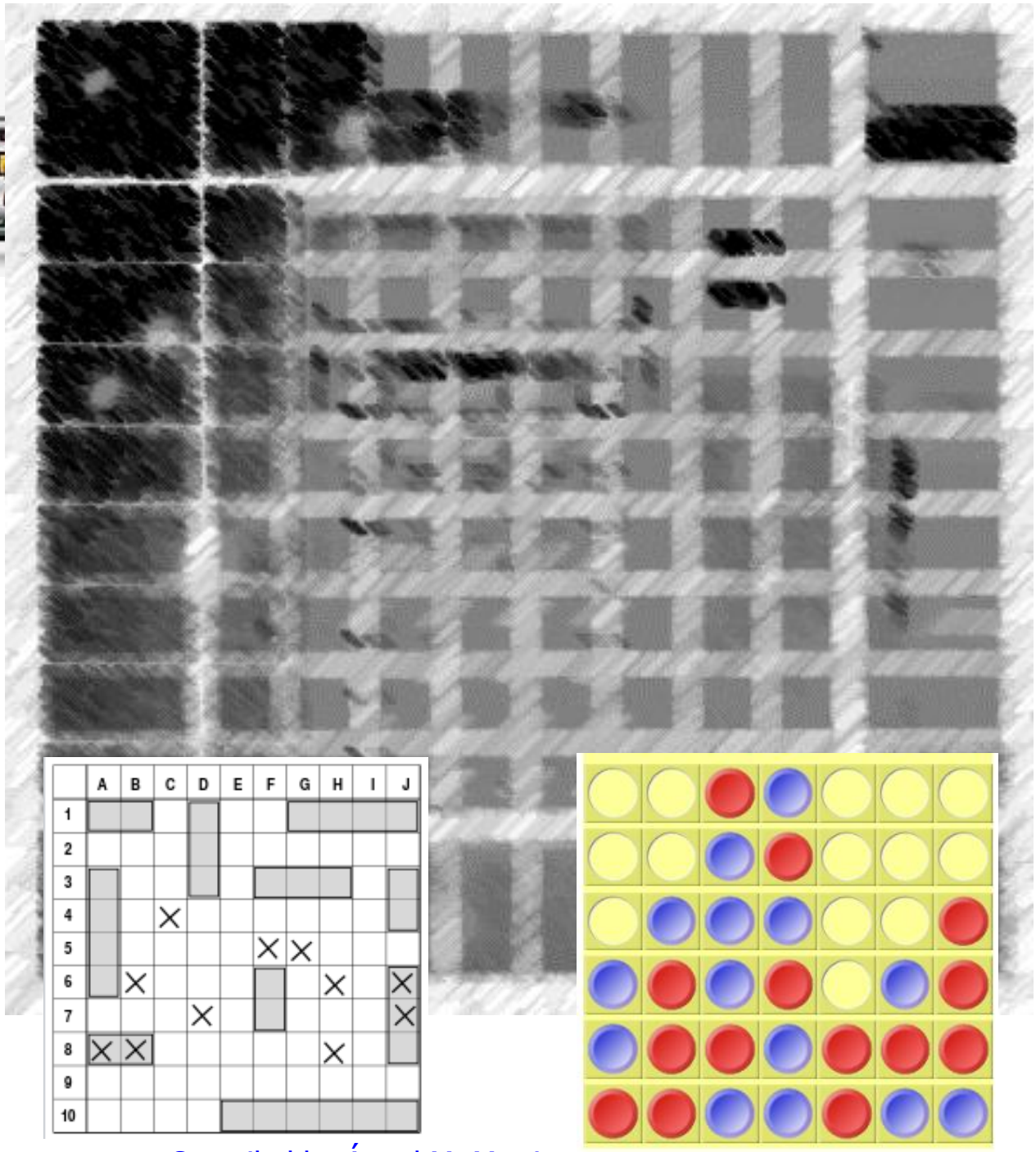
VINTAGE GAMES VOLUME-1

COLLECTION FOR THE HP-41



Compiled by Ángel M. Martin

May 2019

This compilation revision 1.2.2

Screen captures taken from V41, Windows-based emulator developed by Warren Furlow.
See www.hp41.org

Introduction.

This compilation includes a large amount of information on the subject of Games for the HP-41. Most of the games described here (and then some more!) are included in one of the Games Modules available in the CL Library; you can refer to the CL Modules Reference section for a relationship of the specific programs of interest.

The sources of the material included are very diverse: HP Museum, hp41.org Archive, PPC Calculator Journal, Data File Issues, Prisma Magazine, HP User program Library, Swap Disks (that huge heap of mostly undocumented stuff…), and finally different individual contributors' web sites. Collecting all this material hasn't been trivial, and necessarily introduces small inconsistencies in form and structure – but nevertheless the descriptions should be sufficient for a working implementation of the games.

The compilation is divided into three main sections, plus a final CL module reference as detailed below. You can use the hyperlinks to go directly to your area of interest, or use the index in the next pages to access the individual program.

With the exception of the Adventure games (a class on their own for obvious reasons), there's no category, subject, topic or other criteria used to structure the compilation (Brain teasers, Casino, Puzzles, Board, Mazes, Simulations, etc). Broadly speaking, the games are structured in a "from more simple to more complex" sequence. This of course is not the same as "from worse to better", as this is largely a personal choice. Some of the most enjoyable games are small in size but require quick reflexes; and conversely some of the more elaborate simulations are a tad too long and the player may become desinterested after a few runs.

The way original authors documented their programs varies immensely, some are really minimalistic in the sketches, whereas others use a more verbose description of the game instructions with prolific program details.

So all in all, here you have a comprehensive representation of the Games on the HP-41 platform that can provide many days of enjoyment to the user. At the very least, it should contribute by providing easy access to a ton of documentation only available using obscure sources difficult to locate.

Table of Contents (in alphabetical order)

Part I : MCODE Games

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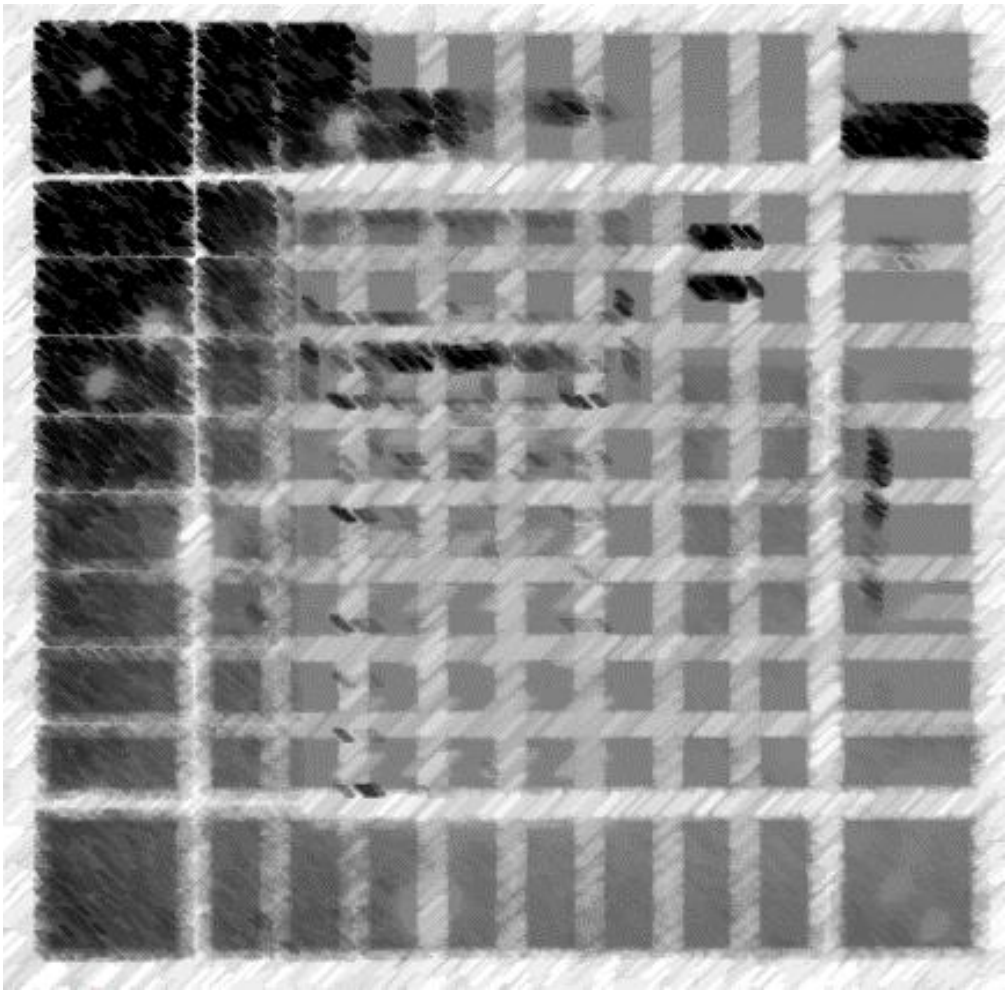


Four MCODE Games for the HP 41.

G. Vallance- DataFile V11N2, p23-30 ; (March 1992)

The idea for these games came from BASIC programs for the TI99/4A home computer (1,2,3,4). These had the advantage of a color TV display but were exasperatingly slow. The MCODE versions are satisfyingly fast and the one-line display adds a further challenge.

The listings given here use the ZENROM mnemonics and occupy FBA7 to FF43. The only address dependent parts are the four FAT entries FCF7, FD70, FE04, and FE94, and the two-word class 1 subroutines calls to **RANL**, **RAN**, **WAITKEY**, **MARK**, **STODISP,T ESTEXP**, **EVAL** and **DISP**. Three of the programs start with a class 3 jump around a keycode table. At the start of the XROM function (5) the entry address is in C(6:3) thusthe address of the keycode table can be stored.

All the programs use a random number generator; the one given here is Ken Emery's (6). You may prefer to use your own or one based on Mark Power's (7). Note the two entry points (**RAN** and **RANL**) depending on whether X is to be saved in L. This allows any game to be repeated (or restarted after pressing the back arrow) by recalling LASTx even if the program calls RAN several times.

All the programs use **WAITKEY**, a general purpose routine for keyboard input, this exists to standby if back arrow is pressed or the battery goes flat; pressing the ON key causes all necessary housekeeping to be done before turning off. Any other keypress returns to the calling program with the keycode in A[1:0].

The first three games use a 3 by 3 board represented on the display as three groups of three separated by colons, with the number of moves on the right. For keyboard input the board corresponds to the 3 by 3 grid formed by the nine digit keys 1 to 9. For example PI FIVE displays 202:334:510 representing:

2 0 2	corresponding to keys	7 8 9
3 3 4		4 5 6
5 1 0		1 2 3

References,

(1). Hal. Renko and Sam Edwards. Tantalizing Games for your TI99/4A. Addison-Wesley 1983. Explosion, pp. 70-76
(2). Ibid. One to Five, pp 46-49
(3). Scott Vincent. Dynamic Games for your TI99/4A. Interface 1983. Flippa, pp. 105-108
(4). Ibid. Number Juggle, pp. 144-146
(5). Ken Emery. MCode for beginners. Synhetix 1985. What's up on entry p.132
(6). Ibid. "RN", pp. 100-102
(7). Mark Power. Mcode Random Numbers. Datafile V6N8p9
(8). Ken Emery. Op. cit. XOR, pp. 80-82
(9). Richard Kendon. Reverse the order of digits of an integer. DataFile V10N4p24

EXPLOSION.(Reference [#1])

Two players place counters on empty squares or their own counters on a 3 by 3 grid. If a pile of counters becomes critical it explodes and takes over neighboring (not diagonal) squares, which may in turn explode. The critical capacity is the number of non-diagonal adjacent squares i.e. 2 for corners, 3 for the centers of the sides, and 4 for the center. The winner is the one starting a self-sustaining chain reaction.

At the prompt "C/M" press C for a game against the calculator with the calculator having the first go; M to play against the calculator with me making the first move; or press any other key (except ON or back arrow) for a game between two people. It is possible to reach stalemate where neither side can move. For example, 13521343435 displays AAA:BBA:AAA: 5- press back arrow to escape.

The calculator takes about half a second to evaluate a move at the beginning of a game, compared to 18 sec on the TI99. Slowest evaluation later in the game is about 2 sec. The calculator only evaluates the next move and it is not difficult to defeat it. Incidentally, the original BASIC program (1) has an undocumented feature (not in this MCODE version) which sometimes causes the evaluation procedure to go haywire, so that a simple scheme to defeat it did not always work.

Flag	Clear	Set
F0	first player	calculator or second player
F1	no explosion	explosion
F2	<16 explosions	>15 explosions (self-sustaining)
F3	actual move	evaluating (don't store or display)
F4	2 players	against calculator (needs to evaluate)

Data Storage:

M[12:4]critical capacity;	M[2:0] number of turns	
N[13] pointer;	N[12:4] board;	N[2:0] evaluation
Q[13] explosions;	Q[6:3] table address;	Q[2:0] random

The status of the board is stored as the nine digits N[12:4]. Each position is stored as a single digit and is displayed as a single character. The positions of the first player are stored as positive digits and displayed as A, B, etc; moves by the calculator or second player are stored as negative digits (F, E, etc.) and displayed as a, b, etc.

The program starts with a jump to FD02 where the keycode table address is stored in Q[6:3]. FD03 to FD11 gets a random seed, multiplies it by 1,000 converts to binary (max 3E7) shifts two bits left, adds one for luck and stores it in Q[2:0]. This provides 12 more or less random bits for the EVAL subroutine. FD12-E initializes the board and stores the capacity of each position. FD1F-29 prompts for the type of game required. FD2A-35 tests whether C or M was pressed and sets or clears flags 0 and 4. FD36-8 displays the empty board at the start of the game.

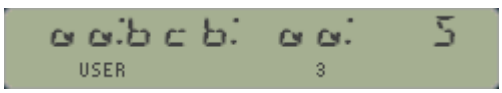
The main program loop starts at FD39. FD39-43 uses the keycode table to test for valid keys and at the same time sets the pointer to the corresponding digit. FD44-50 tests that the position is occupied by the player's counter(s) or is empty and either rejects the move od adds or subtracts one to the board in A[12:4]. FD51-6 adds one to the number of moves on alternate moves. The rest of the main program stores the move, tests for explosions, tests for end of game (flag 2 set), changes player by toggling flag 0, evaluates if necessary, and loops back for the next move.

The **STODISP** subroutine takes the new board from A[12:4] and stores it in N[12:4], displays the new board and number of moves, and beeps.

The **TESTEXP** subroutine tests whether the board in A[12:4] has a critical position and determines the effect of subsequent explosions. FC4C-62 tests whether A[PT] is critical, and if so subtracts the critical value. FC65-76 adds one to the adjacent positions and takes them over by giving them the current player's sign. These positions may have become critical, so if flag 1 is set the program loops back to test again. FC7A-E stores the number of explosions in Q[13] and sets flag 2 if there are more than 15 – this seems to be a sufficient criterion for a continuous chain reaction.

The **MARK** subroutine loads a 9 bit number and expands it into 9 digits in C[12:4] with ones at the potential adjacent to the current pointer. For example PT=11 corresponds to key 8; the non-diagonal adjacent keys are 7, 9, and 5, indicated by C[12:4] = 101010000. A loop counter, 8, is left in C[13] for use by the calling program. These loops, FC65-76 and FCC0-D0, change the pointer, but exit with the pointer unchanged because they are controlled by the counter.

The **EVAL** subroutine evaluates each possible move as a umber (biased by 100h to take care of negative numbers) in A[2:0] and stores the best (lowest) in N[2:0]. FC94-8 subtracts one for the center square if it's not already taken (not in original program); FCA4-B3 adds the value of each position; FCB7-D subtracts 2 for each of the calculator's subcritical positions; but FCBE-D0 adds 10 if an adjoining opponent's position is also subcritical. If the evaluation is equal to the value already stored in N[2:0] the random number in Q[2:0] is used to choose between them. FCAB tests the leftmost bit and if it is set it's replaced at the right at FCDF so the 12 bits are rotated and can be used indefinitely. FCE3-8 converts the current pointer (i.e. move being stored) to a constant and stores it in N[13]. EVAL exits with PT=P set to the optimum value. EVAL uses PT=Q to indicate the move being evaluated; TEXTEXP uses PT=P to evaluate each move but STODSP, which also uses PT=Q, is not called during evaluation.



```
Header AA58  085  "E"
Header AA59  004  "D"          Explosion
Header AA5A  00F  "O"
Header AA5B  00C  "L"
Header AA5C  010  "P"          DataFile V11N2p23
Header AA5D  018  "X"          G. Vallance
XPLODE       05B  JNC +11d
       AA5F  086  "3"
       AA60  076  "2"
       AA61  036  "1"
       AA62  085  "6"
       AA63  075  "5"          keycodes table
       AA64  035  "4"
       AA65  084  "9"
       AA66  074  "8"
       AA67  034  "7"
       AA68  000               end of table
LB_AA67      268  WRIT 9(Q)
       AA6A  379  PORT DEP:    Random number
       AA6B  03C  XQ           sets DEC mode
       AA6C  104  ->A904       [RANL]
       AA6D  226  C=C+1 S&X
       AA6E  226  C=C+1 S&X
       AA6F  226  C=C+1 S&X
       AA70  260  SETHEX
       AA71  38D  ?NC XQ
       AA72  008  ->02E3       [BCDBIN]
       AA73  1E6  C=C+C S&X
       AA74  1E6  C=C+C S&X
       AA75  226  C=C+1 S&X
       AA76  106  A=C S&X
       AA77  278  READ 9(Q)
       AA78  0A6  A<>C S&X
       AA79  268  WRIT 9(Q)
       AA7A  04E  C=0 ALL
       AA7B  070  N=C ALL
       AA7C  35C  PT= 12
       AA7D  090  LD@PT- 2
       AA7E  0D0  LD@PT- 3
       AA7F  090  LD@PT- 2     2,32343232
       AA80  0D0  LD@PT- 3
       AA81  110  LD@PT- 4
       AA82  0D0  LD@PT- 3
       AA83  090  LD@PT- 2
       AA84  0D0  LD@PT- 3
       AA85  090  LD@PT- 2
       AA86  158  M=C ALL
       AA87  3C1  ?NC XQ       Enable & Clear LCD
       AA88  0B0  ->2CF0       [CLLCDE]
       AA89  3BD  ?NC XQ
       AA8A  01C  ->07EF  [    MESSL]
       AA8B  003  "C"
```

```
        AA8C  02F   "/"          "C/M"
        AA8D  20D   "M"
        AA8E  149   ?NC XQ
        AA8F  024   ->0952       [ENCP00]
        AA90  379   PORT DEP:
        AA91  03C   XQ
        AA92  124   ->A924       [WAITKY]
        AA93  048   SETF 4
        AA94  388   SETF 0
        AA95  130   LDI S&X      070
        AA96  070   CON:
        AA97  366   ?A#C S&X
        AA98  1D3   JNC  +58d    [LB_AAD0]
        AA99  384   CLRF 0
        AA9A  130   LDI S&X      082
        AA9B  082   CON:
        AA9C  366   ?A#C S&X
        AA9D  013   JNC  +02     [LB_AA9D]
        AA9E  044   CLRF 4
LB_AA9DF 1A0  A=B=C=0
        AAA0  379   PORT DEP:
        AAA1  03C   XQ
        AAA2  16D   ->A96D       [STODSP]
LB_AAA1 379   PORT DEP:
        AAA4  03C   XQ
        AAA5  124   ->A924       [WAITKY]
        AAA6  01C   PT= 3
        AAA7  278   READ 9(Q)
LB_AAA6 23A   C=C+1 M
        AAA9  330   FETCH S&X
        AAAA  2E6   ?C#0 S&X
        AAAB  3C3   JNC  -08     [LB_AAA1]
        AAAC  3DC   PT=PT+1
        AAAD  366   ?A#C S&X
        AAAE  3D7   JC   -06     [LB_AAA6]
LB_AAAD 0B0   C=N ALL
        AAB0  10E   A=C ALL
        AAB1  38C   ?FSET 0
        AAB2  02F   JC   +05     [LB_AAB5]
        AAB3  1E2   C=C+C @PT
        AAB4  37F   JC   -17d    [LB_AAA1]
        AAB5  162   A=A+1 @PT
        AAB6  033   JNC  +06     [LB_AABA]
LB_AAB5 2E2   ?C#0 @PT
        AAB8  01B   JNC  +03     [LB_AAB9]
        AAB9  1E2   C=C+C @PT
        AABA  34B   JNC  -23d    [LB_AAA1]
LB_AAB9 1A2   A=A-1 @PT
LB_AABA 198   C=M ALL
        AABD  2F6   ?C#0 XS
        AABE  013   JNC  +02     [LB_AABE]
        AABF  226   C=C+1 S&X
```

```
LB_AABE     2B6   C=-C-1 XS
      AAC1  158   M=C ALL
      AAC2  379   PORT DEP:
      AAC3  03C   XQ
      AAC4  16D   ->A96D        [STODSP]
      AAC5  004   CLRF 3
      AAC6  379   PORT DEP:
      AAC7  03C   XQ
      AAC8  1A9   ->A9A9        [TSTEXP]
      AAC9  20C   ?FSET 2
      AACA  067   JC  +12d      [LB_AAD4]
      AACB  38C   ?FSET 0
      AACC  01B   JNC  +03      [LB_AACD]
      AACD  384   CLRF 0
      AACE  2AB   JNC  -43d     [LB_AAA1]
LB_AACD     388   SETF 0
      AAD0  04C   ?FSET 4
      AAD1  293   JNC -46d      [LB_AAA1]
LB_AAD0     379   PORT DEP:
      AAD3  03C   XQ
      AAD4  1E7   ->A9E7        [EVAL]
      AAD5  2D3   JNC  -38d     [LB_AAAD]
LB_AAD4     2ED   ?NC XQ
      AAD7  040   ->10BB        [BEEP]
      AAD8  1F9   ?NC GO
      AAD9  00E   ->037E        [STMSGF]
```

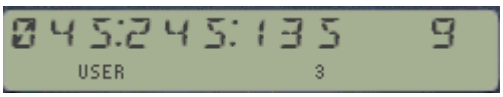
ONE to FIVE. (Reference [#2])

Pressing one of the digit keys adds one to each of the numbers in the same row and same column, but adding one to five gives zero. The puzzle is solved by reducing all the numbers to zero. The method of solving is similar to that used with Rubik's Cube, in that one develops algorithms for changing one set of numbers while leaving the relations between some others unchanged.

The nine digits on the board are stored in N[13:5], the number of goes in N[2:0]. This program does not use a keycode table, instead FD92-A2 tests the keycode to see if it is in the range of keycodes for the digit keys.

The **DISP** subroutine requires the keycode for one of the digit keys in A[1:0], 034 in C[2:0], and PT=1. FDB3-D generates the number 100100100 and may shift it right 1 or 2, depending on which column the keycode belongs to. FDBF-C9 makes 111000000 and shifts it by 3 or 6 depending on the row. These two numbers are combined with OR and added to the numbers on the board. FDCF-D8 changes sixes to zero and stores the new board. The rest of DISP displays the new board and beeps.

