic instructions which can save memory or allow otherwise impossible things to be done on your HP 41C.

G. Create a 2 Byte Non - Standard Instruction using the Byte - Jumper \( m \) (e.g. STO N).

1. Have you carried out Section "A"? if not go back & do so.

2. Go into program mode, at line where 2 Byte non-standard instruction is required.

3. Key in an \( x \times y \) instruction; then in Alpha mode the text "AB".

4. Go into run mode & in user mode, press the key to which you assigned the Byte - Jumper (hereafter written as "Byte - Jump").

5. Go back into program mode & see:

6. Key in "STO 99" instruction, SST, see *, BST, see \( x \neq \emptyset \)?

7. Delete the \( x \neq \emptyset \) & then key in "Last X" instruction.
G. 8. BST, see "R", go into run mode & in user mode, Byte Jump.

9. Come back into program mode, see:

10. Key in a "+" instruction, BST to see x<->y, SST, to see "A [x]

11. SST again to see the required 2 byte non-standard instruction "STO N".

12. BST & SST deleting the unwanted instructions around your 2 byte instruction.

H. Create Non-Standard Global Labels, including being able to XEQ (or) GTO them!

Firstly one must assign 5 keys using the key assignment program. XEQ "KA", when "Key 1" appears in display, key in the "RCL M" assignmnet as follows:

Key in 144 Enter up, 117 Enter up, & the keycode of the key to which you wish to assign it, e.g. key 11 = Σ + key, key -11 = the shifted Σ + key, key 12 = 1/x key etc. then press R/S.

When "Key 2" appears in display, key in the "STO Q" assignment as follows:

Key in 145 Enter up, 121 Enter up, & the keycode, press R/S.

"Key 3", the "Global Label" assignment:

Key in 205 Enter up, 19 Enter up, & the keycode, press R/S.

"Key 4", the "GTO Global Label" assignment:

Key in 4 Enter up, 29 Enter up, & the keycode, press R/S.

"Key 5", the "XEQ Global Label" assignment:

Key in 4 Enter up, 30 Enter up, & the keycode, press R/S.

The 1ST METHOD, (up to 7 characters).

1. XEQ "NN", then for each character required in the Non-Standard Label, key in the decimal address (i.e.), pressing R/S after each decimal entry (you will find these decimal addresses directly above the centre character on the Hex Chart). N.B. Enter the decimal equivalents, in the reverse order (up to 7 characters); e.g. if you required "Lbl Geo!" you would key in decimal 33 = to the l, R/S, Decimal 79 = to the 0, R/S, Decimal 69 = to the E, R/S & Decimal 71 = to the G, R/S.

2. When label characters are complete, go into Alpha mode & check that they are correct (if they are not you will need to XEQ "NN" again & recreate the characters, don't
3. When text line in Alpha is correct & complete (in reverse order) come out of Alpha mode & GTO the line in the program where the non-standard global label is required.

4. In run mode & in user mode, press the "RCL M" assigned key, press the "STO Q" assigned key, go into program mode & press either:
   a. "Global Label" assigned key, b. "GTO Global Label" assigned key (or) c. "XEQ Global Label" assigned key, whichever you require & there you have it! e.g., construct a non-standard Global Label, following the above instructions, then construct a matching GTO, or XEQ as follows: In run mode & in user mode, press the "RCL M" assigned key, then the "STO Q" assigned key. Go into program mode & press either the b or c key, as noted above.

The following 2nd simpler method allows you to make Non-Standard Global Labels of up to 6 Characters.

Firstly one must assign 3 keys using the key assignment program.

XEQ "XA", when "Key 1" appears in display, key in the "Global Label" assignment as follows:
Key in 205 Enter up, # Enter up & the keycode of the key to which you wish to assign it e.g. Key 11 = \( \Sigma + \) key, Key -11 = the shifted \( \Sigma + \) key, Key 12 = \( \frac{1}{x} \) key, etc., press R/S.

When "Key 2" appears in display, key in the "GTO Global Label" assignment as follows:
Key in 4 Enter up, 29 Enter up, % the keycode /S, "Key 3", the "XEQ Global Label" assignment:
Key in 4 Enter up, 30 Enter up, & the keycode /S, 1e XEQ "X EQ" then for each character required in the Non-Standard Label, key in the decimal address (No.), (you will find these decimal addresses directly above the centre character on the Hex Chart). Unlike the previous method, you must enter the decimal equivalents in the order in which you wish them to appear in your label, pressing R/S after each decimal entry, (up to 6 characters); e.g., if you require "Lbl GEO!" you would key in Decimal 71 = to the G, R/S, Decimal 69 = to the E, R/S, Decimal 79 = to the Q, R/S, & Decimal 33 = to the !, R/S.
2. When label characters are complete, go into Alpha mode & check that they are correct (if they are not you will need to XEQ "NN" again & recreate the characters, don't forget to enter the decimal equivalents in the order in which you wish them to appear in your label, as example on previous page).

3. When the text line in Alpha is complete & correct come out of Alpha mode & GTO the line in the program where the non - standard label is required.