A random distribution of numbers cannot usually be solved – the game is started by making ten random moves on an empty board. FD76-B puts a random digit in the range 0 to 8 in A[S]; the JC -1 at FD7B takes care of the rare case when **RAN** returns a zero. The digit in A[S] is divided by 3 and the quotient and remainder are used to make a random keycode which is passed to the **DISP** subroutine.




```
Header AADB  085   "E"
Header AADC  016   "V"
Header AADD  009   "I"          One to Five
Header AADE  006   "F"
Header AADF  00F   "O"          DataFile V11N2p23
Header AAE0  014   "T"          G. Vallance
TOFIVE AAE1  0F8   READ 3(X)
       AAE2  128   WRIT 4(L)
       AAE3  04E   C=0 ALL
       AAE4  130   LDI S&X       009
       AAE5  009   CON:
LB_AAE4      070   N=C ALL
       AAE7  000
       AAE8  375   PORT DEP:     Random number
       AAE9  03C   XQ            sets DEC mode
       AAEA  106   ->A906        [RAN]
LB_AAE8      2FC   RCR 13
       AAEC  11E   A=C MS
```

```
LB_AAEA     1BE   A=A-1 MS
        AAEE 3FF  JC  -01       [LB_AAEA]
        AAEF 04E  C=0 ALL
        AAF0 130  LDI S&X343
        AAF1 343  CON:
        AAF2 33C  RCR 1
        AAF3 106  A=C S&X
        AAF4 31C  PT= 1
LB_AAF2     31E   ?A<C MS
        AAF6 027  JC  +04       [LB_AAF7]
        AAF7 1DE  A=A-C MS
        AAF8 162  A=A+1 @PT
        AAF9 3E3  JNC -04       [LB_AAF2]
LB_AAF7     362   ?A#C @PT
        AAFB 013  JNC +02       [LB_AAFA]
        AAFC 142  A=A+C @PT
LB_AAFA     1BE   A=A-1 MS
        AAFE 01F  JC  +03       [LB_AAFE]
        AAFF 166  A=A+1 S&X
        AB00 3EB  JNC -03       [LB_AAFA]
LB_AAFE     158   M=C ALL
        AB02 375  PORT DEP:
        AB03 03C  XQ
        AB04 328  ->AB28        [DISP]
        AB05 266  C=C-1 S&X
        AB06 303  JNC -32d      [LB_AAE4]
LB_AB04     375   PORT DEP:
        AB08 03C  XQ
        AB09 124  ->A924        [WAITKY]
        AB0A 130  LDI S&X       097
        AB0B 097  CON:
        AB0C 31C  PT= 1
        AB0D 302  ?A<C @PT
        AB0E 2EB  JNC -35d      [LB_AAE8]
        AB0F 39C  PT= 0
        AB10 302  ?A<C @PT
        AB11 3B3  JNC -10d      [LB_AB04]
        AB12 130  LDI S&X       034
        AB13 034  CON:
        AB14 302  ?A<C @PT
        AB15 397  JC  -14d      [LB_AB04]
        AB16 31C  PT= 1
        AB17 302  ?A<C @PT
        AB18 37F  JC  -17d      [LB_AB04]
        AB19 0F0  C<>N ALL
        AB1A 226  C=C+1 S&X
        AB1B 289  ?C GO
        AB1C 003  ->00A2        [ERROF]
        AB1D 0F0  C<>N ALL
        AB1E 158  M=C ALL
        AB1F 375  PORT DEP:
        AB20 03C  XQ
```

```
        AB21  328   ->AB28        [DISP]
        AB22  2FA   ?C#0 M
        AB23  327   JC  -28d       [LB_AB04]
        AB24  2ED   ?NC XQ
        AB25  040   ->10BB         [BEEP]
        AB26  1F9   ?NC GO
        AB27  00E   ->037E         [STMSGF]
DISP    AB28  198   C=M ALL
        AB29  1C6   A=A-C S&X
        AB2A  222   C=C+1 @PT
        AB2B  0E2   B<>C @PT
        AB2C  04E   C=0 ALL
        AB2D  226   C=C+1 S&X
        AB2E  23A   C=C+1 M
        AB2F  2BC   RCR 7
        AB30  23E   C=C+1 MS
        AB31  182   A=A-B @PT
        AB32  02F   JC  +05        [LB_AB34]
        AB33  33C   RCR 1
        AB34  1A2   A=A-1 @PT
        AB35  017   JC  +02        [LB_AB34]
        AB36  33C   RCR 1
LB_AB34         0EE   B<>C ALL
        AB38  04E   C=0 ALL
        AB39  130   LDI S&X        111
        AB3A  111   CON:
        AB3B  03C   RCR 3
        AB3C  39C   PT= 0
        AB3D  1A2   A=A-1 @PT
        AB3E  02F   JC  +05        [LB_AB40]
        AB3F  03C   RCR 3
        AB40  1A2   A=A-1 @PT
        AB41  017   JC  +02        [LB_AB40]
        AB42  03C   RCR 3
LB_AB43         06E   A<>B ALL
        AB44  370   C=C OR A
        AB45  10E   A=C ALL
        AB46  0B0   C=N ALL
        AB47  14E   A=A+C ALL
        AB48  190   LD@PT- 6
LB_AB46         33C   RCR 1
        AB4A  362   ?A#C @PT
        AB4B  017   JC  +02 [      LB_AB4A]
        AB4C  002   A=0 @PT
LB_AB4A         3D4   PT=PT-1
        AB4E  054   ?PT= 4
        AB4F  3D3   JNC  -06
        AB50  0AE   A<>C ALL
        AB51  070   N=C ALL
        AB52  3D9   ?NC XQ
        AB53  01C   ->07F6         [ENLCD]
LB_AB51         130   LDI S&X      003
```

```
        AB55   003    CON:
        AB56   154    ?PT= 6
        AB57   01F    JC  +03        [LB_AB57]
        AB58   254    ?PT= 9
        AB59   01B    JNC +03
LB_AB57         130   LDI S&X        00B
        AB5B   00B    CON:
LB_AB59         2FC   RCR 13
        AB5D   3E8    WRIT 15(e)
        AB5E   3DC    PT=PT+1
        AB5F   2D4    ?PT= 13
        AB60   3A3    JNC  -12d      [LB_AB51]
        AB61   0B0    C=N ALL
        AB62   03C    RCR 3
        AB63   130    LDI S&X        002
        AB64   002    CON:
        AB65   358    ST=C XP
LB_AB63         2FE   ?C#0 MS
        AB67   013    JNC  +02       [LB_AB66]
        AB68   388    SETF 0
LB_AB66         398   C=ST XP
        AB6A   2FC    RCR 13
        AB6B   3E8    WRIT 15(e)
        AB6C   3DC    PT=PT+1
        AB6D   214    ?PT= 2
        AB6E   3C3    JNC  -08       [LB_AB63]
        AB6F   149    ?NC XQ
        AB70   024    ->0952         [ENCP00]
        AB71   130    LDI S&X        059
        AB72   059    CON:
        AB73   358    ST=C XP
        AB74   379    ?NC XQ
        AB75   058    ->16DE         [XTONE]
        AB76   2A0    SETDEC
        AB77   0B0    C=N ALL
        AB78   3E0    RTN
```

FLIPX(Reference [#3])

There are 9 counters on a 3 by 3 grid. They are white on one side and black on the other. You can turn over a black counter but not a white one. However, if you turn over a black counter some of its neighbors are flipped over as well, whatever their color. Flipping a corner also flips the 3 adjoining counters. Flipping the centers of the sides also flips the two nearby corners. Flipping the center also flips the centers of the four sides. The object of the game is to make the center white and all the others black. If you make all the counters white, you are stuck and must press back arrow to exit.

The white or black status of the 9 counters is stored as a 9-bit number in M[X], and the bits are tested and toggled using the Boolean operators. The toggle mask for each move is stored together with the corresponding keycode in the table at the beginning of the program. The table address is stored in N[6:3] and the number of moves is in N[2:0]

The start of the program generates a random nine bit number and drops into the main program loop at FE30. The display routine FE30-47 tests the ninth bit in A[2:0] (the 3 higher bits are zero) and displays it as letter O or boxed star depending on whether it is clear or set, corresponding to white or black. A colon is added to every third one by setting flag 7 when the character code is in the flag register. FE48-58 displays the number of moves with leading spaces.

The keycode test loop is FE69-79; both the toggle mask and keycode are read from ROM, so the loop contains two FETCH S&X instructions. At the same time a test mask is generated in A.M, FE81-6 gets the board from M to A.X and brings the test mask to C.X and tests it with CANDA to see if the keypress corresponds to a black or white counter. FE87-D uses OR, AND, NOT AND to make the XOR operator (8) to flip the appropriate counters. It then loops back to the display routine.

```
Header AC35  098   "X"
Header AC36  010   "P"          Flip characters
Header AC37  009   "I"
Header AC38  00C   "L"          DataFile V11N2p23
Header AC39  006   "F"          G. Vallance
FLIPX  AC3A  0A3   JNC +20d
       AC3B  01B
       AC3C  086   "3"
       AC3D  007
       AC3E  076   "2"
       AC3F  036
       AC40  036   "1"
       AC41  049
       AC42  085   "6"
       AC43  0BA                  keycodes table
       AC44  075   "5"
       AC45  124
       AC46  035   "4"
       AC47  0DB
       AC48  084   "9"
       AC49  1C0
       AC4A  074   "8"
       AC4B  1B0
       AC4C  034   "7"
       AC4D  000                  end of table
LB_AC4B      046   C=0 S&X
       AC4F  070   N=C ALL
LB_AC4D      391   PORT DEP:      Random number
       AC51  08C   XQ             sets DEC mode
       AC52  104   ->A904         [RANL]
       AC53  10E   A=C ALL
       AC54  04E   C=0 ALL
       AC55  39C   PT= 0
       AC56  090   LD@PT- 2
       AC57  010   LD@PT- 0       C = 511
       AC58  150   LD@PT- 5
       AC59  050   LD@PT- 1
       AC5A  050   LD@PT- 1
       AC5B  135   ?NC XQ
       AC5C  060   ->184D [       MP2-10]
       AC5D  260   SETHEX
       AC5E  38D   ?NC XQ
       AC5F  008   ->02E3         [BCDBIN]
       AC60  226   C=C+1 S&X
       AC61  158   M=C ALL
       AC62  106   A=C S&X
       AC63  130   LDI S&X        1EF
       AC64  1EF   CON:
       AC65  366   ?A#C S&X
       AC66  353   JNC  -22       [LB_AC4D]
LB_AC64      3D9   ?NC XQ
       AC68  01C   ->07F6         [ENLCD]
```

```
        AC69   39C    PT= 0
LB_AC67         130    LDI S&X        00F
        AC6B   00F    CON:           "O"
        AC6C   356    ?A#0 XS
        AC6D   01B    JNC  +03       [LB_AC6D]
        AC6E   130    LDI S&X        03A
        AC6F   03A    "*"            boxed star
LB_AC6D         214    ?PT= 2
        AC71   01F    JC   +03       [LB_AC71]
        AC72   094    ?PT= 5
        AC73   023    JNC  +04       [LB_AC74]
LB_AC71         3D8    C<>ST XP
        AC75   288    SETF 7
        AC76   3D8    C<>ST XP
LB_AC747        3E8    WRIT 15(e)
        AC78   114    ?PT= 8
        AC79   037    JC   +06       [LB_AC7C]
        AC7A   3DC    PT=PT+1
        AC7B   016    A=0 XS
        AC7C   086    B=A S&X
        AC7D   126    A=A+B S&X
        AC7E   363    JNC  -20d      [LB_AC67]
LB_AC7C         0B0    C=N ALL
        AC80   03C    RCR 3
        AC81   130    LDI S&X        002
        AC82   002    CON:
LB_AC80         2FE    ?C#0 MS
        AC84   023    JNC  +04       [LB_AC85]
        AC85   3D8    C<>ST XP
        AC86   388    SETF 0
        AC87   3D8    C<>ST XP
LB_AC85         2FC    RCR 13
        AC89   3E8    WRIT 15(e)
        AC8A   3C6    RSHFC S&X
        AC8B   3DC    PT=PT+1
        AC8C   194    ?PT= 11
        AC8D   3B3    JNC  -10d      [LB_AC80]
        AC8E   149    ?NC XQ
        AC8F   024    ->0952         [ENCP00]
        AC90   130    LDI S&X        059
        AC91   059    CON:
        AC92   358    ST=C XP
        AC93   379    ?NC XQ
        AC94   058    ->16DE         [XTONE]
        AC95   198    C=M ALL
        AC96   106    A=C S&X
        AC97   130    LDI S&X        1EF
        AC98   1EF    CON:
        AC99   366    ?A#C S&X
        AC9A   037    JC   +06       [LB_AC9D]
        AC9B   2ED    ?NC XQ
        AC9C   040    ->10BB         [BEEP]
```

```
        AC9D  1F9   ?NC GO
        AC9E  00E   ->037E          [STMSGF]
        AC9F  243   JNC  -56d       [LB_AC64]
LB_AC9D         391   PORT DEP:
        ACA1  08C   XQ
        ACA2  124   ->A924          [WAITKY]
        ACA3  01A   A=0 M
        ACA4  17A   A=A+1 M
        ACA5  0B0   C=N ALL
LB_ACA3         23A   C=C+1 M
        ACA7  330   FETCH S&X
        ACA8  2E6   ?C#0 S&X
        ACA9  3BB   JNC  -09        [LB_AC9D]
        ACAA  0E6   B<>C S&X
        ACAB  23A   C=C+1 M
        ACAC  330   FETCH S&X
        ACAD  366   ?A#C S&X
        ACAE  023   JNC  +04        [LB_ACAF]
        ACAF  09A   B=A M
        ACB0  13A   A=A+B M
        ACB1  3AB   JNC  -11d       [LB_ACA3]
LB_ACAF         0B0   C=N ALL
        ACB3  2A0   SETDEC
        ACB4  226   C=C+1 S&X
        ACB5  289   ?C GO
        ACB6  003   ->00A2          [ERROF]
        ACB7  260   SETHEX
        ACB8  070   N=C ALL
        ACB9  198   C=M ALL
        ACBA  0AE   A<>C ALL
        ACBB  03C   RCR 3
        ACBC  3B0   C=C AND A
        ACBD  2E6   ?C#0 S&X
        ACBE  30B   JNC  -31d       [LB_AC9C] -> [AC64]
        ACBF  0C6   C=B S&X
        ACC0  370   C=C OR A
        ACC1  0E6   B<>C S&X
        ACC2  3B0   C=C AND A
        ACC3  2A6   C=-C-1 S&X
        ACC4  066   A<>B S&X
        ACC5  3B0   C=C AND A
        ACC6  158   M=C ALL
        ACC7  106   A=C S&X
        ACC8  2BB   JNC  -41d       [LB_AC9C] -> [AC64]
```

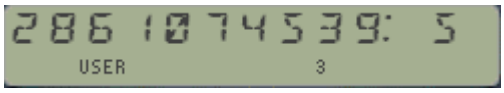
REVERSE. (Reference [#4])

This is a one-line game which starts by displaying the ten digits 0 to 9 in random order. Pressing a digit key N reverses the display between the Nth. and last digits. The game is solved by getting the digits in order from 0 to 9. It is not difficult to solve; the challenge is to do it in the smallest number of moved.

This is a rather long program for such a simple game, most of it taken up with juggling the display during setup. The type of random selector used, in which selected items are excluded from further selections may be used in other games.

FEA2-E stores the solution in Reg "a" for later testing and also in N for the random selector. This works by first selecting on of the ten digits, then selecting one of the nine left, and so on. FEB3-C6 multiplies the random seed by ten by adding one to the exponent on the first time round but on subsequent rounds does a floating point multiplication by 9, 8, etc. The random digit is left in C[5], FEC7-D0 sets the pointer to the random digit, puts the digit at the pointer in G and closes the gap. FED1-2 decrements the multiplier, and stores it and the shortened source string in N. FED3-B right justifies the display. FEDC-E6 adds the newly selected character to the display, left justifies it and loops back if there is more than one digit left. The new random string is not stored in a register, only in the display, so FEE7-F6 extracts the string from the display, adds the last digit from N and drops into the main program loop.

FEF7-FF26 does the display, beeps and tests for end of game. FF27-34 tests the keycode and at the same time sets the pointer to the relevant digit and creates a counter in A[S]. FF35-A increments the number of goes, maximum 99. FF3B-43 uses Richard Kendon's idea (9) to reverse the number to the right of the pointer and loops back to display the new result.



Header AB7A	085	**"E"**	
Header AB7B	013	**"S"**	
Header AB7C	012	**"R"**	Reverse Digits
Header AB7D	005	**"E"**	
Header AB7E	016	**"V"**	
Header AB7F	005	**"E"**	DataFile V11N2p23
Header AB80	012	**"R"**	G. Vallance
REVERSE	**05B**	**JNC +11d**	
AB82	084	"9"	
AB83	074	"8"	
AB84	034	"7"	
AB85	085	"6"	
AB86	075	"5"	keycodes table
AB87	035	"4"	

```
        AB88  086   "3"
        AB89  076   "2"
        AB8A  036   "1"
        AB8B  000                 end of table
LB_AB89       268   WRIT 9(Q)
        AB8D  0F8   READ 3(X)
        AB8E  128   WRIT 4(L)
        AB8F  04E   C=0 ALL
        AB90  19C   PT= 11
        AB91  050   LD@PT- 1
        AB92  090   LD@PT- 2
        AB93  0D0   LD@PT- 3
        AB94  110   LD@PT- 4      C = 0123456789
        AB95  150   LD@PT- 5
        AB96  190   LD@PT- 6
        AB97  1D0   LD@PT- 7
        AB98  210   LD@PT- 8
        AB99  250   LD@PT- 9
        AB9A  2E8   WRIT 11(a)
        AB9B  070   N=C ALL
        AB9C  3C1   ?NC XQ
        AB9D  0B0   ->2CF0        [CLLCDE]
LB_AB9B       260   SETHEX
        AB9F  149   ?NC XQ
        ABA0  024   ->0952        [ENCP00]
        ABA1  379   PORT DEP:     Random number
        ABA2  03C   XQ            sets DEC mode
        ABA3  106   ->A906        [RAN]
        ABA4  10E   A=C ALL
        ABA5  0B0   C=N ALL
        ABA6  2E6   ?C#0 S&X
        ABA7  03F   JC  +07       [LB_ABAB]
        ABA8  166   A=A+1 S&X
        ABA9  130   LDI S&X       010
        ABAA  010   <decimal>
        ABAB  070   N=C ALL
        ABAC  0AE   A<>C ALL
        ABAD  02B   JNC +05       [LB_ABAF]
LB_ABAB       05A   C=0 M
        ABAF  23C   RCR 2
        ABB0  135   ?NC XQ
        ABB1  060   ->184D        [MP2-10]
LB_ABAF       2E6   ?C#0 S&X
        ABB3  013   JNC +02       [LB_ABB2]
        ABB4  04E   C=0 ALL
LB_ABB2       2FC   RCR 13
        ABB6  2DC   PT= 13
LB_ABB4       3D4   PT=PT-1
        ABB8  27E   C=C-1 MS
        ABB9  3F3   JNC -02       [LB_ABB4]
        ABBA  0B0   C=N ALL
        ABBB  058   G=C @PT,+
```

```
        ABBC   11A    A=C M
        ABBD   006    A=0 S&X
        ABBE   3EA    LSHFA R<
        ABBF   0BA    A<>C M
        ABC0   266    C=C-1 S&X
        ABC1   070    N=C ALL
        ABC2   3D9    ?NC XQ
        ABC3   01C    ->07F6          [ENLCD]
        ABC4   130    LDI S&X         020
        ABC5   020    " "             space char
        ABC6   106    A=C S&X
LB_ABC4         3F8    READ 15(e)
        ABC8   366    ?A#C S&X
        ABC9   3F7    JC  -02         [LB_ABC4]
        ABCA   3B8    READ 14(d)
        ABCB   39C    PT= 0
        ABCC   098    C=G @PT,+
        ABCD   31C    PT= 1
        ABCE   0D0    LD@PT- 3
        ABCF   3E8    WRIT 15(e)
        ABD0   3DD    ?NC XQ
        ABD1   0AC    ->2BF7          [LEFTJ]
        ABD2   0B0    C=N ALL
        ABD3   266    C=C-1 S&X
        ABD4   2E6    ?C#0 S&X
        ABD5   24F    JC  -55d        [LB_AB9B]
        ABD6   2DC    PT= 13
        ABD7   210    LD@PT- 8
        ABD8   10E    A=C ALL
LB_ABD6         3F8    READ 15(e)
        ABDA   0BE    A<>C MS
        ABDB   3EE    LSHFA ALL
        ABDC   39C    PT= 0
        ABDD   102    A=C @PT
        ABDE   11E    A=C MS
        ABDF   1BE    A=A-1 MS
        ABE0   3CB    JNC -07         [LB_ABD6]
        ABE1   0B0    C=N ALL
        ABE2   2FC    RCR 13
        ABE3   11E    A=C MS
        ABE4   0AE    A<>C ALL
        ABE5   0FC    RCR 10
LB_ABE3         070    N=C ALL
        ABE7   3D9    ?NC XQ
        ABE8   01C    ->07F6          [ENLCD]
        ABE9   2DC    PT= 13
        ABEA   0D0    LD@PT-- 3
        ABEB   046    C=0 S&X
        ABEC   37C    RCR 12
LB_ABEA         3E8    WRIT 15(e)
        ABEE   3C6    RSHFC S&X
        ABEF   2FC    RCR 13
```

```
        ABF0  3D4   PT=PT-1
        ABF1  014   ?PT= 3
        ABF2  3DB   JNC  -05        [LB_ABEA]
        ABF3  3D8   C<>ST XP
        ABF4  288   SETF 7
        ABF5  3D8   C<>ST XP
        ABF6  3E8   WRIT 15(e)
        ABF7  0B0   C=N ALL
        ABF8  23C   RCR 2
        ABF9  130   LDI S&X         002
        ABFA  002   CON:
        ABFB  358   ST=C XP
LB_ABF9         2FE   ?C#0 MS
        ABFD  013   JNC  +02        [LB_ABFC]
        ABFE  388   SETF 0
LB_ABFC         398   C=ST XP
        AC00  2FC   RCR 13
        AC01  3E8   WRIT 15(e)
        AC02  3D4   PT=PT-1
        AC03  214   ?PT= 2
        AC04  3C7   JC   -08        [LB_ABF9]
        AC05  149   ?NC XQ
        AC06  024   ->0952          [ENCP00]
        AC07  130   LDI S&X         059
        AC08  059   CON:
        AC09  358   ST=C XP
        AC0A  379   ?NC XQ
        AC0B  058   ->16DE          [XTONE]
        AC0C  0B0   C=N ALL
        AC0D  11A   A=C M
        AC0E  2F8   READ 11(a)
        AC0F  37A   ?A#C M
        AC10  037   JC   +06        [LB_AC13]
        AC11  2ED   ?NC XQ
        AC12  040   ->10BB          [BEEP]
        AC13  1F9   ?NC GO
        AC14  00E   ->037E          [STMSGF]
        AC15  28B   JNC -47d        [LB_ABE3]
LB_AC13         260   SETHEX
        AC17  391   PORT DEP:
        AC18  08C   XQ
        AC19  124   ->A924          [WAITKY]
        AC1A  01C   PT= 3
        AC1B  278   READ 9(Q)
        AC1C  01E   A=0 MS
LB_AC1A         23A   C=C+1 M
        AC1E  330   FETCH S&X
        AC1F  2E6   ?C#0 S&X
        AC20  3B3   JNC -10d
        AC21  3DC   PT=PT+1
        AC22  17E   A=A+1 MS
        AC23  366   ?A#C S&X
```

```
        AC24   3CF    JC  -07        [LB_AC1A]
        AC25   0B0    C=N ALL
        AC26   2A0    SETDEC
        AC27   226    C=C+1 S&X
        AC28   2F6    ?C#0 XS
        AC29   289    ?C GO
        AC2A   003    ->00A2         [ERROF]
        AC2B   11A    A=C M
        AC2C   0E6    B<>C S&X
LB_AC2A         3CA    RSHFC R<
        AC2E   0A2    A<>C @PT
        AC2F   3FA    LSHFA M
        AC30   1BE    A=A-1 MS
        AC31   3E3    JNC -04        [LB_AC2A]
        AC32   0C6    C=B S&X
        AC33   313    JNC -30d       [LB_AC12] -> [LB_ABE3]
```

Routine Library:

```
WAITKY          A924   3C8    CLRKEY
LB_A922         160    ?LOWBAT
        A926   06F    JC  +13        [LB_A930]
        A927   3CC    ?KEY
        A928   3EB    JNC -03        [LB_A922]
        A929   220    C=KEY
LB_A927         3C8    CLRKEY
        A92B   3CC    ?KEY
        A92C   3F7    JC  -02        [LB_A927]
        A92D   03C    RCR 3
        A92E   056    C=0 XS
        A92F   106    A=C S&X
        A930   130    LDI S&X        0C3
        A931   0C3    CON:           <back arrow>
        A932   366    ?A#C S&X
LB_A930         3C1    ?NC GO
        A934   002    ->00FO         [NFRPU]
LB_A932         130    LDI S&X        018
        A936   018    CON:           <ON keycode>
        A937   366    ?A#C S&X
        A938   360    ?C RTN
        A939   260    SETHEX
        A93A   0A0    SLCTP
        A93B   149    ?NC XQ
        A93C   024    ->0952         [ENCP00]
        A93D   3B8    READ 14(d)
        A93E   358    ST=C XP
        A93F   321    ?NC GO
        A940   046    ->11C8         [OFF]
MARK    A941   04E    C=0 ALL
        A942   130    LDI S&X        008
```

```
        A943  008   CON:        loop counter
        A944  1BC   RCR 11
        A945  130   LDI S&X      0A0
        A946  0A0   CON:
        A947  354   ?PT= 12
        A948  0FF   JC  +31d     [LB_A964]
        A949  130   LDI S&X      150
        A94A  150   CON:
        A94B  194   ?PT= 11
        A94C  0DF   JC  +27d     [LB_A964]
        A94D  130   LDI S&X      088
        A94E  088   CON:
        A94F  0D4   ?PT= 10
        A950  0BF   JC  +23d     [LB_A964]
        A951  130   LDI S&X      114
        A952  114   CON:
        A953  254   ?PT= 9
        A954  09F   JC  +19d     [LB_A964]
        A955  130   LDI S&X      0AA
        A956  0AA   CON:
        A957  114   ?PT= 8
        A958  07F   JC  +15d     [LB_A964]
        A959  130   LDI S&X      051
        A95A  051   CON:
        A95B  294   ?PT= 7
        A95C  05F   JC  +11d     [LB_A964]
        A95D  130   LDI S&X      022
        A95E  022   CON:
        A95F  154   ?PT= 6
        A960  03F   JC  +07      [LB_A964]
        A961  130   LDI S&  X    015
        A962  015   CON:
        A963  094   ?PT= 5
        A964  01F   JC  +03      [LB_A963]
        A965  130   LDI S&X      00A
        A966  00A   CON:
LB_A963         2FC   RCR 13
        A968  3C6   RSHFC S&X
        A969  1E6   C=C+C S&X
        A96A  2FE   ?C#0 MS
        A96B  3E3   JNC  -04     [LB_A963]
        A96C  3E0   RTN
STODSPA96D      0E0   SLCT Q
        A96E  3C1   ?NC XQ       Enable & Clear LCD
        A96F  0B0   ->2CF0       [CLLCDE]
        A970  0B0   C=N ALL
        A971  0BA   A<>C M
        A972  070   N=C ALL
        A973  11A   A=C M
        A974  2DC   PT= 13
        A975  210   LD@PT-  8
        A976  11E   A=C MS
```

```
        A977  2FC   RCR 13
LB_A974       130   LDI S&X       002
        A979  002   CON:
        A97A  2FE   ?C#0 MS
        A97B  03B   JNC  +07      [LB_A97E]
        A97C  046   C=0 S&X
        A97D  31E   ?A<C MS
        A97E  023   JNC  +04      [LB_A97E]
        A97F  130   LDI S&X       010
        A980  010   CON:
        A981  29E   C=0-C MS
LB_A97E       2FC   RCR 13
        A983  0D4   ?PT= 10
        A984  02F   JC   +05      [LB_A985]
        A985  294   ?PT= 7
        A986  01F   JC   +03      [LB_A985]
        A987  054   ?PT= 4
        A988  023   JNC  +04      [LB_A988]
[LB_A985]     3D8   C<>ST XP
        A98A  288   SETF 7
        A98B  3D8   C<>ST XP
[LB_A988]     3E8   WRIT 15(e)
        A98D  3D4   PT=PT-1
        A98E  014   ?PT= 3
        A98F  34B   JNC  -23d     [LB_A974]
        A990  3F8   READ 15(e)
        A991  3F8   READ 15(e)
        A992  198   C=M ALL
        A993  21C   PT= 2
        A994  010   LD@PT- 0
        A995  0D0   LD@PT- 3
        A996  2E2   ?C#0 @PT
        A997  01F   JC   +03      [LB_A996]
        A998  130   LDI S&X       020
        A999  020   " "           <space char>
[LB_A996]     3E8   WRIT 15(e)
        A99B  149   ?NC XQ
        A99C  024   ->0952        [ENCP00]
        A99D  0A0   SLCTP
        A99E  0B0   C=N ALL
        A99F  130   LDI S&X       059
        A9A0  059   CON:
        A9A1  3D8   C<>ST XP
        A9A2  070   N=C ALL
        A9A3  379   ?NC XQ
        A9A4  058   ->16DE        [XTONE]
        A9A5  0B0   C=N ALL
        A9A6  11A   A=C M
        A9A7  358   ST=C XP
        A9A8  3E0   RTN
TSTEXP  A9A9  278   READ 9(Q)
        A9AA  05E   C=0 MS
```

```
        A9AB  268   WRIT 9(Q)
        A9AC  204   CLRF 2
[LB_A9A9]     304   CLRF 1
        A9AE  35C   PT= 12
[LB_A9AB]     198   C=M ALL
        A9B0  082   B=A @PT
        A9B1  122   A=A+B @PT
        A9B2  037   JC  +06       [LB_A9B4]
        A9B3  062   A<>B @PT
        A9B4  302   ?A<C @PT
        A9B5  157   JC  +42d      [LB_A9D8]
        A9B6  1C2   A=A-C @PT
        A9B7  043   JNC +08       [LB_A9BB]
[LB_A9B4]     062   A<>B @PT
        A9B9  282   C=0-C @PT
        A9BA  222   C=C+1 @PT
        A9BB  302   ?A<C @PT
        A9BC  11B   JNC +35d      [LB_A9D8]
        A9BD  198   C=M ALL
        A9BE  142   A=A+C @PT
[LB_A9BB]     308   SETF 1
        A9C0  379   PORT DEP:
        A9C1  03C   XQ
        A9C2  141   ->A941        [MARK]
[LB_A9BE]     3D4   PT=PT-1
        A9C4  014   ?PT= 3
        A9C5  013   JNC +02       [LB_A9C2]
        A9C6  35C   PT= 12
[LB_A9C2]     2E2   ?C#0
        A9C8  05B   JNC +11d
        A9C9  0A2   A<>C @PT
        A9CA  102   A=C @PT
        A9CB  142   A=A+C @PT
        A9CC  013   JNC +02       [LB_A9C9]
        A9CD  282   C=0-C @PT
[LB_A9C9]     222   C=C+1 @PT
        A9CF  38C   ?FSET 0
        A9D0  013   JNC +02       [LB_A9CD]
        A9D1  282   C=0-C @PT
[LB_A9CD]     102   A=C @PT
        A9D3  27E   C=C-1 MS
        A9D4  37B   JNC -17d      [LB_A9BE]
        A9D5  00C   ?FSET 3
        A9D6  027   JC  +04
        A9D7  379   PORT DEP:
        A9D8  03C   XQ
        A9D9  16D   ->A96D        [STODSP]
        A9DA  278   READ 9(Q)
        A9DB  23E   C=C+1 MS
        A9DC  013   JNC +02       [LB_A9D7]
        A9DD  208   SETF 2
[LB_A9D7]     268   WRIT 9(Q)
```

```
[LB_A9D8]       3D4   PT=PT-1
        A9E0    014   ?PT= 3
        A9E1    273   JNC  -50d      [LB_A9AB]
        A9E2    20C   ?FSET 2
        A9E3    360   ?C RTN
        A9E4    30C   ?FSET 1
        A9E5    247   JC   -56d      [LB_A9A9]
        A9E6    3E0   RTN
EVAL    A9E7    0E0   SLCTQ
        A9E8    35C   PT= 12
        A9E9    0B0   C=N ALL
        A9EA    130   LDI S&X       3FF
        A9EB    3FF   CON:
        A9EC    070   N=C ALL
LB_A9E9         10E   A=C ALL
        A9EE    2E2   ?C#0 @PT
        A9EF    01B   JNC  +03      LB_A9EE
        A9F0    1E2   C=C+C @PT
        A9F1    12B   JNC  +37d     LB_AA11
LB_A9EE         006   A=0 S&X
        A9F3    176   A=A+1 XS
        A9F4    114   ?PT= 8
        A9F5    023   JNC  +04      LB_A9F5
        A9F6    342   ?A#0 @PT
        A9F7    017   JC   +02      LB_A9F5
        A9F8    1A6   A=A-1 S&X
LB_A9F5         1A2   A=A-1 @PT
        A9FA    0A0   SLCTP
        A9FB    008   SETF 3
        A9FC    379   PORT DEP:
        A9FD    03C   XQ
        A9FE    1A9   ->A9A9       [TSTEXP]
        A9FF    20C   ?FSET 2
        AA00    02B   JNC  +05      LB_AA00
LB_A9FC         3DC   PT=PT+1
        AA02    120   ?P=Q
        AA03    3F3   JNC  -02      LB_A9FC
        AA04    3E0   RTN
LB_AA00         2DC   PT= 13
        AA06    210   LD@PT-  8
        AA07    11E   A=C MS
        AA08    04E   C=0 ALL
        AA09    0BA   A<>C M
        AA0A    11A   A=C M
        AA0B    2FC   RCR 13
LB_AA07         31E   ?A<C MS
        AA0D    01B   JNC  +03      LB_AA0B
        AA0E    130   LDI S&X       0FF
        AA0F    0FF   CON:
LB_AA0B         2FC   RCR 13
        AA11    146   A=A+C S&X
        AA12    046   C=0 S&X
```

```
        AA13   2EE    ?C#0 ALL
        AA14   3C7    JC  -08        LB_AA07
        AA15   01B    JNC +03        LB_AA13
        AA16   1BB    JNC +55d       LB_AA46
        AA17   2B3    JNC -42d       LB_A9E9
LB_AA13         198    C=M ALL
        AA19   262    C=C-1 @PT
        AA1A   282    C=0-C @PT
        AA1B   362    ?A#C @PT
        AA1C   0C7    JC  +24d       LB_AA2D
        AA1D   1A6    A=A-1 S&X
        AA1E   1A6    A=A-1 S&X
        AA1F   027    JC  +04
        AA20   379    PORT DEP:
        AA21   03C    XQ
        AA22   141    ->A941         [MARK]
LB_AA1C         3D4    PT=PT-1
        AA24   014    ?PT= 3
        AA25   013    JNC +02        LB_AA20
        AA26   35C    PT= 12
LB_AA20         2E2    ?C#0 @PT
        AA28   053    JNC +10d       LB_AA2B
        AA29   0EE    B<>C ALL
        AA2A   198    C=M ALL
        AA2B   262    C=C-1 @PT
        AA2C   362    ?A#C @PT
        AA2D   027    JC  +04        LB_AA2A
        AA2E   130    LDI S&X        00A
        AA2F   00A    CON:
        AA30   146    A=A+C S&X
LB_AA2A         0CE    C=B ALL
LB_AA2B         27E    C=C-1 MS
        AA33   383    JNC -16d       LB_AA1C
LB_AA2D         3D4    PT=PT-1
        AA35   014    ?PT= 3
        AA36   313    JNC -30d       LB_AA13
        AA37   0B0    C=N ALL
        AA38   306    ?A<C S&X
        AA39   067    JC  +12d       LB_AA3E
        AA3A   366    ?A#C S&X
        AA3B   08F    JC  +17d       LB_AA45
        AA3C   0EE    B<>C ALL
        AA3D   278    READ ( 9)Q
        AA3E   1E6    C=C+C S&X
        AA3F   01F    JC  +03        LB_AA3B
        AA40   268    WRIT 9(Q)
        AA41   05B    JNC +11d       LB_AA45
LB_AA3B         226    C=C+1 S&X
        AA43   268    WRIT ( 9)Q
        AA44   0CE    C=B ALL
LB_AA3E         0A6    A<>C S&X
        AA46   05E    C=0 MS
```

```
LB_AA40         27E   C=C-1 MS
        AA48    3DC   PT=PT+1
        AA49    120   ?P=Q
        AA4A    3EB   JNC  -03      LB_AA40
        AA4B    070   N=C ALL
LB_AA45         0E0   SLCTQ
LB_AA46         3D4   PT=PT-1
        AA4E    0B0   C=N ALL
        AA4F    014   ?PT= 3
        AA50    23B   JNC  -57d     LB_AA12
        AA51    0A0   SLCTP
        AA52    01C   PT= 3
LB_AA4C         3DC   PT=PT+1
        AA54    23E   C=C+1 MS
        AA55    3F3   JNC  -02      LB_AA4C
        AA56    3E0   RTN
Header  A901    0A3   "#"
Header  A902    00E   "N"           DataFile V11N2p23
Header  A903    012   "R"           G. Vallance
RANL    A904    0F8   READ 3(X)
        A905    128   WRIT 4(L)
RAN     A906    0F8   READ 3(X)
        A907    00E   A=0 ALL
        A908    355   ?NC XQ
        A909    050   ->14D5        Unlabeled - Sets DEC mode
        A90A    35C   PT= 12
        A90B    250   LD@PT- 9
        A90C    210   LD@PT- 8
        A90D    090   LD@PT- 2      C = 982.3
        A90E    050   LD@PT- 1
        A90F    130   LDI S&X
        A910    003   CON: 3
        A911    135   ?NC XQ
        A912    060   ->184D        [MP2-10]
        A913    10E   A=C ALL
        A914    04E   C=0 ALL
        A915    266   C=C-1 S&X
        A916    35C   PT= 12
        A917    090   LD@PT- 2
        A918    050   LD@PT- 1      C = 0.211327
        A919    050   LD@PT- 1
        A91A    0D0   LD@PT- 3
        A91B    090   LD@PT- 2
        A91C    1D0   LD@PT- 7
        A91D    01D   ?NC XQ
        A91E    060   ->1807        [AD2-10]
        A91F    084   CLRF 5
        A920    0ED   ?NC XQ
        A921    064   ->193B        [INTFRC]
        A922    0E8   WRIT 3(X)
        A923    3E0   RTN
```

Metronome for the HP-41

Mark Power, DataFile V9N4 p18

Requires: Any HP41, Time Module (or CX)
MCODE equipment (e.g ZENROM and RSU)

First of all, many thanks to Frank Wales at Zengrange without whose help I wouldn't have been able to convince the Time Module to talk to me. The functions presented here are my first attempts at using the Time Modules Phineas chip. Being a keen musician I have long been on the lookout for a cheap Metronome, well at last it's here - in disguise as an HP41!

Before we start on the program, a few words of warning to anyone with a ZENROM manual using the chapter on Advanced Machine Code Programming:

- In Section 8.2 on display handling, the diagram showing the use of Bits 6 and 7 is incorrect. The titles for the two columns should be reversed. (Bits 6should be Bits 7).
- Still in Section 8.2, the hexadecimal value for 'DISOFF' should be '2E0' not'230'.
- Also in this section, the comment for 'READAN' should be "Read theannunciators bit pattern to C[X]".
- More importantly for this article, in Section 8.4, The Timer Module, the hexadecimal values for 'TIMER=A' and 'TIMER=B' should be reversed i.e. 3E8 TIMER=A Select timer A 3A8 TIMER=B Select timer B

The Metronome function makes use of a subroutine I have written which checks the existence of the Time Module, and that it has been initialized. If you want to explore with the module, then this routine may be useful:

CHECK TIME MODULE ROUTINE

This function checks that the Timer Module is plugged in and that the timer circuitry has been initialized (this is very likely if you use your '41 normally).

Routines used: ENTMR @ 50E2 (from the Timer Module)
ERRSUB @ 22E8
CLLCDE @ 2CF0
MESSL @ 07EF
MSG105 @ 1C80
ERR110 @ 22FB

Input: None.
Output: Returns if Timer present and initialized or displays "TIMER ERROR" and stops.
Assumes: Nothing.

```
x800   04E CHKTMR: C=0 ALL        ; Check Timer exists.
x801   15C PT= 6                  ;
x802   150 LC 5                   ; Access XROM of ROM in
x803   330 RDROM                  ; page 5 (Timer page).
x804   106 A=C X                  ; Put XROM into A[X].
x805   130 LDI                    ;
x806   01A CON 26                 ; Load Timer XROM.
x807   366 ?A#C X                 ; Compare the two.
x808   05F JC+0B TMRERR           ; If not the same TMRERR
```

```
x809   389 *                ; otherwise, enable Timer.
x80A   140 NC XQ ENTMR      ; and disable RAM.
x80B   3A8 TIMER=B          ; Enable B timers.
x80C   0B8 RALM             ; Read warm start constant.
x80D   00E A=0 ALL          ; Check that it is
x80E   2A0 SETDEC           ; 09999999999000.
x80F   1BA A=A-1 M          ;
x810   260 SETHEX           ;
x811   36E ?A#C ALL         ; If it is then
x812   3A0 NCRTN            ; exit
x813   3A1 TMRERR: *        ; Otherwise do custom
x814   088 NC XQ ERRSUB     ; error
x815   3C1 *                ; TIMER ERROR.
x816   0B0 NC XQ CLLCDE     ; Clear & enable LCD.
x817   3BD *                ;
x818   01C NC XQ MESSL      ; Display message.
x819   014 T                ; Text starts here.
x81A   009 I                ;
x81B   00D M                ;
x81C   005 E                ;
x81D   012 R                ;
x81E   020                  ;
x81F   005 E                ;
x820   012 R                ;
x821   012 R                ;
x822   00F O                ;
x823   012 R                ; 12 characters so we
x824   320                  ; don't need to justify.
x825   201 *                ; Output to any printers
x826   070 NC XQ MSG105     ; in TRACE mode.
x827   3ED *                ; Exit via standard
x828   08A NC GO ERR110     ; error handler.
```

METRONOME FUNCTION

This function, called METRO, takes a number of beats per minute, in from the X register. It then calculates using the standard division routine and rounding routine, the interval in hundredths of a second between beats. If a Time module is not present, TIM ER ERROR is displayed (as above).

The interval timer (as used by the CLOCK function) is then set to repeatedly cause an alarm service request. When this occurs, the timer status is checked to ensure that it was us who caused the alarm. If it wasn't then the routine exits immediately. This allows Alarms from the Time Module to interrupt operation without causing problems. If the alarm was due to us, then TONE 89 is sounded and the alarm status cleared.

While the machine is waiting for the alarm, it repeatedly polls the key down flag. If any key is pressed, the routine exits. On exit, the interval timer is stopped and the DTZIT status flag cleared (as required by the Phineas specification).

Note that the processor is running continuously (unlike in the CLOCK function) and so you shouldn't leave this program running for hours unless you want flat batteries.