4. In run mode & in Alpha mode, key in "ASTO X" instruction, then come out of Alpha mode & key in "GTO IND X" instruction, this produces "NONEXISTENT" in the display, ignore this.

5. Go into program mode & press either the "Global Label" assigned key, the "GTO Global Label" assigned key or the "XEQ Global Label" assigned key.

I. Create Non - Standard Global Labels A - J, a - o, using an assigned key.

Firstly one must assign a key using the key assignment program.
XEQ "KA"%, when "Key 1" appears in display, key in the "Global label" assignment as follows:
Key in 205 <Enter up, f Enter up, % the keycode of the key to which you wish to assign it e.g. Key 11 = $ + key, Key -11 = the shifted $ + key, Key 12 = 1/x key etc.
GTO the line in the program where the Global label is required, key in the local label equivalent of the Global label required, then simply press the "Global Label" assigned key, there you have it.
Now BST & delete the unwanted local label.
e.g. Key in "Lbl A", then press the "Global Label" assigned key, see "Lbl T A".
If you now assign "A" to a key, then press this assigned key, you will get "XEQ T A".

J. Create a Non - Standard Global Label using the Byte - Jumper. (The label can then be assigned to a key).
1. Have you carried out Section "A" if not go back & do so.
2. Go into program mode, at line where Non - Standard Global label is required.
3. Key in an x<->y instruction, then in Alpha mode the text
J. "ABCDE". Note this line No. for you have to come back to it.

4. With this text line in view, go into run mode & in user mode, press the key to which you assigned the Byte - Jumper (hereafter written as "Byte - Jump").

5. Come back into program mode & see:—

6. Key in "Lbl N" instruction (if more than one character is required in the label, simply key in an Alpha character for each Non - Standard character, e.g. if 2 characters are required in the label, key in "Lbl NN", if 3 characters are required, key in "Lbl NNN" etc.

N.B. If you wish to assign this label to a key, simply, in program mode, assign Alpha "N" Alpha & press the key to which you wish to assign it, now (for you cannot do it later in this procedure).

7. GTO. (line No. of the text "ABCDE", it will appear in a Non - Standard form, you must not BST, if you do you will place the program pointer in the status registers. If however you do this by accident, come out of program mode & GTO, when display normalises, GTO Alpha "The Program Name" Alpha, & start again).

8. Key in the "stand alone" instructions that equal the Non - Standard characters of your label (you will find these instructions directly below the centre character on the Hex Chart).

9. Go through step 7 again.

10. Go into run mode & in user mode, Byte - Jump.

11. Come back into program mode, and again see:—

12. Key in a "+" instruction, then SST to see your required Global Label.

13. SST & BST deleting the unwanted instructions around your label.

14. If you press your assigned key, you will get "XEQ Lbl _ ".

K. Save a Byte when entering Exponents using the Byte - Jumper!!

1. Have you carried out Section "A" if not go back & do so.

2. Go to the line in the program, where the exponent entry is required.

3. Key in an x<|>y instruction, then in Alpha mode the text "ABC", then come out of Alpha mode.

4. With the text line in view, go into run mode & in user mode, press the key to which you assigned the Byte - Jumper.

5. Come back into program mode, see:—
HOW TO:

K. Key in your EEEX entry, e.g. press the EEEX key & fill
the prompts with the digit you require from 1 - 99 or
-1 to -99.

7. BST, see x(>y, SST, to see the text line "A- ".
8. SST again to see your E1 - E99 or E-1 to E-99,
(optional).
9. BST & SST around your EEEX instruction, deleting the
unwanted instructions.

L. Use the "Q" Loader.

Firstly one assigns 2 keys using the key assignment
program.
XEQ "KA" & when "Key 1" appears in the display key in
the "STO Q" assignment as follows:
Key in 145 Enter up, 121 Enter up, & the keycode of the
key you wish to assign it, e.g. Key 11 = + key, Key -11
= the shifted + key, Key 12 = 1/x key etc. Press R/S.
When "Key 2" appears in display, key in the digit "5"
assignment as follows:
Key in 4 Enter up, 21 Enter up, & the keycode, press R/S.

Having now assigned these 2 keys, you can now make up a
non-standard text line in a program, in a different
way (as opposed to the Byte - Jumper).
However this method is limited to a 7 character text,
but you don't need to enter the text prefix, decimal Nos,
240 - 255 (decimal addresses along the bottom row of the
Hex Chart), this is of great value when one is keying up
a text line, where a decimal 240 - 255 is used as a
character in a text line e.g.  

Decimal 247, 248, 13, 1, 60, 1, 33 & 64 ref. PPC3 V7,
N 5, P 18 (Valentin Albillo's Display Test Program).

Forgetting the text prefix, (247 = to a 7 character text
line), you would enter this line as follows: XEQ "NN" &
key in Decimal 64, R/S, 33, R/S, 1, R/S, 60, R/S, 1, R/S,
13, R/S, 248 R/S.

N.B. As above example shows, you must enter your decimal
No. equivalents of the text characters in Reverse
Order. You will find these decimal addresses (Nos.)
directly above the centre character on the Hex Chart.
2. When the text line is complete, go into Alpha mode &
check that it is correct (it will be in the reverse
L. If they are not correct, you will need to XEQ "NN" again & recreate the characters, (don't forget to enter them in reverse order).