Routines used: DV2-10 @ 1898
ROUND @ 0A35
ERRDE @ 282D
CHKTMR @ x800 (described above)
RSTKB @ 0098
ENCP00 @ 0952
XTONE @ 16DE
ENTMR @ 50E2 (from the Timer Module)

Input: X = Number of beats per minute.
Output: Beeps in accordance with rate set above or exits with error shown.
Assumes: Nothing.

```
x900   08F    O
x901   012    R
x902   014    T
x903   005    E
x904   00D    M
x905   04E     XMETRO: C=0 ALL ; METRO entry point.
x906   130    LDI              ;
x907   106    CON 262          ; Load the normalized
x908   23C    RCR 2            ; number 60 into N2.
x909   10E    A=C ALL          ;
x90A   0F8    C=REG 3/X        ; Load BPM into N1.
x90B   2A0    SETDEC           ; Entry condition for:
x90C   261    *                ; Floating point
x90D   060    NC XQ DV2-10     ; division (N2/N1).
x90E   016    A=0 XS           ; Specify 2 digits to
x90F   176    A=A+1 XS         ; be rounded in A[XS].
x910   176    A=A+1 XS         ;
x911   104    CF 8             ; Set 'XRND' condition.
x912   288    SF 7             ; Set 'FIX' mode.
x913   0D5    *                ; Execute floating
x914   028    NC XQ ROUND      ; point RouND function.
x915   0A6    A<>C X           ; Move mantissa out
x916   130    LDI              ; whilst loading
x917   004    CON 04           ; normalisation value.
x918   0A6    A<>C X           ;
x919   2A0    SETDEC           ; This normalises the
x91A   226    C=C+1 X          ; number so that it is in
x91B   226    C=C+1 X          ; BCD form in 1/100ths
x91C   306    ?A<C X           ; of a second in the
x91D   0B5    *                ; bottom of the C register.
x91E   0A3     LOOP: C GO ERRDE ;
x91F   3DA     CSR M           ; If the value was too big
x920   226    C=C+1 X          ; then DATA ERROR.
x921   306     ?A<C X          ;
x922   3EB     JNC-03 LOOP     ;
x923   2BC     RCR 7           ; Move 1/100ths to bottom
x924   158    M=C              ; of C register.
x925   260    SETHEX           ;
x926   379    *                ; Check Timer module
x927   03C    *                ; exists and timer is
```

```
x928  000    GOSUB CHKTMR          ; running.
      x929   261    *              ; Don't start until
x92A  000    NC XQ RSTKB           ; keyboard has been
x92B  198    C=M                   ; debounced.
x92C  3E8    TIMER=A               ; Ready to get status.
x92D  168    WINST                 ; Start interval timer.
x92E  36C    MLOOP: ?ALM           ; Test for alarm.
x92F  083    JNC+10 CHKEY          ; If no alarm check key.
x930  0F8    RSTS                  ; If alarm, read status
x931  3D8    C<>ST                 ; and check that it is
x932  04C    ?SET 4                ; our alarm (DTZIT bit
x933  073    JNC+0E MEND           ; should be set if it is).
x934  044    CF 4                  ; If not ours then end.
x935  130    LDI                   ; Else clear bit and
x936  059    CON 89                ; get TONE number ready.
x937  3D8    C<>ST                 ; Write back status with
x938  0E8    WSTS                  ; DTZIT bit clear.
x939  149    *                     ; Disable Timer and
x93A  024    NC XQ ENCP00          ; enable chip 00.
x93B  379    *                     ; Execute TONE with
x93C  058    NC XQ XTONE           ; number in ST.
x93D  389    *                     ; Enable timer again.
x93E  140    NC XQ ENTMR           ;
x93F  3CC    CHKEY: ?KEY           ; Check for key press.
x940  373    JNC-12 MLOOP          ; No key, go round again.
x941  1E8    MEND: STPINT          ; Exit, stop timer.
x942  0F8    RSTS                  ; Read status.
x943  3D8    C<>ST                 ;
x944  044    CF 4                  ; Clear DTZIT bit.
x945  3D8    C<>ST                 ;
x946  0E8    WSTS                  ; Write status back
x947  261    *                     ; Exit after debouncing
x948  002    NC GO RSTKB           ; the keyboard.
```

The DTZIT bit (Decrement Through Zero Interval Timer), indicates that the alarm was caused by the interval timer counter reaching zero at the end of the time period specified in the WINST instruction. Other bits in the status register indicate other alarm conditions (e.g label and stopwatch alarms).

The WINST (Write Interval Timer and Start) takes a BCD value in hundredths of seconds specified in C[4:0]. Hence the interval timer may be used to cause an alarm repeatedly every 0.01 to 999.99 seconds.

The CLOCK function in the Time Module uses the interval timer with an interval of 1 second or 1 minute depending on the clock mode (CLKT/CLKTD). Even using the built in XTONE function, the metronome seems to be quite capable of producing 1000 beats per minute down to one beat every 15 minutes – whether you can play at those speeds is another thing!

For us lesser mortals, it is quite capable of beating at 60 to 208 per minute, which seems to cover all of my music which has a tempo indicated on it. Perhaps the next step is to make it indicate 'Up beats' and be able to play in all of the common time signatures! Any takers?

.END.

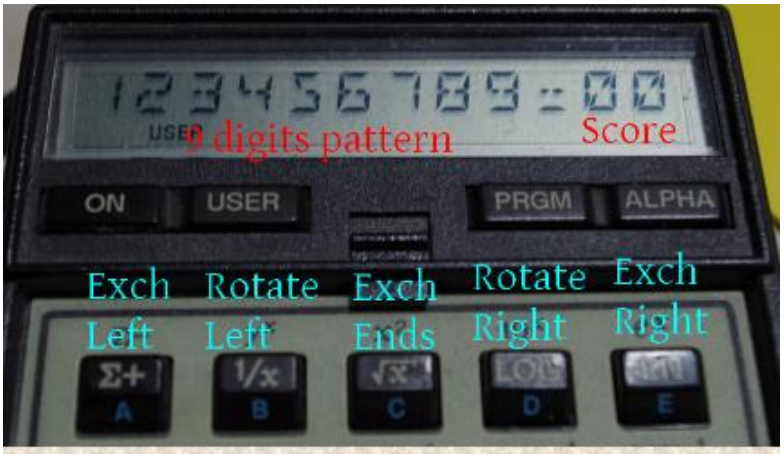
Pattern Twister(TWIX)

Guillaume Tello- http://gtello.pagesperso-orange.fr/hp41_e.htm

Source:I found this game in a version for the HP67/97 "Super Twix" written by David V. Smith.

The Objective: The goal is to transform a pattern of 9 digits into another with limited movements. Traditionally, one tries to transform the pattern "123456789" into "987654321".

How to play: You write the starting pattern of 9 digits, then XEQ TWIX, and you can see the board game as show on the right:




```
;        13 12 11 10   9   8   7   6   5   4   3   2   1   0
; A=      x  x  N  NNNNNNNN  D   S   S
; NNN... the 9
digits                                                          ; D =
character for
separation                                                        ;
SS how many steps in
game                                                          ; B used
to save A
; C used everywhere
; no other register, no flag.

                          .NAME   "TWIX"
F006 098                  #098             ;"X"
F007 009                  #009            ;"I"
F008 017                  #017            ;"W"
F009 014                  #014            ;"T"
; ******************************
; initialization
; ******************************
F00A 0F8    [TWIX]        READ    3       ; copy X into C
F00B 11A                  A=C     M       ; the mantissa into A
F00C 39A                  RSHFA   M       ; 9 digits in positions 11-4
F00D 006                  A=0     S&X     ; clear exp. =no. of steps, score
F00E 2A0                     SETDEC       ; everything in decimal.
; ******************************
; DISPLAY routine
; ******************************
```

```
F00F 130010 [DISP]      LDIS&X  10
F011 270                RAMSLCT      ; dummy ram zone
F012 1300FD              LDIS&X  FD
F014 3F0                 PRPHSLCT          ; select screen
F015 0AE10E              C=A     ALL       ; get the 9 digits + score
F017 21C                 R=      2
F018 350                 LD@R    D         ; code for separator in XS
F019 1BC                 RCR     11        ; the first digit in correct
position
F01A 0A0                 SLCTP
F01B 35C                 R=      12        ; for the loop
F01C 0E0    [L1]         SLCTQ
F01D 21C                 R=      2
F01E 010                 LD@R    0
F01F 0D0                 LD@R    3         ; prepare code 03N into C
F020 3E8                 WRIT    15        ; copy to screen
F021 2FC                 RCR     13        ; next digit
F022 0A0                 SLCTP
F023 3D4                 R=R-1             ; one less
F024 394                 ?R=     0         ; until zero
F025 3BB                 JNC     [L1]      ;-9    F01C
F026 130000              LDIS&X  0         ; quit screen
F028 3F0                 PRPHSLCT
F029 3C8    [WAIT]       CLRKEY            ; wait for a key
F02A 3CC                 ?KEY
F02B 3F3                 JNC     [WAIT]    ;-2    F029
F02C 220                 C=KEY             ; key into 4-3
F02D 33C                 RCR     1         ; key into 3-2
F02E 166                 A=A+1   S&X       ; one more step in score
F02F 08E                 B=A     ALL       ; save A !
F030 0AE                 A<>C    ALL       ; key in A 3-2
F031 21C                 R=      2         ; point to XS
F032 0D0                 LD@R    3         ; XS = 3
F033 376                 ?A#C    XS        ; last nibble of key is 3 ?
F034 3A0                 ?NCRTN            ; if so, END OF GAME (key from
                                           ; the line ENTER to <-)
F035 356                 ?A#0    XS        ; last nibble of key is zero?
F036 39F                 JC      [WAIT]    ;-13 F029 ; no, so invalid key !
F037 0F53C0              ?NCXQ   [ACTION]  ;F03D ; subprogram for  actions
F039 3C8    [KOFF]       CLRKEY            ; wait for the key be released
F03A 3CC                 ?KEY
F03B 3F7                 JC      [KOFF]    ;-2   F039
F03C 29B                 JNC     [DISP]    ;-45  F00F ; display new pattern
; ******************************
; execute the action according
to                                          ; one of the 5 keys of first
line
; ******************************
F03D 38E    [ACTION]     RSHFA   ALL       ; high nibble of KEY in XS
F03E 15C                 R=      6
F03F 050                 LD@R    1
F040 0D0                 LD@R    3
F041 1D0                 LD@R    7
F042 210                 LD@R    8
F043 310                 LD@R    C          ; codes for the 5 keys
F044 376                 ?A#C    XS         ; equal to C (key C0=LN)
F045 0B3                 JNC     [XRIGHT]   ;+22 F05B ; yes, exchange right
F046 33C                 RCR     1
F047 376                 ?A#C    XS      ; equal to 8 (key 80=LOG)
F048 113                 JNC     [RRIGHT]   ;+34 F06A ; yes, rotate right
F049 33C                 RCR     1
F04A 376                 ?A#C    XS        ; equal to 7 (key 70=SQR)
```

```
F04B 093                JNC     [XENDS]   ;+18   F05D ; yes, exchange ends
F04C 33C                RCR     1
F04D 376                ?A#C    XS        ; equal to 3 (key 30=1/X)
F04E 0BB                JNC     [RLEFT]   ;+23   F065 ; yes, rotate left
F04F 33C                RCR     1
F050 376                ?A#C    XS        ; equal to 1 (key 10=S+)
F051 360                ?CRTN             ; no! bad key (impossible...)
; ******************************
; (S+) exchange left
; ******************************
F052 0DC                R=      10
F053 0EE    [XCOMM]     C<>B    ALL     ; old A value in C
F054 10E                A=C     ALL   ; and back in A
F055 33C                RCR     1
F056 102                A=C     @R      ;old a11 into a10 (or a4 into a3)
F057 37C                RCR     12
F058 3DC                R=R+1
F059 102    [GETR]      A=C     @R      ; old a10 into a11 (or a3 into a4)
F05A 3E0                RTN
; ******************************
; (LN) exchange right
; ******************************
F05B 01C    [XRIGHT]    R=      3
F05C 3BB                JNC     [XCOMM] ;-9    F053
; ******************************
; (SQR) exchange ends
; ******************************
F05D 0EE    [XENDS]     C<>B    ALL     ; old A value in C
F05E 10E                A=C     ALL     ; and back in A
F05F 17C                RCR     6
F060 19C                R=      11
F061 102                A=C     @R      ; old a3 into a11
F062 23C                RCR     2
F063 01C    [GET3]      R=      3
F064 3AB                JNC     [GETR]  ;-11   F059 ; old a11 into a4
; ******************************
; (1/X) rotate left
; ******************************
F065 0EE    [RLEFT]     C<>B    ALL     ; old A value in C
F066 10E                A=C     ALL     ; and back in A
F067 3FA                LSHFA   M       ; shift mantissa, but one digit is
lost!
F068 13C                RCR     8       ; put the old first digit in 3
F069 3D3                JNC     [GET3]  ;-6    F063 ; and get the lost
digit
; ******************************
; (LOG) rotate right
; ******************************
F06A 0EE    [RRIGHT]    C<>B    ALL     ; old A value in C
F06B 10E                A=C     ALL     ; and back in A
F06C 39A                RSHFA   M       ; shift mantissa, but one digit
lost!
F06D 17C                RCR     6       ; old last digit in 11
F06E 19C                R=      11
F06F 353                JNC     [GETR]  ;-22   F059 ; and get lost digit
```

"Le Compte est Bon" for the HP-41

Jean-Marc Baillard-http://hp41programs.yolasite.com/lceb.php

Overview

"Le compte est bon" is a popular French TV game: a set of 6 numbers (n1 , n2 , n3 , n4 , n5 , n6) is chosen at random amongst the following 24 integers:

```
1 -  1 -  2 -  2 -  3 -  3
4 -  4 -  5 -  5 -  6 -  6
7 -  7 -  8 -  8 -  9 -  9
10 - 10 - 25 - 50 - 75 - 100
```

for instance the set including numbers: 1 - 9 - 8 - 4 - 3 - 100

Then you have to obtain another random number N between 100 and 999 inclusive, say N = 629, using the 6 numbers above (or fewer) and using the 4 basic operations: addition, subtraction, multiplication, division.

For example, one solution of the above problem is:

100 - 1 = 99
99 / 3 = 33
33 + 4 = 37
9 + 8 = 17
37 * 17 = 629

A solution has 5 operations at most, and the same number from the set cannot be used multiple times. More exactly, you can use "ni" twice or less if there are 2 "ni"s, and you can only use "ni" once (or less) if there is just one (or none) "ni".

Example1: 3 - 7 - 7 - 50 - 1 - 8 // 947

3, STO 01, 7, STO 02, STO 03, 50, STO 04, 1, STO 05, 8, STO 06, 947, STO 07

XEQ "LCEB" >>>> "50+8=58" Execution time = 15 s
R/S "58*7=406"
R/S "406*7=2842"
R/S "2842-1=2841"
R/S "2841/3=947"

Example2: 4 - 7 - 50 - 1 - 4 - 100 // 903

4 STO 01 ..... 903 STO 07

XEQ "LCEB" >>> "100/4=25" Execution time = 70s
R/S "25-7=18"
R/S "50*18=900"
R/S "900-1=899"
R/S "899+4=903"

Example3: 2 - 3 - 4 - 5 - 6 - 7 // 5041

1 STO 01 ..... 5041 STO 07

XEQ "LCEB" >>>> "Nb NOT FOUND' Execution time = 15m27s

Here, there is no solution at all since we cannot exceed 5040.

The following program can help you to find one or several solution(s) to this problem. Note the use od a MCODE routine to perform most of the auxiliary calculations – optimized for this purpose.

Data Registers: • R01 = n1 • R02 = n2 ..... • R06 = n6 • R07 = N
These 7 registers are to be initialized before executing "LCEB"
R00 & R08 thru R17: temp

Flags: F05-F06-F07

Subroutines: LCeB MCODE function.

Notes:

Since the M-Code routine uses synthetic register a, "LCEB" cannot be used as more than a first-level subroutine.

- If the solution involves 1 operation, flag F01 is set. Press XEQ 01 if you want to display it again.
- If the solution involves 2 operations, flag F02 is set. Press XEQ 02 to display it again.
- If the solution involves 5 operations, flag F05 is set. Press XEQ 05 to display it again.
- Flag F07 is set if the solution has been found in the second part of the search.

It may be wise to add the following lines at the beginning of the program:

7	LBL 14	ABS	LN	STO IND Z
E4	CLX	INT	X>Y?	DSE Z
ENTER^	RCL IND Z	X=0?	ACOS	GTO 14

to check that all the data in registers R01 thru R07 are valid.

Program Listing.

Note that the name of the FOCAL program is "TCIG", i.e. 'The Count is Good"

Note also that the program will prompt for the number entry automatically.

```
01*LBL "TCIG"
 02 1.007
 03*LBL 10
 04 "N"
 05 AIP
 06 "`=?"
 07 PROMPT
 08 STO IND Y
 09 RDN
 10 ISG X
 11 GTO 10
 12 CLX
 13 X<>F
 14 RCL 07
 15 STO \
 16 RCL 06
 17 STO [
 18 RCL 05
 19 SIGN
 20 RCL 01
 21 RCL 02
 22 RCL 03
 23 RCL 04
 24 LCeB
 25 X=0?
 26 "Nb NOT
FOUND"
 27 X=0?
 28 PROMPT
 29 STO 04
 30 RDN
 31 STO 03
 32 RDN
 33 STO 02
 34 X<>Y
 35 STO 01
 36 LASTX
 37 STO 05
 38 RCL [
 39 STO 06
 40 RCL ]
 41 STO 08
 42 RCL ^
 43 STO 09
 44 RCL _
 45 STO 10
 46 RCL a
 47 STO 00
 48 FS? 01
 49 GTO 01
 50 FS? 02
 51 GTO 02
 52 FS? 03
 53 GTO 03
 54 FS? 04
 55 GTO 04
 56*LBL 05
 57 RCL 00
 58 RCL 05
 59 RCL 06
 60 XEQ 00
 61*LBL 04
 62 RCL 10
 63 RCL 04
 64 RCL 00
 65 XEQ 00
 66*LBL 03
 67 RCL 09
 68 RCL 03
 69 RCL 10
 70 XEQ 00
 71*LBL 02
 72 FS? 07
 73 GTO 07
 74 RCL 08
 75 RCL 02
 76 RCL 09
 77 XEQ 00
 78*LBL 01
 79 RCL 07
 80 RCL 01
 81 RCL 08
 82 GTO 00
 83*LBL 07
 84 RCL 08
 85 RCL 01
 86 RCL 02
 87 XEQ 00
 88 RCL 07
 89 RCL 08
 90 RCL 09
 91*LBL 00
 92 FIX 0
 93 CF 29
 94 X<Y?
 95 X<>Y
 96 STO T
 97 X<>Y
 98 " "
 99 ARCL Y
100 +
101 X=Y?
102 "`+"
103 X<> T
104 LASTX
105 -
106 X=Y?
107 "`-"
108 X<> T
109 LASTX
110 ST/ T
111 *
112 X=Y?
113 "`*"
114 X<> T
115 X=Y?
116 "`/"
117 ARCL L
118 "`="
119 ARCL Y
120 FIX 4
121 SF 29
122 PROMPT
123 END
```

```
Header A817   082   "B"
Header A818   065   "e"          Le Compteest Bon
Header A819   003   "C"
Header A81A   00C   "L"
LCeB  A81B    2A0   SETDEC      1st. word at addr F08C
      A81C    130   LDI S&X
      A81D    006   006
      A81E    070   N=C ALL
      A81F    270   RAMSLCT
      A820    375   PORT DEP:    to shift the digits in the right
      A821    03C   XQ           format -  part of the mantissa field
      A822    284   ->AA84       [ADR_F292]
      A823    2F0   WRTDATA
      A824    0B0   C=N ALL
      A825    266   C=C-1 S&X
      A826    3C3   JNC -08
      A827    04E   C=0 ALL
      A828    01C   PT=3
```

```
     A829  090  LD@PT- 3
     A82A  070  N=C ALL
     A82B  2DC  PT=13
     A82C  150  LD@PT- 5
     A82D  110  LD@PT- 4
     A82E  0D0  LD@PT- 3
     A82F  130  LDI S&X
     A830  006  006
     A831  158  M=C ALL
F0A3 A832  1B8  READ 6(N)      LBL01
     A833  10E  A=C ALL
     A834  0B0  C=N ALL
     A835  0EE  B<>C ALL
     A836  04E  C=0 ALL
     A837  270  RAMSLCT
     A838  038  READATA
     A839  304  CLRF 1
     A83A  204  CLRF 2
     A83B  004  CLRF 3
     A83C  31A  ?A<C M
     A83D  017  JC  +02
     A83E  0BA  A<>C M
     A83F  33A  ?A<B M
     A840  09F  JC  +19d
     A841  0EE  C<>B ALL       parameter passing
     A842  375  PORT DEP:      Quotient-remainder sub
     A843  03C  XQ
     A844  2B3  ->AAB3         [ADR_F2BB]
     A845  35A  ?A#0 M
     A846  1D3  JNC +58d       [LBL_02]
     A847  308  SETF 1
     A848  04E  C=0 ALL
     A849  270  RAMSLCT
     A84A  038  READATA
     A84B  10E  A=C ALL
     A84C  1B8  READ 6(N)
     A84D  0EE  C<>B ALL       parameter passing
     A84E  375  PORT DEP:      Multiplication Subroutine
     A84F  03C  XQ
     A850  29E  ->AA9E         [ADR_F2A8]
     A851  17B  JNC +47d       [LBL_02]
     A852  303  JNC -32d
     A853  208  SETF 2
     A854  04E  C=0 ALL
     A855  270  RAMSLCT
     A856  038  READATA
     A857  10E  A=C ALL
     A858  1B8  READ 6(N)
     A859  21A  C=A+C M
     A85A  133  JNC +38d       [LBL_02]
     A85B  008  SETF 3
     A85C  04E  C=0 ALL
```

```
        A85D  270  RAMSLCT
        A85E  038  READATA
        A85F  10E  A=C ALL
        A860  1B8  READ 6(N)
        A861  31A  ?A<C M
        A862  013  JNC +02
        A863  0BA  A<>C M
        A864  25A  C=A-C M
        A865  0DB  JNC +27d      [LBL_02]
        A866  04E  C=0 ALL
        A867  270  RAMSLCT
        A868  038  READATA
        A869  10E  A=C ALL
        A86A  1D8  C<>M ALL
        A86B  266  C=C-1 S&X
        A86C  270  RAMSLCT
        A86D  1D8  C<>M ALL
        A86E  038  READATA
        A86F  0AE  A<>C ALL
        A870  2F0  WRTDATA
        A871  0AE  A<>C ALL
        A872  028  WRIT 0(T)
        A873  198  C=M ALL
        A874  2E6  ?C#0 S&X
        A875  2EF  JC  -35d      [LBL_01]
        A876  365  PORT DEP:     GTO 2nd part of the routine
        A877  03C  GO            if no solution has been found yet
        A878  1C5  ->A9C5        [ADR_F1F3]
        A879  00C  ?FSET 3
        A87A  367  JC  -20d
        A87B  20C  ?FSET 2
        A87C  2FF  JC  -33d
        A87D  30C  ?FSET 1
        A87E  2AF  JC  -43d
        A87F  243  JNC -56d
LBL 02  A880  1E8  WRIT 7(O)     Since we can only use 4 subroutine-levels,
REDO7   A881  1F8  READ 7(O)     CPU-flags are used to avoid  ?NCXQ LBL 02
        A882  10E  A=C ALL
        A883  0B0  C=N ALL
        A884  0EE  B<>C ALL
        A885  078  READ 1(Z)
        A886  37A  ?A#C M
        A887  037  JC  +06
        A888  365  PORT DEP:     GTO end1
        A889  03C  GO
        A88A  194  ->A994        [ADR_F1C9]
        A88B  3B3  JNC -10d
        A88C  36B  JNC -19d
        A88D  31A  ?A<C M
        A88E  017  JC  + 02
        A88F  0BA  A<>C M
        A890  33A  ?A<B M
```

```
A891  05F   JC  +11d
A892  0EE   C<>B ALL      parameter passing
A893  375   PORT DEP:     Quotient-remainder sub
A894  03C   XQ
A895  2B3   ->AAB3        [ADR_F2BB]
A896  35A   ?A#0 M
A897  02F   JC  +05
A898  228   WRIT 8(P)     parameter passing
A899  375   PORT DEP:     LBL 03
A89A  03C   XQ
A89B  0C9   ->A8C9        [ADR_F125]
A89C  1F8   READ 7(O)
A89D  10E   A=C ALL
A89E  078   READ 1(Z)
A89F  21A   C=A+C M
A8A0  02F   JC  +05
A8A1  228   WRIT 8(P)     parameter passing
A8A2  375   PORT DEP:     LBL 03
A8A3  03C   XQ
A8A4  0C9   ->A8C9        [ADR_F125]
A8A5  1F8   READ 7(O)
A8A6  10E   A=C ALL
A8A7  078   READ 1(Z)
A8A8  31A   ?A<C M
A8A9  013   JNC +02
A8AA  0BA   A<>C M
A8AB  25A   C=C-A M
A8AC  02F   JC  +05
A8AD  228   WRIT 8(P)     parameter passing
A8AE  375   PORT DEP:     LBL 03
A8AF  03C   XQ
A8B0  0C9   ->A8C9        [ADR_F125]
A8B1  078   READ 1(Z)
A8B2  10E   A=C ALL
A8B3  0B8   READ 2(Y)
A8B4  0AE   A<>C ALL
A8B5  0A8   WRIT 2(Y)
A8B6  0F8   READ 3(X)
A8B7  0AE   A<>C ALL
A8B8  0E8   WRIT 3(X)
A8B9  138   READ 4(L)
A8BA  0AE   A<>C ALL
A8BB  128   WRIT 4(L)
A8BC  178   READ 5(M)
A8BD  068   WRIT 1(Z)
A8BE  0AE   A<>C ALL
A8BF  168   WRIT 5(M)
A8C0  198   C=M ALL
A8C1  27E   C=C-1 MS
A8C2  158   M=C ALL
A8C3  2FE   ?C#0 MS
A8C4  23F   JC  -57d
```

```
        A8C5  2DC   PT=13
        A8C6  150   LD@PT- 5
        A8C7  158   M=C ALL
        A8C8  223   JNC -60d
 F125   A8C9  2A0   SETDEC      LBL 03
REDO8   A8CA  238   READ 8(P)   get parameter
        A8CB  10E   A=C ALL
        A8CC  0B0   C=N ALL
        A8CD  0EE   B<>C ALL
        A8CE  0B8   READ 2(Y)
        A8CF  37A   ?A#C M
        A8D0  027   JC  +04
        A8D1  365   PORT DEP:   END 02
        A8D2  03C   GO
        A8D3  199   ->A999      [ADR_F1CD]
        A8D4  31A   ?A<C M
        A8D5  017   JC  +02
        A8D6  0BA   A<>C M
        A8D7  33A   ?A<B M
        A8D8  05F   JC  +11d
        A8D9  0EE   C<>B ALL    parameter passing
        A8DA  375   PORT DEP:   Quotient-remainder sub
        A8DB  03C   XQ
        A8DC  2B3   ->AAB3      [ADR_F2BB]
        A8DD  35A   ?A#0 M
        A8DE  02F   JC  +05
        A8DF  268   WRIT 9(Q)   parameter passing
        A8E0  375   PORT DEP:   LBL  04
        A8E1  03C   XQ
        A8E2  110   ->A910      [ADR_F15C]
        A8E3  238   READ 8(P)
        A8E4  10E   A=C ALL
        A8E5  0B8   READ 2(Y)
        A8E6  21A   C=A+C M
        A8E7  02F   JC  +05
        A8E8  268   WRIT 9(Q)   parameter passing
        A8E9  375   PORT DEP:   LBL  04
        A8EA  03C   XQ
        A8EB  110   ->A910      [ADR_F15C]
        A8EC  238   READ 8(P)
        A8ED  10E   A=C ALL
        A8EE  0B8   READ 2(Y)
        A8EF  31A   ?A<C M
        A8F0  013   JNC +02
        A8F1  0BA   A<>C M
        A8F2  25A   C=A-C M
        A8F3  02F   JC  +05
        A8F4  268   WRIT 9(Q)   parameter passing
        A8F5  375   PORT DEP:   LBL  04
        A8F6  03C   XQ
        A8F7  110   ->A910      [ADR_F15C]
        A8F8  0B8   READ 2(Y)
```

```
         A8F9  10E  A=C ALL
         A8FA  0F8  READ 3(X)
         A8FB  0AE  A<>C ALL
         A8FC  0E8  WRIT 3(X)
         A8FD  138  READ 4(L)
         A8FE  0AE  A<>C ALL
         A8FF  128  WRIT 4(L)
         A900  178  READ 5(M)
         A901  0A8  WRIT 2(Y)
         A902  0AE  A<>C ALL
         A903  168  WRIT 5(M)
         A904  198  C=M ALL
         A905  35C  PT=12
         A906  262  C=C-1@PT
         A907  158  M=C ALL
         A908  2E2  ?C#0@PT
         A909  20F  JC- 63d
         A90A  110  LD@PT- 4
         A90B  158  M=C ALL
         A90C  3CC  ?KEY
         A90D  3A0  ?NC RTN
         A90E  020  XQ>GO
         A90F  3E0  RTN
F15C     A910  2A0  SETDEC       LBL04
REDO9    A911  278  READ 9(Q)    get parameter
         A912  10E  A=C ALL
         A913  0B0  C=N ALL
         A914  0EE  B<>C ALL
         A915  0F8  READ 3(X)
         A916  37A  ?A#C M
         A917  02F  JC  +05
         A918  365  PORT DEP:    end 03
         A919  03C  GO
         A91A  19E  ->A99E       [ADR_F1D1]
         A91B  3B3  JNC -10d
         A91C  31A  ?A<C M
         A91D  017  JC  +02
         A91E  0BA  A<>C M
         A91F  33A  ?A<B M
         A920  0B7  JC  +22d
         A921  0EE  C<>B ALL     parameter passing
         A922  375  PORT DEP:    Quotient-remainder sub
         A923  03C  XQ
         A924  2B3  ->AAB3       [ADR_F2BB]
         A925  35A  ?A#0 M
         A926  02F  JC  +05
         A927  2E8  WRIT 11(a)   parameter passing
         A928  375  PORT DEP:    LBL 05
         A929  03C  XQ
         A92A  15D  ->A95D       [ADR_F197]
         A92B  278  READ 9(Q)
         A92C  10E  A=C ALL
```

```
        A92D  0F8   READ 3(X)
        A92E  0EE   C<>B ALL      parameter passing
        A92F  375   PORT DEP:     Multiplication Subroutine
        A930  03C   XQ
        A931  29E   ->AA9E        [ADR_F2A8]
        A932  2E8   WRIT 11(a)    parameter passing
        A933  375   PORT DEP:     LBL 05
        A934  03C   XQ
        A935  15D   ->A95D        [ADR_F197]
        A936  278   READ 9(Q)
        A937  10E   A=C ALL
        A938  0F8   READ 3(X)
        A939  21A   C=A+C M
        A93A  02F   JC  +05
        A93B  2E8   WRIT 11(a)    parameter passing
        A93C  375   PORT DEP:     LBL 05
        A93D  03C   XQ
        A93E  15D   ->A95D        [ADR_F197]
        A93F  278   READ 9(Q)
        A940  10E   A=C ALL
        A941  0F8   READ 3(X)
        A942  31A   ?A<C M
        A943  013   JNC +02
        A944  0BA   A<>C M
        A945  25A   C=A-C M
        A946  02F   JC  +05
        A947  2E8   WRIT 11(a)    parameter passing
        A948  375   PORT DEP:     LBL 05
        A949  03C   XQ
        A94A  15D   ->A95D [      ADR_F197]
        A94B  0F8   READ 3(X)
        A94C  10E   A=C ALL
        A94D  138   READ 4(L)
        A94E  0AE   A<>C ALL
        A94F  128   WRIT 4(L)
        A950  178   READ 5(M
        A951  0E8   WRIT 3(X)
        A952  0AE   A<>C ALL
        A953  168   WRIT 5(M)
        A954  198   C=M ALL
        A955  19C   PT=11
        A956  262   C=C-1@PT
        A957  158   M=C ALL
        A958  2E2   ?C#0@PT
        A959  217   JC  -62d
        A95A  0D0   LD@PT- 3
        A95B  158   M=C ALL
        A95C  3E0   RTN
F197    A95D  2A0   SETDEC        LBL 05
        A95E  2F8   READ 11(a)    get parameter
        A95F  10E   A=C ALL
        A960  178   READ 5(M)
```

```
        A961  37A   ?A#C M
        A962  01B   JNC +03       [end4]
        A963  138   READ 4(L)
        A964  37A   ?A#C M
        A965  1EB   JNC +61d      [end4]
        A966  31A   ?A<C M
        A967  013   JNC +02
        A968  0BA   A<>C M
        A969  1DA   A=A-C M
        A96A  178   READ 5(M
        A96B  37A   ?A#C M
        A96C  1D3   JNC +58d      [end5]
        A96D  2F8   READ 11(a)
        A96E  10E   A=C ALL
        A96F  138   READ 4(L)
        A970  15A   A=A+C M
        A971  178   READ 5(M
        A972  37A   ?A#C M
        A973  19B   JNC +51d      [end5]
        A974  2F8   READ 11(a)
        A975  10E   A=C ALL
        A976  0B0   C=N ALL
        A977  0EE   B<>C ALL
        A978  138   READ 4(L)
        A979  31A   ?A<C M
        A97A  017   JC  +02
        A97B  0BA   A<>C M
        A97C  33A   ?A<B M
        A97D  05F   JC  +11d
        A97E  0EE   C<>B ALL      parameter passing
        A97F  375   PORT DEP:     Quotient-remainder sub
        A980  03C   XQ
        A981  2B3   ->AAB3        [ADR_F2BB]
        A982  35A   ?A#0 M
        A983  02F   JC  +05
        A984  10E   A=C ALL
        A985  178   READ 5(M
        A986  37A   ?A#C M
        A987  0FB   JNC +31d      [end5]
        A988  2F8   READ 11(a)
        A989  10E   A=C ALL
        A98A  138   READ 4(L)
        A98B  0EE   C<>B ALL      parameter passing
        A98C  375   PORT DEP:     Multiplication Subroutine
        A98D  03C   XQ
        A98E  29E   ->AA9E        [ADR_F2A8]
        A98F  10E   A=C ALL
        A990  178   READ 5(M)
        A991  37A   ?A#C M
        A992  360   ?C RTN
        A993  09B   JNC +19d      [end5]
F1C9    A994  2A0   SETDEC        end1
```

```
        A995  04E   C=0 ALL
        A996  2DC   PT=13
        A997  110   LD@PT- 4
        A998  0A3   JNC +20d      [OK]
F1CD    A999  2A0   SETDEC       end2
        A99A  04E   C=0 ALL
        A99B  2DC   PT=13
        A99C  090   LD@PT- 2
        A99D  073   JNC +14d      [XQGO1]
F1D1    A99E  2A0   SETDEC       end3
        A99F  04E   C=0 ALL
        A9A0  23E   C=C+1 MS
        A9A1  04B   JNC +09       [XQGO2]
F1D4    A9A2  04E   C=0 ALL       end4 -
        A9A3  35C   PT=12
        A9A4  210   LD@PT- 8
        A9A5  023   JNC +04       [XQGO3]
F1D8    A9A6  04E   C=0 ALL       end5
        A9A7  35C   PT=12
        A9A8  110   LD@PT- 4
        A9A9  020   XQ->GO
        A9AA  020   XQ->GO
        A9AB  020   XQ->GO
        A9AC  10E   A=C ALL       free at last…
        A9AD  3B8   READ 14(d)
        A9AE  20E   C=A+C ALL
        A9AF  3A8   WRIT 14(d)
        A9B0  130   LDI S&X
        A9B1  009   009
        A9B2  070   N=C ALL
        A9B3  270   RAMSLCT
        A9B4  038   READATA
        A9B5  10E   A=C ALL       parameter passing
        A9B6  375   PORT DEP:     reformat
        A9B7  03C   XQ
        A9B8  28F   ->AA8F        [ADR_F29B]
        A9B9  2F0   WRTDATA
        A9BA  0B0   C=N ALL
        A9BB  266   C=C-1 S&X
        A9BC  3B3   JNC -10d
        A9BD  2F8   READ 14(d)
        A9BE  10E   A=C ALL       parameter passing
        A9BF  375   PORT DEP:     reformat
        A9C0  03C   XQ
        A9C1  28F   ->AA8F        [ADR_F29B]
        A9C2  2E8   WRIT 14(d)
        A9C3  3C1   ?NC GO        4 subroutine-levels are used,
        A9C4  002   ->00F0        [NFRPU]
F1F3    A9C5  2A0   SETDEC       2nd part of the search
        A9C6  198   C=M ALL
        A9C7  01C   PT=3
        A9C8  190   LD@PT- 6
```

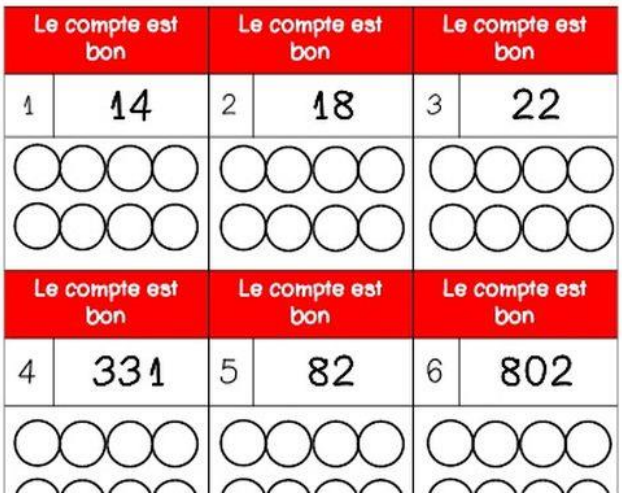
```
         A9C9  130  LDI S&X
         A9CA  006  006
         A9CB  158  M=C ALL
         A9CC  04E  C=0 ALL
         A9CD  35C  PT=12
         A9CE  050  LD@PT- 1
         A9CF  10E  A=C ALL
         A9D0  3B8  READ 14(d)
         A9D1  20E  C=A+C ALL
         A9D2  3A8  WRIT 14(d)
F200     A9D3  2A0  SETDEC      LBL 12
         A9D4  04E  C=0 ALL
         A9D5  270  RAMSLCT
         A9D6  038  READATA
         A9D7  10E  A=C ALL
         A9D8  078  READ 1(Z)
         A9D9  21A  C=A+C M
         A9DA  1E8  WRIT 7(O)
         A9DB  10E  A=C ALL
         A9DC  1B8  READ 6(N)
         A9DD  31A  ?A<C M
         A9DE  017  JC  +02
         A9DF  0BA  A<>C M
         A9E0  0EE  C<>B ALL    parameter passing
         A9E1  375  PORT DEP:   Quotient-remainder sub
         A9E2  03C  XQ
         A9E3  2B3  ->AAB3      [ADR_F2BB]
         A9E4  35A  ?A#0 M
         A9E5  02F  JC  +05
         A9E6  228  WRIT 8(P)   parameter passing
         A9E7  375  PORT DEP:   LBL 03
         A9E8  03C  XQ
         A9E9  0C9  ->A8C9      [ADR_F125]
         A9EA  04E  C=0  ALL
         A9EB  270  RAMSLCT
         A9EC  038  READATA
         A9ED  10E  A=C ALL
         A9EE  078  READ 1(Z)
         A9EF  37A  ?A#C M
         A9F0  0CB  JNC +25d
         A9F1  31A  ?A<C M
         A9F2  013  JNC +02
         A9F3  0BA  A<>C M
         A9F4  25A  C=A-C M
         A9F5  1E8  WRIT 7(O)
         A9F6  10E  A=C ALL
         A9F7  0B0  C=N ALL
         A9F8  0EE  B<>C ALL
         A9F9  1B8  READ 6(N)
         A9FA  31A  ?A<C M
         A9FB  017  JC  +02
         A9FC  0BA  A<>C M
```

```
A9FD  33A  ?A<B M
A9FE  05F  JC  +11d
A9FF  0EE  C<>B ALL      parameter passing
AA00  375  PORT DEP:     Quotient-remainder sub
AA01  03C  XQ
AA02  2B3  ->AAB3        [ADR_F2BB]
AA03  35A  ?A#0 M
AA04  02F  JC  +05
AA05  228  WRIT 8(P)     parameter passing
AA06  375  PORT DEP:     LBL 03
AA07  03C  XQ
AA08  0C9  ->A8C9        [ADR_F125]
AA09  04E  C=0  ALL
AA0A  270  RAMSLCT
AA0B  038  READATA
AA0C  10E  A=C ALL
AA0D  0B0  C=N ALL
AA0E  0EE  B<>C ALL
AA0F  078  READ 1(Z)
AA10  31A  ?A<C M
AA11  017  JC  +02
AA12  0BA  A<>C M
AA13  33A  ?A<B M
AA14  1EF  JC  +61d
AA15  0EE  C<>B ALL      parameter passing
AA16  375  PORT DEP:     Multiplication Subroutine
AA17  03C  XQ
AA18  29E  ->AA9E        [ADR_F2A8]
AA19  1E8  WRIT 7(O)
AA1A  10E  A=C ALL
AA1B  1B8  READ 6(N)
AA1C  31A  ?A<C M
AA1D  013  JNC +02
AA1E  0BA  A<>C M
AA1F  25A  C=A-C M
AA20  02F  JC  +05
AA21  228  WRIT 8(P)     parameter passing
AA22  375  PORT DEP:     LBL 03
AA23  03C  XQ
AA24  0C9  ->A8C9        [ADR_F125]
AA25  1F8  READ 7(O)
AA26  10E  A=C ALL
AA27  1B8  READ 6(N)
AA28  21A  C=A+C M
AA29  02F  JC  +05
AA2A  228  WRIT 8(P)     parameter passing
AA2B  375  PORT DEP:     LBL 03
AA2C  03C  XQ
AA2D  0C9  ->A8C9        [ADR_F125]
AA2E  04E  C=0  ALL
AA2F  270  RAMSLCT
AA30  038  READATA
```

```
AA31  10E  A=C ALL
AA32  078  READ 1(Z)
AA33  31A  ?A<C M
AA34  017  JC  +02
AA35  0BA  A<>C M
AA36  0EE  C<>B ALL       parameter passing
AA37  375  PORT DEP:      Quotient-remainder sub
AA38  03C  XQ
AA39  2B3  ->AAB3         [ADR_F2BB]
AA3A  35A  ?A#0 M
AA3B  0B7  JC  +22d
AA3C  1E8  WRIT 7(O)
AA3D  10E  A=C ALL
AA3E  1B8  READ 6(N)
AA3F  21A  C=A+C M
AA40  02F  JC  +05
AA41  228  WRIT 8(P)      parameter passing
AA42  375  PORT DEP:      LBL 03
AA43  03C  XQ
AA44  0C9  ->A8C9         [ADR_F125]
AA45  1B8  READ 6(N)
AA46  10E  A=C ALL
AA47  1F8  READ 7(O)
AA48  31A  ?A<C M
AA49  013  JNC +02
AA4A  0BA  A<>C M
AA4B  25A  C=A-C M
AA4C  02F  JC  +05
AA4D  228  WRIT 8(P)      parameter passing
AA4E  375  PORT DEP:      LBL 03
AA4F  03C  XQ
AA50  0C9  ->A8C9         [ADR_F125]
AA51  078  READ 1(Z)
AA52  10E  A=C ALL
AA53  198  C=M ALL
AA54  01C  PT=3
AA55  262  C=C-1@PT
AA56  158  M=C ALL
AA57  03C  RCR 3
AA58  270  RAMSLCT
AA59  0EE  B<>C ALL
AA5A  038  READATA
AA5B  0AE  A<>C ALL
AA5C  2F0  WRTDATA
AA5D  0AE  A<>C ALL
AA5E  068  WRIT 1(Z)
AA5F  0EE  B<>C ALL
AA60  266  C=C-1 S&X
AA61  2E6  ?C#0 S&X
AA62  023  JNC  +04
AA63  365  PORT DEP:      LBL 12
AA64  03C  GO
```

```
      AA65  1D3   ->A9D3       [ADR_F200]
      AA66  04E   C=0 ALL
      AA67  270   RAMSLCT
      AA68  038   READATA
      AA69  10E   A=C ALL
      AA6A  198   C=M ALL
      AA6B  266   C=C-1 S&X
      AA6C  158   M=C ALL
      AA6D  270   RAMSLCT
      AA6E  038   READATA
      AA6F  0AE   A<>C ALL
      AA70  2F0   WRTDATA
      AA71  0AE   A<>C ALL
      AA72  028   WRIT 0(T)
      AA73  198   C=M ALL
      AA74  10E   A=C ALL
      AA75  1BC   RCR 11
      AA76  01C   PT=3
      AA77  102   A=C@PT
      AA78  0AE   A<>C ALL
      AA79  158   M=C ALL
      AA7A  266   C=C-1 S&X
      AA7B  2E6   ?C#0 S&X
      AA7C  023   JNC  +04
      AA7D  365   PORT DEP:   lbl 12
      AA7E  03C   GO
      AA7F  1D3   ->A9D3      [ADR_F200]
      AA80  04E   C=0 ALL
      AA81  0E8   WRIT 3(X)
      AA82  3C1   ?NC GO      4 subroutine-levels are used,
      AA83  002   ->00F0      [NFRPU]
F292  AA84  2A0   SETDEC      To shift the integers in the right part of the mantissa field
      AA85  038   READATA     get parameter
      AA86  006   A=0 S&X
      AA87  39C   PT=0
      AA88  1A2   A=A-1@PT
      AA89  366   ?A#C S&X
      AA8A  01B   JNC +03
      AA8B  3DA   RSHFC M
      AA8C  3E3   JNC -04
      AA8D  046   C=0 S&X
      AA8E  3E0   RTN
F29B  AA8F  2A0   SETDEC      The reverse operation ( reformating )
      AA90  0AE   A<>C ALL    get parameter
      AA91  2FA   ?C#0 M
      AA92  3A0   ?NC RTN
      AA93  130   LDI S&X
      AA94  009   009
      AA95  35C   PT=12
      AA96  11A   A=C M
      AA97  342   ?A#0@PT
      AA98  027   JC  +04
```

```
        AA99  266  C=C-1 S&X
        AA9A  3FA  LSHFA M
        AA9B  3E3  JNC -04
        AA9C  0BA  A<>C M
        AA9D  3E0  RTN
F2A8    AA9E  2A0  SETDEC      Multiplication routine
        AA9F  0CE  C=B ALL     get parameter
        AAA0  31A  ?A<C M
        AAA1  013  JNC +02
        AAA2  0AE  A<>C ALL
        AAA3  08E  B=A ALL
        AAA4  00E  A=0 ALL
        AAA5  01C  PT=3
        AAA6  2E2  ?C#0@PT
        AAA7  023  JNC +04
        AAA8  13A  A=A+B M
        AAA9  262  C=C-1@PT
        AAAA  3E3  JNC -04
        AAAB  3DC  PT=PT+1
        AAAC  07A  A<>B M
        AAAD  3FA  LSHFA M
        AAAE  07A  A<>B M
        AAAF  154  ?PT=6
        AAB0  3B3  JNC -10d
        AAB1  0AE  A<>C ALL
        AAB2  3E0  RTN
F2BB    AAB3  2A0  SETDEC      Quotient-Remainder  Routine
        AAB4  0CE  C=B ALL     get parameter
        AAB5  23A  C=C+1 M
        AAB6  0EE  B<>C ALL
        AAB7  04E  C=0 ALL
        AAB8  21C  PT=2
        AAB9  3FA  LSHFA M
        AABA  3DC  PT=PT+1
        AABB  33A  ?A<B M
        AABC  3EF  JC  -03
        AABD  39A  RSHFA M
        AABE  07A  A<>B M
        AABF  1BA  A=A-1 M
        AAC0  222  C=C+1@PT
        AAC1  19A  A=A-B M
        AAC2  33A  ?A<B M
        AAC3  3EB  JNC -03
        AAC4  3BA  RSHFB M
        AAC5  3D4  PT=PT-1
        AAC6  214  ?PT=2
        AAC7  3DB  JNC -05
  F2CE  AAC8  3E0  RTN
```



Master Mind.(MCODE version)

JM Baillard – http://hp41programs.yolasite.com/mastermind.php

This version allows codes of different length, from 1 to 10 numbers. You determine the length when you enter the first guess, which length is taken as the reference. The program displays "M-N" after your guess to mean that M digits are in right positions and N digits are in wrong positions. (using "*" & "/" would be difficult to read for more than 6-digit numbers).