3. Come out of Alpha mode & GTO the line in the program where the Non - Standard Text is required, whilst in run mode & in user mode, press the "STO Q" assigned key, then go into program mode & press the "5" assigned key, delete the 5, then SST to see your Non - Standard text line.

M. Use the routine "little b2" to place Non - Standard Text Lines up to 15 characters in your programs, written by John Mc Gachie (3324), & updated by Richard Collatt (4523).

1. One must assign "RCL b" to a key using the key assignment program.
   XEQ "KA" & when "Key 1" appears in display, key in 144 Enter up, 124 Enter up, & the keycode of the key to which you wish to assign it e.g. Key 11 = $ + key, Key -11 = the shifted $ + key, Key 12 = 1/x key, etc. then press R/S.

2. Write your Non - Standard text on a piece of paper, placing beneath each character its decimal number equivalent (these decimal Nos. are to be found directly above the centre character on the Hex Chart). Then write down the text prefix as the leftmost number, in your row of decimal numbers, e.g. 242 = a 2 character text, 247 = a 7 character text, 250 = a 10 character text, 252 = a 12 character text, through to 255 which is the equivalent of a 15 character text.
   Section them off into groups of 7 characters starting at the right end of your text.

3. XEQ "NN" then enter the decimal equivalents of the last 7 characters in your Non - Standard text line, pressing R/S after each decimal number entry.

4. When this section of your text is complete, go into Alpha mode & check that it is correct, (if not you must XEQ "NN", again & recreate this section of your text, come out of Alpha mode.

5. Go to the line in the program where the non - standard text is required.
7. Go into run mode & in user mode XEQ "PACK", then press the "RCL b" assigned key.

Then XEQ "b2", the prompt "Y = NNN, X = Rb?" will appear in the display, this is asking you, have you placed your non-normal number in the "Y" register, & have you recalled "b" into the "X" register, if so press R/S, this will place the "stand alone" instruction equivalents of your decimal No. entries into the required program.

9. XEQ "NN" again entering the decimal equivalents of the next set of characters to the left of the first 7 you entered, then go through step 10, then 4, 7 & 8 again. If there are more characters remaining repeat steps 4, 7 & 8 repeatedly. Treat the text prefix as a character!!

10. Go to the "+" instruction immediately before the 1st "stand alone" instruction, that relates to your text.

11. BST & SST around your text line deleting the "+" instructions.
Create a Byte - Jumper without the use of a Card Reader or any RAMS, (Modules).

Jim Trainor's original method improved.

N.B. This method does not disturb program memory, nor does it affect existing assignments.

1. Assign Alpha "+" Alpha & press the key to which you wish to assign the Byte - Jumper.
2. Assign Alpha "LN" Alpha (or any dummy assignment), & press any unassigned key.
3. XEQ Alpha "space" Alpha & immediately you release your finger from the Alpha toggle, disconnect the power source.
4. After a few seconds reconnect the power source, the display will show XEQ
5. Place one finger on the delete key, & another on the R/S key, press the delete key then immediately after, press the R/S key.
   If you aren't fast enough in pressing the R/S key "NONEXISTENT" appears in the display, in which case go back & continue from step 3. GTO,006
6. Go into program mode & see "+", (if you have keys already assigned, SST 'til you find the "+" sign), delete this then you will see "Lbl 03" in display, delete this also.
7. When the display normalises to 04 1, go into Alpha mode & press "A". * See overleaf.
8. Come out of Alpha mode & GTO.
9. Come back into run mode & in user mode, hold down the key to which you assigned the Byte - Jumper, you will see "XROM 05,01" this is your Byte - Jumper.

Create a Byte Jumper without a Card Reader. The Module (RAM) Pulling Method.

1. Master Clear, by holding down the delete key whilst turning the machine on.
2. XEQ "SIZE", display will show "SIZE_ _ _", fill the prompts with "000".
3. Assign 2 keys, e.g. "LN" to the 1/x key "LOG" to the Σ + key
4. Turn the 41C off.
5. Take out a Module (RAM) & wait approx. 20 seconds.
6. Place the module back in the 41C.
7. Switch the machine on & go into program mode.

8. SST, see you will then wait approx. 10 seconds before the display normalises.

9. Once the display normalises to you will then wait approx. 10 seconds before the display normalises.

10. SST again & after approx. a 6 second wait see

11. Then delete the "LOG" instruction, presently in view (deletion takes about 6 seconds), then delete the "Lbl 03" instruction, the display then returns to what it was in step 8.

12. When the display normalises to go into Alpha mode & press the \( \Sigma + \) key, wait, then see

13. Come out of Alpha mode & GTO (this appears in display for approx. 9 seconds).

14. Come back into run mode & press assign Alpha Alpha, & press the 1/x key (this unassigns the key).

15. In user mode, hold down the \( \Sigma + \) key & see "XROM 05,01" this is your Byte - Jumper.

* If other assignments have been made, the display will normalise to something other than shown on the previous page, this is of no consequence !