The hidden number is computed after your first guess but - of course - independently, except for the number of its digits.After your first guess, all your guesses must have the same number of digits: this program does not check!

The MCODE routine MN? Speeds-up the execution and facilities the gameplay.

Example: 1 STO 00 , and suppose you want to play with 7-digit numbers

1111111 XEQ "MMD2" >>>> "1111111: 1-0" there is one "1"

1222222 R/S "1222222: 0-1"
the "1" is in wrong position and there is no "2"

3133333 R/S "3133333: 2-1"
2 digits are in right positions, 1 digit is in a wrong position. There are two "3"s

3413444 R/S "3413444: 2-2"
2 digits are in right positions, 2 digits are in a wrong position there is one "4"

3451355 R/S "3451355: 1-3"
1 digit is in right position, 3 digits are in a wrong position there is no "5"

3314666 R/S "3314666: 1-4"
1 digit is in right position, 4 digits are in a wrong position there is one "6"

4613377 R/S "4613377: 0-5"
4 6 1 3 3 are in a wrong location. There is no "7"

3866431 R/S "3866431: 2-3"
2 digits are in a right position, 3 in a wrong position. There is no "8"

3936149 R/S "3936149: 4-3"
4 digits are in a right position, 3 in a wrong position. There are two "9"s

3936914 R/S "3936914 / / 10"
you've found the hidden number in 10 guesses.

FOCAL Program :

```
01*LBL "MMIND"
02 4
03 XROM "INIT"
04 RCL Z
05 STO 00
06 CLA
07 ARCL X
08 ALENG
09 STO 02
10 STO 03
11 CLX
12*LBL 00
13  E1
14 *
15 RNG
16  E1
17 *
18 INT
19 +
20 DSE 02
21 GTO 00
22 STO 01
23 RCL 00
24*LBL 01
25 CLA
26 ARCL X
27 ISG 02
28 CLX
29 RCL 01
30 MN?
31 RCL 03
32 X=Y?
33 GTO 02
34 "`: "
35 ARCL Y
36 "`-"
37 ARCL Z
38 PROMPT
39 GTO 01
40*LBL 02
41 "`//"
42 ARCL 02
43 FIX 4
44 SF 29
45 AVIEW
46 END
```

MCODE Code:

```
Header AF7F  0BF  "?"          Mastermind
Header AF80  00E  "N"          auxiliary fnc
Header AF81  00D  "M"
MN?    AF82  2A0  SETDEC       JM Baillard
       AF83  0F8  READ  3(X)
       AF84  046  C=0 S&X
       AF85  10E  A=C ALL
       AF86  0B8  READ 2(Y)
       AF87  046  C=0 S&X
       AF88  02E  B=0 ALL
       AF89  35C  PT=12
       AF8A  362  ?A#C @PT
       AF8B  057  JC +10d
       AF8C  310  LD@PT- C
       AF8D  3DC  PT=PT+1
       AF8E  0BA  A<>C M
       AF8F  350  LD@PT- D
       AF90  3DC  PT=PT+1
       AF91  0BA  A<>C M
       AF92  0FA  C<>B M
       AF93  23A  C=C+1 M
       AF94  0FA  C<>B M
       AF95  3D4  PT=PT-1
       AF96  2E2  ?C#0 @PT
       AF97  39F  JC -13d
       AF98  0EE  C<>B ALL
       AF99  0BC  RCR 5
       AF9A  2DC  PT=13
       AF9B  2E2  ?C#0 @PT
       AF9C  01B  JNC +03
```

```
AF9D  33C  RCR 1
AF9E  226  C=C+1 S&X
AF9F  0E8  WRIT 3(X)      #of well-placed digits
AFA0  04E  C=0 ALL
AFA1  0EE  C<>B ALL
AFA2  130  LDI S&X
AFA3  013  CON: 19
AFA4  3D4  PT=PT-1
AFA5  2E2  ?C#0 @PT
AFA6  04F  JC +09
AFA7  0EE  C<>B ALL
AFA8  0BC  RCR 5
AFA9  2FE  ?C#0? MS
AFAA  01B  JNC +03
AFAB  33C  RCR 1
AFAC  226  C=C+1 S&X
AFAD  0A8  WRIT 2(Y)      #digits in wrong position
AFAE  3E0  RTN
AFAF  362  ?A#C @PT
AFB0  057  JC +0A
AFB1  310  LD@PT- C
AFB2  3DC  PT=PT+1
AFB3  0BA  A<>C M
AFB4  350  LD@PT- D
AFB5  3DC  PT=PT+1
AFB6  0BA  A<>C M
AFB7  0EE  C<>B ALL
AFB8  23A  C=C+1 M
AFB9  0EE  C<>B ALL
AFBA  0AE  A<>C ALL
AFBB  2FC  RCR 13
AFBC  0AE  A<>C ALL
AFBD  266  C=C-1 S&X
AFBE  327  JC -1C
AFBF  383  JNC -10
```

Random Number Generator Using the Time Module:

Header	AFC0	087	"G"	Random Number
Header	AFC1	00E	"N"	with Timer
Header	AFC2	012	"R"	
RNG	**AFC3**	**18C**	**?FSET 11**	Jean-Marc Baillard
	AFC4	3B5	?C XQ	Stack lift
	AFC5	051	->14ED [	R_SUB]
	AFC6	130	LDI S&X	
	AFC7	010	CON:	User memory must be deselected
	AFC8	270	RAM SLCT	by selecting non-existent RAM
	AFC9	130	LDI S&X	(at 010h)
	AFCA	0FB	CON :	then the Timer is selected
	AFCB	3F0	PRPH SLCT	
	AFCC	3E8	WRIT 15(e)	Set the A/B pointer to A
	AFCD	038	READATA	
	AFCE	1BC	RCR 11	Rotates C-register 11 digits right
	AFCF	046	C=0 S&X	Chp0 is selected again
	AFD0	270	RAM SLCT	
	AFD1	05E	C=0 MS	
	AFD2	130	LDI S&X	
	AFD3	041	041	
	AFD4	2A0	SETDEC	
	AFD5	10E	A=C ALL	
	AFD6	04E	C=0 ALL	
	AFD7	35C	PT=12	
	AFD8	1D0	LD@PT- 7	
	AFD9	210	LD@PT- 8	
	AFDA	110	LD@PT- 4	
	AFDB	050	LD@PT- 1	
	AFDC	090	LD@PT- 2	7,841298787
	AFDD	250	LD@PT- 9	
	AFDE	190	LD@PT- 6	
	AFDF	1D0	LD@PT- 7	
	AFE0	210	LD@PT- 8	
	AFE1	1D0	LD@PT- 7	
	AFE2	044	CLRF 4	
	AFE3	070	N=C ALL	
	AFE4	171	?NC XQ	C = A mod C
	AFE5	064	195C	
	AFE6	10E	A=C ALL	
	AFE7	0B0	C=N ALL	
	AFE8	261	?NCXQ	C = A/C
	AFE9	060	1898	
	AFEA	0E8	WRIT 3(X)	
	AFEB	3E0	RTN	

High Rollers. (MCODE version)

Ross Cooling – PPCCJ V14N2 p21 ; (February 1987)

After working hard at MCODE it's good to take a break . I liked playing the user language HP-41 version or High Rollers (PPCJ V6N7P47, that's right - way back in October l979) to help me relax It's based on an old TV game where you start off with the digits 1 to 9. You roll a pair of dice and try to remove a digit(s) adding up to your dice throw total. Anytime you roll a double you get an insurance marker to use when you can't remove totaling your throw (by entering a zero). The objective is to remove all 9 digits and you win !

The problem was that it took a few seconds between moves, which detracted from the enjoyment. Like most user language programs it also disturbed the stack, and some user registers. When I got into MCODE I decided I'd write an MCODE version. I started about a year ago and got most of it done in about a week, except for three things. Getting some of the displays to work properly required some extra reading and experimentation. Trying to find enough internal registers to retail all I needed to keep was the second problem. This just needed some slight rearranging and changes to my algorithm, and use of some of the status registers. The toughest part was getting the digits to remove reply without disturbing the previous display until necessary. For this I used some code in Ken Emery's HP-41 MCODE for Beginners in a routine called HXENTRY. Even with it I still couldn't get it to work properly, until just a short while ago when I got back into looking at it. It's still not perfect, but it's quite acceptable to me!

The program follows the user language version for the most part as far as the displays and logic goes, correcting some shortcomings. Of course it doesn't touch the stack or user registers, and it's about 20 times faster! It does use the Q register, P(13:8), and the "a"register. The routine is non-programmable so it's safe to clobber the subroutine stack in a, and I also zero out most of user register "b" so any values in "a" won't be used accidentally.

The program contains some comments, but what follows is the high-level version.

```
Display "HIGH ROLLERS" and pause
#WON = 0, #LOST = 0

[TOP]
        #INS = 0
        Set all digits "on"

[NEXT]
        Get pseudo-random #1 and store it
        Get pseudo-random #2 and store it
        If die#1 = die#1
                #INS = #INS + 1

[DISPLAY]
        Send die#1 to display and a comma
        Send die#2 to display and a comma
        If #INS = 0
                Send a space to display
        Else
```

```
            Send #INS to display and a colon

[DIGITS]
        For each digit 1 to 9
            If digit "on"
                Send digit to display
            Else
                Send a space to display
        Show the display and wait for keypress
        Show a zero and an underscore in display
        Accept 0 to 9, ← , R/S, or ON
        If ON
            Quit and turn off
        If 0
            If #INS = 0
                Go to [LOSE]
            Else
                #INS = #INS – 1
                Go to [NEXT]
        Else
            If numbers not = die#1 + die#2
                Go to [DISPLAY]
            Else
                Set ptoper digits "off"
                If any digits already "off"
                    Go to [DISPLAY]
                If all digits "off"
                    Go to [WIN]
                Else
                    Go to [NEXT]

[WIN]
        #WON = #WON + 1
        Display "YOU WON" and pause

[SCORE]
        Display "YOU ARE", #WON, ":", #LOST
        pause
        display "CONTINUE? 1:NO"
        if keypress = 1
            exit
        else
            go to [TOP]

[LOSE]
        #LOST = #LOST + 1
        Display "YOU LOSE" and pause
        Go to [SCORE]
```

ROLLERS was written using an HP-41DX and the only possible dependency is the call to 5AB6 to get the time for use as a pseudo-random number. It has been published elsewhere, but I'll just show enough code necessary for ROLLERS (feel free to substitute your own if desired).

Registers used:
User P(13:8) – last pseudo-random number
User Q - answer of digit(s):
N (and User "a" temporarily for a copy)
N[0:2] nine bits for digits 1 to 9
N{3] four bits for #INS
N[4] three bits for die#1
N[5] three bits for die#2
N[6] four bits for #LOST
N[7] four bits for #WON

Due to display size once either #WON or #LOST would become 10, it will reset the values so they'll always be one decimal digit.

Due to the large size of this program, and the fact that it's MCODE, if anyone wants a ROM>REG image on cards, ad a fuller annotated listing, send $1.00 (Canadian in Canada, US elsewhere) and 4 (four) cards to me. I hope you enjoy this program, and if you have any comments or improvements (especially on receiving the answer without throwing away the first keypress) please write!

Ross Cooling (#12433)
R.R. #1
Kimberly, Ontario
Canada N0C 1G0

RNG	ADEA	2A0	SETDEC	
	ADEB	04E	C=0 ALL	
	ADEC	35C	PT= 12	
	ADED	250	LD@PT- 9	
	ADEE	210	LD@PT- 8	
	ADEF	090	LD@PT- 2	982,1
	ADF0	050	LD@PT- 1	
	ADF1	39C	PT= 0	
	ADF2	0D0	LD@PT- 3	
	ADF3	135	?NC XQ	
	ADF4	060	->184D	[MP2_10]
	ADF5	10E	A=C ALL	
	ADF6	04E	C=0 ALL	
	ADF7	266	C=C-1 S&X	
	ADF8	35C	PT= 12	
	ADF9	090	LD@PT- 2	
	ADFA	050	LD@PT- 1	0,211327
	ADFB	050	LD@PT- 1	
	ADFC	0D0	LD@PT- 3	
	ADFD	090	LD@PT- 2	
	ADFE	1D0	LD@PT- 7	
	ADFF	01D	?NC XQ	

```
        AE00  060   ->1807          [AD2_10]
        AE01  3C4   ST=0
        AE02  0ED   ?NC XQ
        AE03  064   ->193B [        INTFRC]
        AE04  10E   A=C ALL
        AE05  3E0   RTN
Header  AE06  093   "S"
Header  AE07  012   "R"
Header  AE08  005   "E"             High Rollers
Header  AE09  00C   "L"
Header  AE0A  00C   "L"
Header  AE0B  00F   "O"             PPCCJ V14N2P21
Header  AE0C  012   "R"             Ross Cooling
ROLLERS       000   NOP             not programmable
        AE0E  338   READ 12(b)
        AE0F  33C   RCR 1
        AE10  05A   C=0 M           Clear return stack
        AE11  2FC   RCR 13          to use register a
        AE12  328   WRIT 12(b)
        AE13  3D9   ?NC XQ          Enable Display
        AE14  01C   ->07F6          [ENLCD]
        AE15  3BD   ?NC XQ          Display Message
        AE16  01C   ->07EF          [MESSL]
        AE17  008   "H"
        AE18  009   "I"
        AE19  007   "G"
        AE1A  008   "H"
        AE1B  020   " "
        AE1C  012   "R"             "HIGH ROLLERS"
        AE1D  00F   "O"
        AE1E  00C   "L"
        AE1F  00C   "L"
        AE20  005   "E"
        AE21  012   "R"
        AE22  213   "S"
        AE23  149   ?NC XQ          Enable RAM
        AE24  024   ->0952          [ENCP00]
        AE25  1F9   ?NC XQ          View Display
        AE26  00C   ->037E [        STMSGF]
        AE27  046   C=0 S&X
        AE28  266   C=C-1 S&X       pause before showing
        AE29  2E6   ?C#0 S&X        next display msg
        AE2A  3F7   JC  -02
        AE2B  2D9   ?NC XQ          Calls
        AE2C  168   ->5ABC          [TIME]
        AE2D  149   ?NC XQ          Enable RAM
        AE2E  024   ->0952 [        ENCP00]
        AE2F  158   M=C ALL
        AE30  04E   C=0 ALL         #won=0, #lost=0
        AE31  070   N=C ALL
        AE32  198   C=M ALL
        AE33  2A0   SETDEC
```

```
        AE34  13C  RCR 8
        AE35  23E  C=C+1 MS
        AE36  33C  RCR 1
        AE37  05E  C=0 MS
        AE38  046  C=O S&X
        AE39  266  C=C-1 S&X
        AE3A  10E  A=C ALL
        AE3B  3EE  LSHFA ALL
        AE3C  0E0  SLCT Q
        AE3D  2DC  PT= 13
        AE3E  0A0  SLCT P
        AE3F  11C  PT= 8
        AE40  238  READ 8(P)
        AE41  0B2  A<>C P-Q
        AE42  228  WRIT 8(P)     save random number
NEWGAME 0B0  C=N ALL     get saved value
        AE44  01C  PT= 3
        AE45  042  C=0 @PT       #ins.=0
        AE46  130  LDI S&X
        AE47  1FF  CON: 511      set on digit bits
        AE48  070  N=C ALL       save values
RETHROW 238  READ 8(P)   recall random number
        AE4A  3CE  RSHFC ALL
        AE4B  2A0  SETDEC
        AE4C  046  C=0 S&X
        AE4D  266  C=C-1 S&X
        AE4E  108  SETF 8
        AE4F  10E  A=C ALL
        AE50  260  SETHEX
        AE51  379  PORT DEP:     Call RNG,   0<=C<1
        AE52  03C  XQ            (Returns in DEC)
        AE53  1EA  ->ADEA        [RNG]
        AE54  0AE  A<>C ALL
        AE55  158  M=C ALL       save result in M
        AE56  10E  A=C ALL
        AE57  04E  C=0 ALL
        AE58  35C  PT= 12        C = 6
        AE59  190  LD@PT- 6
        AE5A  135  ?NC XQ        Multiply by 6
        AE5B  060  ->184D        [MP2_10]
        AE5C  088  SETF 5        do integer portion
        AE5D  0ED  ?NC XQ        Take Integer
        AE5E  064  ->193B        [INTFRC]
        AE5F  35C  PT= 12
        AE60  222  C=C+1 @PT     add 1 to C, 1<=C<=6
        AE61  13C  RCR 8         rotate to proper spot
        AE62  05C  PT= 4
        AE63  102  A=C @PT
        AE64  0B0  C=N ALL
        AE65  0A2  A<>C @PT      save dice@1 in C[4]
        AE66  070  N=C ALL       resave values
        AE67  198  C=M ALL       recall random number
```

```
        AE68  108  SETF 8
        AE69  10E  A=C ALL
        AE6A  260  SETHEX
        AE6B  379  PORT DEP:    Call RNG,   0<=C<1
        AE6C  03C  XQ           (Returns in DEC)
        AE6D  1EA  ->ADEA       [RNG]
        AE6E  0AE  A<>C ALL
        AE6F  158  M=C ALL      save result in M
        AE70  0AE  A<>C ALL
        AE71  3EE  LSHFA ALL
        AE72  0E0  SLCT Q
        AE73  2DC  PT= 13
        AE74  0A0  SLECT P
        AE75  11C  PT= 8
        AE76  238  READ 8(P)
        AE77  0B2  A<>C P-Q
        AE78  228  WRIT 8(P)
        AE79  198  C=M ALL
        AE7A  10E  A=C ALL
        AE7B  04E  C=0 ALL
        AE7C  35C  PT= 12
        AE7D  190  LD@PT- 6
        AE7E  135  ?NC XQ       Multiply by 6
        AE7F  060  ->184D       [MP2_10]
        AE80  088  SETF 5       do integer portion
        AE81  0ED  ?NC XQ       Take Integer
        AE82  064  ->193B       [INTFRC]
        AE83  35C  PT= 12
        AE84  222  C=C+1 @PT    add 1 to C, 1<=C<=6
        AE85  2BC  RCR 7        rotate to proper spot
        AE86  09C  PT= 5
        AE87  102  A=C @PT
        AE88  0B0  C=N ALL
        AE89  0A2  A<>C @PT     save dice #2 in C[5]
        AE8A  102  A=C @PT
        AE8B  38E  RSHFA ALL    shift dice#2 value
        AE8C  05C  PT= 4
        AE8D  362  ?A#C @PT     compare dice#1 to dice#2
        AE8E  01F  JC  +03
        AE8F  01C  PT= 3
        AE90  222  C=C+1 @PT    if = increment #ins.
        AE91  070  N=C ALL      resave values
        AE92  2E8  WRIT 11(a)   also save in user a
TURN    AE93  3D9  ?NC XQ
        AE94  01C  ->07F6       [ENLCD]
        AE95  0B0  C=N ALL      retrieve values
        AE96  00E  A=0 ALL
        AE97  05C  PT= 4
        AE98  102  A=C @PT      get dice#1
        AE99  0AE  A<>C ALL
        AE9A  07C  RCR 4
        AE9B  31C  PT= 1        convert to ASCII
```

```
AE9C  3D0  LD@PT- F      and display comma
AE9D  3E8  WRABC1R       display them
AE9E  09C  PT= 5
AE9F  0A2  A<>C @PT      get dice#2
AEA0  102  A=C @PT
AEA1  0BC  RCR 5
AEA2  31C  PT= 1         convert to ASCII
AEA3  2D0  LD@PT- B      and display colon
AEA4  3E8  WRABC1R       display them
AEA5  130  LDI S&X       presume @ins.=0
AEA6  020  CON: 32       so prepare a space
AEA7  01C  PT= 3
AEA8  342  ?A#0 @PT      test #ins.
AEA9  033  JNC  +06      jump if zero
AEAA  0A2  A<>C @PT      get #ins.
AEAB  102  A=C @PT
AEAC  03C  RCR 3
AEAD  31C  PT= 1         convert to ASCII
AEAE  2D0  LD@PT- B      and display colon
AEAF  3E8  WRABC1R       display #ins.
AEB0  086  B=A S&X       store digit bits
AEB1  2A0  SETDEC        countdown of
AEB2  1BE  A=A-1 MS      number of digits
AEB3  260  SETHEX        to check
AEB4  05E  C=0 MS
AEB5  23E  C=C+1 MS      digit to test
AEB6  1BE  A=A-1 MS
AEB7  0C6  C=B S&X       only bit in C[2]
AEB8  2F6  ?C#0 XS       is digit or blank?
AEB9  02F  JC  +05  j    ump to show a digit
AEBA  130  LDI S&X
AEBB  020  CON: 32
AEBC  3E8  WRABC1R       display a blank
AEBD  03B  JNC  +07
AEBE  2FC  RCR 13        rotate C[13] to C[0]
AEBF  31C  PT= 1
AEC0  0D0  LD@PT- 3
AEC1  056  C=0 XS        change to ASCII
AEC2  3E8  WRABC1R       display digit
AEC3  33C  RCR 1         rotate back to C[13]
AEC4  0C6  C=B S&X       get last digit
AEC5  056  C=0 XS  drop bit for digit
AEC6  1E6  C=C+C S       &X      get next bit
AEC7  0E6  C<>B S&X      store digit bits
AEC8  0C6  C=B S&X
AEC9  35E  ?A#0 MS       end of digit checks?
AECA  35F  JC  -15       jump to top of loop
AECB  149  ?NC XQ        Enable RAM
AECC  024  ->0952        [ENCP00]
AECD  3C8  CLRKEY
AECE  3CC  ?KEY          wait for a keypress
AECF  3FB  JNC -01
```

```
        AED0  04E   C=0 ALL
        AED1  268   WRIT 9(Q)      save answer in Q
        AED2  3C1   ?NC XQ         set-up disp.
        AED3  0B0   ->2CF0         [CLLCDE]
        AED4  31C   PT= 1          force first key
        AED5  046   C=0 S&X        to show as a zero
        AED6  09B   JNC +13
PRMPT   AED7  115   ?NC XQ         Partial Data Entry
        AED8  038   ->0E45         [NEXT1]
CANCEL  023   JNC +04        jump if backarrow
ANYKEY        04C   ?FSET 4        top two rows (A-J)?
        AEDB  3E7   JC  -04        ignore if so
        AEDC  04B   JNC +09        go to further tests
        AEDD  3B8   RDABC1R        del. Last from display
        AEDE  149   ?NC XQ         Enable RAM
        AEDF  024   ->0952         [ENCP00]
        AEE0  278   READ 9(Q)      get answer so far
        AEE1  04A   C=0 PT<-       blank out last digit
        AEE2  23C   RCR 2
        AEE3  268   WRIT 9(Q)      resave answer
        AEE4  083   JNC +10        go to next prompt
        AEE5  00C   ?FSET 3        was key a digit?
        AEE6  08B   JNC +11        jump to next test
        AEE7  0BE   A<>C MS
        AEE8  2FC   RCR 13
        AEE9  0D0   LD@PT- 3
        AEEA  368   WRAB1R         write digit to disp.
        AEEB  058   G=C @PT,+
        AEEC  149   ?NC XQ         Enable RAM
        AEED  024   ->0952         [ENCP00]
        AEEE  278   READ 9(Q)      get answer so far
        AEEF  37C   RCR 12
        AEF0  098   C=G @PT,+      append latest resp.
        AEF1  268   WRIT 9(Q)      resave answer
        AEF2  042   C=0 @PT
        AEF3  058   G=C @PT,+
        AEF4  3D9   ?NC XQ
        AEF5  01C   ->07F6         [ENLCD]
        AEF6  30B   JNC  -31d      go for next prompt
        AEF7  28C   ?FSET 7        test if dec. point
        AEF8  2FF   JC  -21        ignore and re-prompt
        AEF9  130   LDI S&X
        AEFA  370   CON: 880       test if R/S pressed
        AEFB  106   A=C S&X
        AEFC  0B0   C=N ALL        get keycode
        AEFD  366   ?A#C S&X       ignore other keys
        AEFE  2CF   JC  -27        and re-prompt
        AEFF  3D9   ?NC XQ         Clear Display
        AF00  0B0   ->2CF6         [CLRLCD]
        AF01  261   ?NC XQ         Reset Keys
        AF02  000   ->0098         [RSTKB]
        AF03  149   ?NC XQ         Enable RAM
```

```
AF04  024  ->0952        [ENCP00]
AF05  215  ?NC XQ        Reset Flags
AF06  00C  ->0358        [RSTSQ]
AF07  260  SETHEX
AF08  130  LDI S&X       set max. answers
AF09  007  CON: 7        counter in A[13]
AF0A  33C  RCR1
AF0B  11E  A=C MS        initialize answer
AF0C  006  A=0 S&X       total in A[1:0]
AF0D  278  READ 9(Q)     get answers
AF0E  0A0  SLCT P
AF0F  39C  PT= 0
AF10  0E0  SLCT Q
AF11  31C  PT= 1         convert to ASCII
AF12  042  C=0 @PT       value to binary
AF13  152  A=A+C P-Q     add digit
AF14  23C  RCR 2         rotate to next digit
AF15  1BE  A=A-1 MS      decrement counter
AF16  35E  ?A#0 MS       looped 7 times?
AF17  3DF  JC  -05       if not go back
AF18  2F8  READ 11(a)    get values
AF19  070  N=C ALL       save for redisplay
AF1A  342  ?A#0 @PT      test if total>15
AF1B  07F  JC  +15d      jump to redisplay
AF1C  0BC  RCR 5
AF1D  11E  A=C MS        A[13]= dice#1 value
AF1E  33C  RCR 1
AF1F  15E  A=A+C MS      add dice#2 value
AF20  0BE  A<>C MS
AF21  2FC  RCR 13        rotate dice total
AF22  39C  PT= 0         to C[0]
AF23  342  ?A#0 @PT      test if answer is 0
AF24  04B  JNC  +09
AF25  362  ?A#C @PT      dice total =
AF26  027  JC  +04       answer total?
AF27  369  PORT DEP:
AF28  03C  GO
AF29  39D  ->AF9D        [LAST]
AF2A  369  PORT DEP:     redisplay values
AF2B  03C  GO            if totals don't match
AF2C  293  ->AE93        [TURN]
AF2D  0B0  C=N ALL       get values back
AF2E  01C  PT= 3         point to #ins.
AF2F  2E2  ?C#0 @PT      test if zero
AF30  033  JNC +06       jump to  YOULOSE rtn
AF31  262  C=C-1 @PT     else decrement #ins.
AF32  070  N=C ALL       resave values
AF33  369  PORT DEP:     Back for next turn
AF34  03C  GO
AF35  249  ->AE49        [RETHROW]
AF36  15C  PT= 6
AF37  2A0  SETDEC
```

```
        AF38  222  C=C+1 @PT
        AF39  023  JNC  +04
        AF3A  222  C=C+1 @PT      increase #lost
        AF3B  29C  PT= 7
        AF3C  042  C=0 @PT
        AF3D  260  SETHEX
        AF3E  070  N=C ALL
        AF3F  3D9  ?NC XQ         Enable RAM
        AF40  01C  ->07F6         [ENLCD]
        AF41  3BD  ?NC XQ         Display msg.
        AF42  01C  ->07EF         [MESSL]
        AF43  019  "Y"
        AF44  00F  "O"
        AF45  015  "U"
        AF46  020  " "            "YOU LOSE"
        AF47  00C  "L"
        AF48  00F  "O"
        AF49  013  "S"
        AF4A  205  "E"
YLOSE   AF4B  3DD  ?NC XQ         Left-justify Display
        AF4C  0AC  ->2BF7         [LEFTJ]
        AF4D  046  C=0 S&X
        AF4E  266  C=C-1 S&X      pause before
        AF4F  2E6  ?C#0 S&X       showing next
        AF50  3F7  JC  -02
        AF51  3D9  ?NC XQ         Enable RAM
        AF52  01C  ->07F6         [ENLCD]
        AF53  3BD  ?NC XQ         Display msg.
        AF54  01C  ->07EF         [MESSL]
        AF55  019  "Y"
        AF56  00F  "O"
        AF57  015  "U"
        AF58  020  " "            "YOU ARE "
        AF59  001  "A"
        AF5A  012  "R"
        AF5B  005  "E"
        AF5C  220  " "
        AF5D  0B0  C=N ALL
        AF5E  2BC  RCR 7          put #won in C[0]
        AF5F  31C  PT= 1          convert to ASCII
        AF60  2D0  LD@PT- B       with colon
        AF61  3E8  WRABC1R        write #won to disp.
        AF62  046  C=0 S&X
        AF63  0D0  LD@PT- 3       put #lost in C[0]
        AF64  2FC  RCR 13         convert to ASCII
        AF65  3E8  WRABC1R        write #lost to disp.
        AF66  130  LDI S&X
        AF67  020  CON: 32        make an ASCII space
        AF68  3E8  WRABC1R        write to display 2x
        AF69  3E8  WRABC1R        to fill display
        AF6A  149  ?NC XQ         Enable RAM
        AF6B  024  ->0952         [ENCP00]
```

```
      AF6C  1F9  ?NC XQ       View Display
      AF6D  00C  ->037E       [STMSGF]
      AF6E  046  C=0 S&X
      AF6F  266  C=C-1 S&X    pause before
      AF70  2E6  ?C#0 S&X     showing next msg.
      AF71  3F7  JC  -02
      AF72  3D9  ?NC XQ       Enable RAM
      AF73  01C  ->07F6       [ENLCD]
      AF74  3BD  ?NC XQ       Display msg.
      AF75  01C  ->07EF       [MESSL]
      AF76  003  "C"
      AF77  00F  "O"
      AF78  00E  "N"
      AF79  014  "T"
      AF7A  009  "I"
      AF7B  00E  "N"          "CONTINUE?1:NO"
      AF7C  015  "U"
      AF7D  005  "E"
      AF7E  03F  "?"
      AF7F  0B1  "1:"
      AF80  00E  "N"
      AF81  20F  "O"
      AF82  149  ?NC XQ       Enable RAM
      AF83  024  ->0952       [ENCP00]
      AF84  1F9  ?NC XQ       View Display
      AF85  00C  ->037E       [STMSGF]
      AF86  3C8  CLRKEY
      AF87  3CC  ?KEY         wait for a keypress
      AF88  3FB  JNC  -01
      AF89  220  C=KEY KY     get key pressed
      AF8A  130  LDI S&X
      AF8B  036  CON: 54      check for a 1
      AF8C  0A6  A<>C S&X     save in A[2:0]
      AF8D  03C  RCR 3        make key to C[2:0]
      AF8E  056  C=0 XS
      AF8F  366  ?A#C S&X     test if key=1
      AF90  023  JNC  +04     jump if not
      AF91  369  PORT DEP:    Play another game
      AF92  03C  GO
      AF93  243  ->AE43       [NEWGAME]
      AF94  3D9  ?NC XQ       Clear Display
      AF95  0B0  ->2CF6       [CLRLCD]
      AF96  261  ?NC XQ       Reset Keys
      AF97  000  ->0098       [RSTKB]
      AF98  149  ?NC XQ       Enable RAM
      AF99  024  ->0952       [ENCP00]
      AF9A  215  ?NC XQ       Reset Flags
      AF9B  00C  ->0385       [RSTSQ]
      AF9C  3E0  RTN          end of the game!
LAST  AF9D  278  READ 9(Q)    get answer
      AF9E  39C  PT= 0
      AF9F  0EE  C<>B ALL     save in B
```

```
AFA0  0B0  C=N ALL       get value
AFA1  058  G=C @PT,+
AFA2  106  A=C S&X       save digits in A
AFA3  2CE  ?B#0 ALL
AFA4  18B  JNC +31       no more answers?
AFA5  2C2  ?B#0 @PT
AFA6  027  JNC  +04      non-zero answers?
AFA7  3AE  RSHFB ALL     move next answer
AFA8  3AE  RSHFB ALL     into position
AFA9  3D3  JNC  -06
AFAA  0A2  A<>C @PT
AFAB  250  LD@PT- 9
AFAC  39C  PT= 0         reverse mask
AFAD  0A2  A<>C @PT
AFAE  182  A=A-B @PT
AFAF  130  LDI S&X
AFB0  001  CON: 1
AFB1  342  ?A#0 @PT
AFB2  023  JNC  +04
AFB3  1A2  A=A-1 @PT
AFB4  1E6  C=C+C S&X
AFB5  3E3  JNC  -04
AFB6  0A6  A<>C S&X
AFB7  098  C=G @PT,+
AFB8  0A6  A<>C S&X      if digit set
AFB9  3B0  C=C AND A     C=1, else 0
AFBA  2E6  ?C#0 S&X
AFBB  027  JC  +04
AFBC  369  PORT DEP:     redisplay values
AFBD  03C  GO
AFBE  293  ->AE93        [TURN]
AFBF  0B0  C=N ALL
AFC0  0A6  A<>C S&X
AFC1  106  A=C S&X
AFC2  250  LD@PT- 9      reverse mask
AFC3  39C  PT= 0
AFC4  0A2  A<>C @PT
AFC5  182  A=A-B @PT
AFC6  130  LDI S&X
AFC7  001  CON: 1
AFC8  342  ?A#0 @PT
AFC9  023  JNC  +04
AFCA  1A2  A=A-1 @PT
AFCB  1E6  C=C+C S&X
AFCC  3E3  JNC -04
AFCD  2A6  C=-C-1 S&X
AFCE  0A6  A<>C S&X
AFCF  098  C=G @PT,+
AFD0  0A6  A<>C S&X
AFD1  3B0  C=C AND A     clear digit
AFD2  106  A=C S&X
AFD3  058  C=G @PT,+
```

```
AFD4  29B   JNC  -2D        process next answer
AFD5  0B0   C=N ALL
AFD6  0A6   A<>C S&X
AFD7  2E6   ?C#0 S&X       all digits gone?
AFD8  02B   JNC  +05       go to YOUWIN
AFD9  070   N=C ALL        else
AFDA  369   PORT DEP:      Rethrow dice
AFDB  03C   GO
AFDC  249   ->AE49         [RETHROW]
AFDD  29C   PT= 7
AFDE  2A0   SETDEC
AFDF  222   C=C+1 @PT      add 1 to #won
AFE0  023   JNC  +04       jump if not?9
AFE1  222   C=C+1 @PT      else, set #won to 1
AFE2  15C   PT= 6
AFE3  042   C=0 @PT        and #lost to 0
AFE4  260   SETHEX
AFE5  070   N=C ALL
AFE6  3D9   ?NC XQ         Enable RAM
AFE7  01C   ->07F6         [ENLCD]
AFE8  3BD   ?NC XQ         Display msg.
AFE9  01C   ->07EF         [MESSL]
AFEA  019   "Y"
AFEB  00F   "O"
AFEC  015   "U"            "YOU WIN"
AFED  020   " "
AFEE  017   "W"
AFEF  009   "I"
AFF0  20E   "N"
AFF1  369   PORT DEP:
AFF2  03C   GO
AFF3  34B   ->AF4B         [YLOSE]
```

Ed's note:

By now you have no doubt realize that MCODE gaming is *hard* - just comparing the number of steps in the FOCAL version of High Rollers (see FOCAL sections) is enough to make you understand why so few exist and so far and in between these jewels are…

On the other hand, some games don't need to be written on MCODE to be real masterpieces, including the execution speed and user interface options.

Poker for the HP-41 (MCODE version)

Jean-Marc Baillard -http://hp41programs.yolasite.com/poker.php

This version combines three different cases:

1. DRAW: Play against your HP-41
2. BANDIT: Play with your HP-41 (One-armed Bandit)
3. TEXAS: Texas Hold'em Power

The FOCAL driver program below sets the appropriate flags, resets the SIZE and prompt for the total money amount for betting. It then transfers the execution to the main program "POKER"

```
01*LBL "TEXAS"
02 SF 08
03 GTO 00
04*LBL "BANDIT"
05 SF 07
06 CF 08
07 GTO 00
08*LBL "DRAW"
09 CF 07
10 CF 08
11*LBL 00
12 SIZE?
13 42
14 X>Y?
15 PSIZE
16 RNG
17 STO 00
18 "CA$H=?"
19 PROMPT
20 STO 41
21 XROM "POKER"
22 END
```

Several MCODE routines facilitate the program flow and accelerate the execution of the FOCAL driver programs, so this is a hybrid combination of both. The MCODE routines check that the registers exist, and when appropriate, that they don't hold ALPHA data.

1. The first one "**TRI**" sorts the 5 cards in R01 thru R05, evaluate the poker hand - the value is returned in X -, compares this result with the number already in R48 and stores the maximum of these 2 numbers into R48.
2. The second M-Code routine "**MV**" is equivalent to 17.001005 REGMOVE Checking for alpha data would be unuseful in this case.

   Furthermore, these two routines have been combined into a single one called "**SHFL**", which performs the desired action depending on the contents of the X register on input. This saves one entry in the FAT and runs slightly faster:

   ```
   If X = 0  "#$#"  is equivalent to  TRI
   If X < 0  "#$#"  ----------------  MV
   If X > 0  "#$#"  ----------------  TRI + MV
   ```

3. And the 3rd routine "**CARD**" takes a random number in R00 to calculate another random number which is stored in R00 and returns a "card", i-e an integer between 28 & 40 in register X

Instructions:

You should refer to the POKER Game in the FOCAL Games Section first.

The instructions are almost identical to the FOCAL program case, except that the program does not stop before your next cash is displayed. After displaying your cards, GETKEY is used to place your bet (draw poker or Texas hold'em):

[Σ+] does a bet of about 1,668 $ - [LN] does a bet of about 3,103 $
[X<>Y] does bet of about 6,081 $ - [TAN] does a bet of about 8,619 $
[SHIFT] does a bet of about 13,253 $ - [SST] does a bet of about 16,894 $
.....
[/] does a bet of about 90,480 $ - [R/S] does a bet of about 97,307 $

More exactly, the formula is: Bet = [(keycode) Ln(41)]^2

There are, however, 2 exceptions: press ENTER^ to accept the HP41's raise and press the back-arrow key if you want to fold.

Likewise with CF 08 - when you want to discard some cards, say the cards n° 1 3 5 (seen from the left), simply press 1 3 5 ENTER^ (not too quickly) - the program doesn't stop.

With CF 07 & CF 08 (one-arm bandit), your bet is randomly evaluated.

Notes:

-The HP-41 does not bluff when playing "Texas Hold'em Poker" i-e SF 08
-If you want this option, add for instance RCL 49 * after line 190
add RCL 00 R-D FRC STO 00 .12 X>Y? ST/ 49 after line 110
and add 1 STO 49 after line 33

With respect to execution time, "RIVER**. . .**" is now displayed for 7 or 8 seconds instead of 37s . It's surely possible to save bytes if you create loops inside LBL 17& LBL 18, but this would increase execution time...

```
Header A03B   0A3   "#"
Header A03C   024   "$"          Shuffle
Header A03D   023   "#"          JM Baillard
SHFL   A03E   378   READ 13(c)
       A03F   03C   RCR 3
       A040   106   A=C S&X
       A041   130   LDI S&X
       A042   1D0   1D0h
       A043   306   ?A<C S&X
       A044   381   ?NC GO        if  R48 doesn't exist
       A045   00A   ->02E0        [ERRNE]
       A046   0F8   READ 3(X)
       A047   2FE   ?C#0 MS
       A048   023   JNC +04
       A049   369   PORT DEP:     GOTO the 2nd part
       A04A   03C   GO            of the routine if X < 0
       A04B   1EE   ->A1EE        [LB_FED8]
```

```
A04C  104   CLRF 8
      A04E  2EE   >C#0
      A04E  017   JC  +02
      A04F  108   SETF 8
      A050  130   LDI S&X
      A051  005   005
      A052  146   A=A+C S&X
      A053  266   C=C-1 S&X
      A054  0E6   B<>C S&X
      A055  0A6   A<>C S&X
      A056  270   RAMSLCT
      A057  0A6   A<>C S&X
      A058  038   READATA
      A059  0E6   B<>C S&X
      A05A  270   RAMSLCT
      A05B  0E6   B<>C S&X
      A05C  2F0   WRTDATA
      A05D  1A6   A=A-1 S&X
      A05E  0E6   B<>C S&X
      A05F  266   C=C-1  S&X
      A060  01F   JC  +03
      A061  0E6   B<>C S&X
      A062  39B   JNC  -13d
      A063  130   LDI S&X
      A064  005   005
      A065  070   N=C ALL
      A066  0EE   B<>C ALL
      A067  00E   A=0 ALL
      A068  0CE   C=B ALL
      A069  266   C=C-1 S&X
      A06A  057   JC  +10d
      A06B  270   RAMSLCT
      A06C  0EE   B<>C ALL
      A06D  038   READATA
      A06E  31A   A<C ALL
      A06F  3CB   JNC -07
      A070  0AE   A<>C ALL
      A071  0CE   C=B ALL
      A072  158   M=C ALL
      A073  3AB   JNC -11d
      A074  0B0   C=N ALL
      A075  266   C=C-1 S&X
      A076  070   N=C ALL
      A077  270   RAMSLCT
      A078  038   READATA
      A079  0AE   A<>C ALL
      A07A  2F0   WRTDATA
      A07B  198   C=M ALL
      A07C  270   RAMSLCT
      A07D  0AE   A<>C ALL
      A07E  2F0   WRTDATA
      A07F  0B0   C=N ALL
      A080  2E6   ?C#0 S&X
      A081  32F   JC  -27d
      A082  04E   C=0 ALL
      A083  270   RAMSLCT
      A084  168   WRIT 5(M)
      A085  35C   PT=12
      A086  110   LD@PT- 4
      A087  1A8   WRIT 6(N)
      A088  0B8   READ 2(Y)
      A089  268   WRIT 9(Q)
      A08A  0F8   READ 3(X)
      A08B  228   WRIT 8(P)
      A08C  138   READ 4(L)
      A08D  1E8   WRIT 7(O)
      A08E  046   C=0 S&X
      A08F  270   RAMSLCT
      A090  038   READATA
      A091  158   M=C ALL
      A092  10E   A=C ALL
      A093  078   READ 1(Z)
      A094  070   N=C ALL
      A095  36E   ?A#C ALL
      A096  18B   JNC +49d
      A097  10E   A=C ALL
      A098  0B8   READ 2(Y)
      A099  36E   ?A#C ALL
      A09A  15B   JNC +43d
      A09B  10E   A=C ALL
      A09C  0F8   READ 3(X)
      A09D  36E   ?A#C ALL
      A09E  143   JNC +40d
      A09F  10E   A=C ALL
      A0A0  138   READ 4(L)
      A0A1  36E   ?A#C ALL
      A0A2  1F3   JNC +62d
      A0A3  2A0   SETDEC
      A0A4  10E   A=C ALL
      A0A5  198   C=M ALL
      A0A6  1CE   A=A-C ALL
      A0A7  08E   B=A ALL
      A0A8  04E   C=0 ALL
      A0A9  35C   PT= 12
      A0AA  150   LD@PT- 5
      A0AB  1A8   WRIT 6(N)
      A0AC  3CE   RSHFC
      A0AD  30E   ?A<C ALL
      A0AE  187   JC  +48d
      A0AF  0F8   READ 3(X)
      A0B0  10E   A=C ALL
      A0B1  198   C=M ALL
```

```
A0B2  1CE  A=A-C ALL
A0B3  04E  C=0 ALL
A0B4  19C  PT= 11
A0B5  0D0  LD@PT- 3
A0B6  158  M=C ALL
A0B7  36E  ?A#C ALL
A0B8  087  JC  +16d
A0B9  06E  A<>B ALL
A0BA  3EE  LSHFA
A0BB  04E  C=0 ALL
A0BC  35C  PT= 12
A0BD  1D0  LD@PT- 7
A0BE  1CE  A=A-C ALL
A0BF  1B8  READ 6(N)
A0C0  36E  ?A#C ALL
A0C1  0D7  JC  +26d
A0C2  078  READ 1(Z)
A0C3  1E8  WRIT 7(O)
A0C4  0D3  JNC +26d
A0C5  11B  JNC +35d
A0C6  1D3  JNC +58d
A0C7  0C3  JNC +24d
A0C8  138  READ 4(L)
A0C9  10E  A=C ALL
A0CA  078  READ 1(Z)
A0CB  1CE  A=A-C ALL
A0CC  198  C=M ALL
A0CD  36E  ?A#C ALL
A0CE  02F  JC  +05
A0CF  04E  C=0 ALL
A0D0  35C  PT= 12
A0D1  050  LD@PT- 1
A0D2  04B  JNC +09
A0D3  04E  C=0 ALL
A0D4  35C  PT= 12
A0D5  050  LD@PT- 1
A0D6  090  LD@PT- 2
A0D7  0D0  LD@PT- 3
A0D8  110  LD@PT- 4
A0D9  130  LDI S&X
A0DA  003  003
A0DB  168  M=C ALL
A0DC  04E  C=0 ALL
A0DD  1A8  WRIT 6(N)
A0DE  163  JNC +44d
A0DF  1AB  JNC +53d
A0E0  04E  C=0 ALL
A0E1  35C  PT= 12
A0E2  050  LD@PT- 1
A0E3  090  LD@PT- 2
A0E4  0D0  LD@PT- 3
A0E5  130  LDI S&X
A0E6  002  002
A0E7  0C3  JNC+24d
A0E8  10E  A=C ALL
A0E9  0F8  READ 3(X)
A0EA  36E  ?A#C ALL
A0EB  1CB  JNC +57d
A0EC  10E  A=C ALL
A0ED  138  READ 4(L)
A0EE  36E  ?A#C ALL
A0EF  02F  JC  +05
A0F0  04E  C=0 ALL
A0F1  35C  PT= 12
A0F2  050  LD@PT- 1
A0F3  183  JNC +48d
A0F4  228  WRIT 8(P)
A0F5  078  READ 1(Z)
A0F6  0AE  A<>C ALL
A0F7  268  WRIT 9(Q)
A0F8  04E  C=0 ALL
A0F9  35C  PT= 12
A0FA  050  LD@PT- 1
A0FB  110  LD@PT- 4
A0FC  150  LD@PT- 5
A0FD  130  LDI S&X
A0FE  002  002
A0FF  1A3  JNC +52d
A100  10E  A=C ALL
A101  138  READ 4(L)
A102  36E  ?A#C ALL
A103  047  JC  +08
A104  04E  C=0 ALL
A105  35C  PT= 12
A106  050  LD@PT- 1
A107  090  LD@PT- 2
A108  226  C=C+1 S&X
A109  193  JNC +50d
A10A  183  JNC +48d
A10B  228  WRIT 8(P)
A10C  04E  C=0 ALL
A10D  35C  PT= 12
A10E  050  LD@PT- 1
A10F  090  LD@PT- 2
A110  150  LD@PT- 5
A111  130  LDI S&X
A112  002  002
A113  103  JNC +32d
A114  10E  A=C ALL
A115  0B8  READ 2(Y)
A116  36E  ?A#C ALL
A117  1BB  JNC +55d
A118  10E  A=C ALL
A119  0F8  READ 3(X)
```

A11A	36E	?A#C ALL
A11B	193	JNC +50d
A11C	10E	A=C ALL
A11D	138	READ 4(L)
A11E	36E	?A#C ALL
A11F	037	JC +06
A120	04E	C=0 ALL
A121	35C	PT= 12
A122	0D0	LD@PT- 3
A123	14B	JNC +41d
A124	0C3	JNC +24d
A125	228	WRIT 8(P)
A126	0AE	A<>C ALL
A127	268	WRIT 9(Q)
A128	0B8	READ 2(Y)
A129	070	N=C ALL
A12A	078	READ 1(Z)
A12B	10E	A=C ALL
A12C	04E	C=0 ALL
A12D	35C	PT= 12
A12E	0D0	LD@PT- 3
A12F	110	LD@PT- 4
A130	150	LD@PT- 5
A131	130	LDI S&X
A132	002	002
A133	168	M=C ALL
A134	0AE	A<>C ALL
A135	1E8	WRIT 7(O)
A136	04E	C=0 ALL
A137	35C	PT= 12
A138	050	LD@PT- 1
A139	1A8	WRIT 6(N)
A13A	153	JNC +42d
A13B	123	JNC +36d
A13C	1E8	WRIT 7(O)
A13D	10E	A=C ALL
A13E	138	READ 4(L)
A13F	36E	?A#C ALL
A140	02F	JC +05
A141	04E	C=0 ALL
A142	35C	PT= 12
A143	050	LD@PT- 1
A144	193	JNC +50d
A145	228	WRIT 8(P)
A146	04E	C=0 ALL
A147	35C	PT= 12
A148	050	LD@PT- 1
A149	150	LD@PT- 5
A14A	226	C=C+1 S&X
A14B	0A3	JNC +20d
A14C	113	JNC +34d
A14D	0C3	JNC +24d
A14E	1E8	WRIT 7(O)
A14F	10E	A=C ALL
A150	0F8	READ 3(X)
A151	36E	?A#C ALL
A152	12B	JNC +37d
A153	10E	A=C ALL
A154	138	READ 4(L)
A155	228	WRIT 8(P)
A156	36E	?A#C ALL
A157	183	JNC +48d
A158	0AE	A<>C ALL
A159	268	WRIT 9(Q)
A15A	04E	C=0 ALL
A15B	35C	PT= 12
A15C	110	LD@PT- 4
A15D	150	LD@PT- 5
A15E	226	C=C+1 S&X
A15F	168	WRIT 5(M)
A160	04E	C=0 ALL
A161	35C	PT= 12
A162	0D0	LD@PT- 3
A163	1A8	WRIT 6(N)
A164	11B	JNC +35d
A165	1E8	WRIT 7(O)
A166	10E	A=C ALL
A167	138	READ 4(L)
A168	36E	?A#C ALL
A169	0F3	JNC +30d
A16A	268	WRIT 9(Q)
A16B	04E	C=0 ALL
A16C	35C	PT= 12
A16D	150	LD@PT- 5
A16E	168	WRIT 5(M)
A17B	138	READ 4(L)
A17C	36E	?A#C ALL
A17D	053	JNC +10d
A17E	228	WRIT 8(P)
A17F	04E	C=0 ALL
A180	35C	PT= 12
A181	150	LD@PT- 5
A182	168	WRIT 5(M)
A183	04E	C=0 ALL
A184	35C	PT= 12
A185	190	LD@PT-6
A186	1A8	WRIT 6(N)
A187	260	SETHEX
A188	378	READ 13(c)
A189	03C	RCR 3
A18A	106	A=C S&X
A18B	130	LDI S&X
A18C	00B	011d
A18D	206	C=A+C S&X

```
A18E  270  RAMSLCT
A18F  10E  A=C ALL
A190  0B0  C=N ALL
A191  2F0  WRTDATA
A192  130  LDI S&X
A193  009  009
A194  158  M=C ALL
A195  270  RAMSLCT
A196  038  READATA
A197  0AE  A<>C ALL
A198  266  C=C-1 S&X
A199  270  RAMSLCT
A19A  0AE  A<>C ALL
A19B  2F0  WRTDATA
A19C  198  C=M ALL
A19D  266  C=C-1 S&X
A19E  3B3  JNC -10d
A19F  04E  C=0 ALL
A1A0  270  RAMSLCT
A1A1  35C  PT=12          37 is used to evaluate the poker hands.
A1A2  0D0  LD@PT- 3        Replace these 2 lines if you prefer
A1A3  1D0  LD@PT- 7        another number, but choose at least 16.
A1A4  226  C=C+1 S&X
A1A5  2A0  SETDEC
A1A6  128  WRIT 4(L)
A1A7  10E  A=C ALL
A1A8  1B8  READ 6(N)
A1A9  135  ?NC XQ          C= A*C
A1AA  060  184D            [MP2_10]
A1AB  000
A1AC  1F8  READ 7(O)
A1AD  025  ?NC XQ          C = AB+C
A1AE  060  ->1809          [AD1_10]
A1AF  000
A1B0  138  READ 4(L)
A1B1  13D  ?NC XQ          C= AB*C
A1B2  060  ->184F  [MP1_10]
A1B3  000
A1B4  238  READ 8(P)
A1B5  025  ?NC XQ          C = AB+C
A1B6  060  ->1809          [AD1_10]
A1B7  000
A1B8  138  READ 4(L)
A1B9  13D  ?NC XQ          C= AB*C
A1BA  060  ->184F          [MP1_10]
A1BB  000
A1BC  278  READ 9(Q)
A1BD  025  ?NC XQ          C = AB+C
A1BE  060  ->1809          [AD1_10]
A1BF  000
A1C0  138  READ 4(L)
A1C1  13D  ?NC XQ          C= AB*C
```

```
        A1C2  060   ->184F        [MP1_10]
        A1C3  000
        A1C4  0B0   C=N ALL
        A1C5  025   ?NC XQ        C = AB+C
        A1C6  060   ->1809        [AD1_10]
        A1C7  000
        A1C8  138   READ 4(L)
        A1C9  13D   ?NC XQ        C= AB*C
        A1CA  060   ->184F        [MP1_10]
        A1CB  000
        A1CC  046   C=0 S&X
        A1CD  270   RAMSLCT
        A1CE  038   READATA
        A1CF  025   ?NC XQ        C = AB+C
        A1D0  060   ->1809        [AD1_10]
        A1D1  0E8   WRIT 3(X)     Here the combination is evaluated.
        A1D2  070   N=C ALL       Then its value is compared to R48
        A1D3  260   SETHEX        and the maximum is stored in R48
        A1D4  378   READ 13(c)
        A1D5  03C   RCR 3
        A1D6  106   A=C S&X
        A1D7  130   LDI S&X
        A1D8  030   CON=48
        A1D9  206   C=A+C S&X
        A1DA  270   RAMSLCT
        A1DB  0E6   B<>C S&X
        A1DC  038   READATA
        A1DD  10E   A=C ALL
        A1DE  0B0   C=N ALL
        A1DF  306   ?A<C S&X
        A1E0  037   JC  +06
        A1E1  0AE   A<>C ALL
        A1E2  306   ?A<C S&X
        A1E3  03F   JC  +07
        A1E4  31A   ?A<C M
        A1E5  02F   JC  +05
        A1E6  0E6   B<>C S&X
        A1E7  270   RAMSLCT
        A1E8  0B0   C=N ALL
        A1E9  2F0   WRTDATA
        A1EA  04E   C=0 ALL
        A1EB  270   RAMSLCT
        A1EC  10C   ?FSET 8
        A1ED  360   ?C RTN
LB_FED8 378   READ 13(c)
        A1EF  03C   RCR 3
        A1F0  106   A=C S&X
        A1F1  130   LDI S&X
        A1F2  010   016d
        A1F3  206   C=A+C S&X
        A1F4  0E6   B<>C S&X
        A1F5  130   LDI S&X
```

```
A1F6  004  004
A1F7  070  N=C ALL
A1F8  0E6  B<>C S&X
A1F9  226  C=C+1 S&X
A1FA  270  RAMSLCT
A1FB  0E6  B<>C S&X
A1FC  038  READATA
A1FD  0AE  A<>C ALL
A1FE  226  C=C+1 S&X
A1FF  270  RAMSLCT
A200  0AE  A<>C ALL
A201  2F0  WRTDATA
A202  0B0  C=N ALL
A203  266  C=C-1 S&X
A204  39B  JNC-13d
A205  3E0  RTN
```

```
Header A207   084   "D"
Header A208   012   "R"
Header A209   001   "A"
Header A20A   003   "C"          JM Baillard
CARD   A20B   0F8   READ 3(X)
       A20C   0A8   WRIT 2(Y)
       A20D   378   READ 13(c)
       A20E   03C   WCR 3
       A20F   106   A=C S&X
       A210   130   LDI S&X       check that R00 exist.
       A211   1EB   1EBh
       A212   306   ?A<C S&X
       A213   381   ?NC GO
       A214   00A   ->02E0        [ERRNE]
       A215   0A6   A<>C S&X
       A216   270   RAMSLCT
       A217   038   READATA
       A218   2A0   SETDEC
       A219   231   ?NC XQ        xeq R-D
       A21A   064   ->198C        [TODEC]
       A21B   084   CLRF 5        fractional part
       A21C   0ED   ?NC XQ
       A21D   064   ->193B        [INTFRC]
       A21E   2F0   WRITDATA
       A21F   10E   A=C ALL
       A220   04E   C=0 ALL
       A221   270   RAMSLCT
       A222   35C   PT=12
       A223   050   LD@PT- 1
       A224   0D0   LD@PT- 3
       A225   226   C=C+1 S&X
       A226   135   ?NC XQ         C=A*C
       A227   060   ->184D        [MP2_10]
       A228   088   SETF 5        Integer part
       A229   0ED   ?NC XQ
       A22A   064   ->193B        [INTFRC]
       A22B   10E   A=C ALL
       A22C   04E   C=0 ALL
       A22D   35C   PT=12
       A22E   090   LD@PT- 2
       A22F   210   LD@PT- 8
       A230   226   C=C+1 S&X
       A231   01D   ?NC XQ         C=A+C
       A232   060   ->1807        [AD2_10]
       A233   0E8   WRIT 3(X)
       A234   3E0   RTN
```

FOCAL listing:

```
01*LBL "POKER"
 02 SIZE?
 03 51
 04 X>Y?
 05 PSIZE
 06 10
 07 STO 42
 08 27
 09 "A"
 10 ASTO 40
 11 35
 12 "K"
 13 ASTO 39
 14 1.015008
 15 STO 43
 16 "Q"
 17 ASTO 38
 18 9
 19 "J"
 20 ASTO 37
 21 "T"
 22 ASTO 36
 23 "/"
 24*LBL 00
 25 STO IND Z
 26 R^
 27 XTOA
 28 ASTO IND X
 29 RDN
 30 DSE T
 31 DSE Z
 32 DSE X
 33 X>Y?
 34 GTO 00
 35 FS? 08
 36 CF 07
 37 CF 09
 38*LBL 01
 39 CLX
 40 STO 50
 41 SIGN
 42 STO 49
 43 FIX 0
 44 CF 29
 45 5
 46 STO 48
 47 FS? 08
 48 2
 49 STO 06
 50 15
 51 STO 07
 52 27
 53 STO 08
 54  E3
 55 STO 12
 56 CHS
 57 STO 13
 58 " "
 59 ASTO 21
 60*LBL 02
 61 CLA
 62 ARCL 21
 63 CARD
 64 STO IND 07
 65 ARCL IND X
 66 ASTO 21
 67 FS? 07
 68 GTO 02
 69 CARD
 70 STO IND 06
 71*LBL 02
 72 FS? 08
 73 ARCL IND 08
 74 AVIEW
 75 DSE 08
 76 ISG 07
 77 CLX
 78 DSE 06
 79 GTO 02
 80 FS? 07
 81 GTO 11
 82 FC? 08
 83 GTO 01
 84 SF 09
 85 RCL 00
 86 FRC
 87 4 E3
 88 STO 08
 89 ST* Y
 90 ST+ X
 91 +
 92 STO 10
 93 STO 50
 94 CLX
 95 GTO 14
 96*LBL 20
 97 SF 10
 98 3
 99 STO 24
100 RCL 01
101 STO 13
102 RCL 02
103 STO 14
104 CLA
105 ARCL 21
106 ASTO 44
107 CARD
108 STO 17
109 CARD
110 STO 18
111 CARD
112 STO 19
113 "/"
114 ARCL IND 17
115 ARCL IND 18
116 ARCL IND 19
117 ASTO 45
118 " FLOP. . ."
119 AVIEW
120 XEQ 16
121 STO 47
122 XEQ 16
123 STO 46
124 STO 08
125 CLA
126 ARCL 44
127 ARCL 45
128 ARCL 26
129  E6
130 /
131 X^2
132 RCL 50
133 +
134 STO 10
135 SIGN
136 RCL 00
137 R-D
138 FRC
139 STO 00
140 X^2
141 -
142 ST/ 49
143 CLX
144 GTO 03
145*LBL 01
146 XEQ 09
147 RCL 07
148 X#0?
149 9
150 RCL 06
151 +
152 7
153 X>Y?
154 ST* 10
155 CLX
156*LBL 03
157 AVIEW
158*LBL 14
159 GETKEY
160 44
161 X=Y?
162 GTO 06
163 X<> Z
164 ST+ 12
165 X<>Y
166 41
167 X=Y?
168 GTO 10
169 LN
170 *
171 X^2
172 RCL 12
173 +
174 RCL 10
175 X<>Y
176 X>Y?
177 GTO 07
178 STO 12
179 X<>Y
180 3
181 /
182 X<Y?
183 GTO 10
184 *
185 SQRT
186 RCL 00
187 R-D
188 FRC
189 STO 00
190 *
191 "  +"
192 ARCL X
193 GTO 03
194*LBL 10
195 FC? 08
196 GTO 10
197 FS?C 09
198 GTO 20
199 DSE 24
200 FS? 30
```

```
201 GTO 08
202 CARD
203 FS? 10
204 STO 20
205 STO 21
206 " RIVER. . ."
207 FS? 10
208 " TURN. . ."
209 AVIEW
210 RCL 46
211 FC? 10
212 GTO 04
213 RCL 47
214 XEQ 17
215 STO 47
216 RCL 46
217 XEQ 17
218*LBL 04
219 FC? 10
220 XEQ 18
221 STO 46
222 STO 08
223  E6
224 /
225 X^2
226 RCL 50
227 +
228 RCL 49
229 *
230 STO 10
231 CLA
232 ARCL 45
233 FS? 10
234 ARCL IND 20
235 FC?C 10
236 ARCL IND 21
237 ASTO 45
238 CLA
239 ARCL 44
240 ARCL 45
241 ARCL 26
242 CLX
243 GTO 03
244*LBL 08
245 "/"
246 ARCL IND 13
247 ARCL IND 14
248 ASTO 24
249 CLA
250 ARCL 44
251 ARCL 45
252 ARCL 24
253 ATOX
254 AVIEW
255 RCL 13
256 X<> 15
257 STO 13
258 RCL 14
259 X<> 16
260 STO 14
261 RCL 47
262 XEQ 18
263 STO 47
264 RCL 46
265 -
266 GTO 07
267*LBL 10
268 CLA
269 ARCL 21
270 RCL 13
271 X<0?
272 GTO 10
273 6
274 "`/"
275*LBL 15
276  E
277*LBL 19
278 RCL IND X
279 ARCL IND X
280 AVIEW
281 COS
282 SIGN
283 +
284 X#Y?
285 GTO 19
286 RCL 22
287*LBL 06
288 RCL 08
289 -
290*LBL 07
291 X#0?
292 SIGN
293 RCL 12
294 *
295 ST+ 41
296 RCL 41
297 "  "
298 X>0?
299 "`+"
300 ARCL 41
301 "` $"
302 FIX 4
303 SF 29
304 AVIEW
305 STOP
306 GTO 01
307*LBL 10
308 ARCL 23
309 AVIEW
310*LBL 11
311 CLA
312*LBL 05
313 34
314 GETKEYX
315 X=0?
316 GTO 10
317 XTOA
318 LASTX
319 -
320 CLRGX
321 GTO 05
322*LBL 10
323 ANUM
324 STO 20
325 ALENG
326 ST+ X
327 STO 13
328 20
329 " "
330 15
331*LBL 12
332 RCL IND X
333 X#0?
334 ARCL IND X
335 SIGN
336 +
337 X#Y?
338 GTO 12
339 RCL 06
340 DSE X
341 LOG
342 24
343 +
344 FC? 07
345 ARCL IND X
346 AVIEW
347 XEQ 08
348 FS? 07
349 GTO 07
350 SIGN
351 RCL 00
352 X^2
353 -
354 SQRT
355 ST/ 10
356 PI
357 PI
358 RCL 13
359 -
360 X<0?
361 +
362 RCL 07
363 X<Y?
364 STO 10
365 CLX
366 GTO 03
367*LBL 08
368 FS? 07
369 GTO 06
370 RCL 43
371 REGSWAP
372 XEQ 13
373*LBL 06
374 RCL 43
375 REGSWAP
376*LBL 09
377 XEQ 13
378 FS? 07
379 RTN
380 CLA
381 ARCL IND 15
382 ARCL IND 16
383 ARCL IND 17
384 ARCL IND 18
385 ARCL IND 19
386 ASTO 21
387 ARCL 23
388  E6
389 /
390 X^2
391 STO 10
392 RTN
393*LBL 07
394 5
395 STO 22
396 CHS
397 STO 12
398 CLX
399 X<> 08
400 RCL 07
401 X=0?
402 GTO 07
403 .47
404 *
405 E^X
406 .75
407 *
408 RND
```

```
409 STO 12
410  E
411 X#Y?
412 GTO 07
413 37
414 R^
415 X<Y?
416 DSE 12
417 INT
418 33
419 X>Y?
420 DSE 12
421*LBL 07
422 RCL 00
423 FRC
424 4
425 /
426 8
427 +
428 E^X
429 ST* 12
430 6
431 " "
432 GTO 15
433*LBL 16
434 CLX
435 STO 48
436 SIGN
437 CHS
438 #$#
439 RCL 13
440 X<> 15
441 STO 13
442 STO 04
443 RCL 14
444 X<> 16
445 STO 14
446 STO 05
447 CLX
448 #$#
449 RCL 48
450 RTN
451*LBL 17
452 STO 48
453 CHS
454 #$#
455 RCL 13
456 X<> 15
457 STO 13
458 STO 01
459 RCL 14
460 X<> 16
461 STO 14
462 STO 05
463 #$#
464 RCL 14
465 STO 05
466 RCL 13
467 STO 02
468 #$#
469 RCL 14
470 STO 05
471 RCL 13
472 STO 03
473 #$#
474 RCL 14
475 STO 05
476 #$#
477 RCL 13
478 STO 05
479 CLX
480 #$#
481 RCL 48
482 RTN
483*LBL 18
484 STO 48
485 CHS
486 #$#
487 RCL 13
488 STO 01
489 RCL 14
490 STO 02
491 #$#
492 RCL 13
493 STO 01
494 RCL 14
495 STO 03
496 #$#
497 RCL 13
498 STO 01
499 RCL 14
500 STO 04
501 #$#
502 RCL 13
503 STO 02
504 RCL 14
505 STO 03
506 #$#
507 RCL 13
508 STO 02
509 RCL 14
510 STO 04
511 #$#
512 RCL 13
513 STO 03
514 RCL 14
515 STO 04
516 #$#
517 RCL 13
518 STO 01
519 #$#
520 RCL 13
521 STO 02
522 #$#
523 RCL 13
524 STO 03
525 #$#
526 RCL 13
527 STO 04
528 #$#
529 RCL 14
530 STO 01
531 #$#
532 RCL 14
533 STO 02
534 #$#
535 RCL 14
536 STO 03
537 #$#
538 RCL 14
539 STO 04
540 #$#
541 CLX
542 #$#
543 RCL 48
544 RTN
545*LBL 13
546 RCL 06
547 INT
548 RCL 42
549 ST/ 06
550 MOD
551 X#0?
552 CARD
553 X#0?
554 STO IND Y
555 X#0?
556 GTO 13
557 #$#
558 FC? 07
559 STO 08
560 END
```

Sudoku Solver

Martin/Baillard – http://hp41programs.yolasite.com/sudoku.php

A sudoku is a 81-cell grid with 9 rows, 9 columns and 9 regions of 3 x 3 cells.
Each row, each column and each region must contain all the integers from 1 to 9 exactly once, for instance:

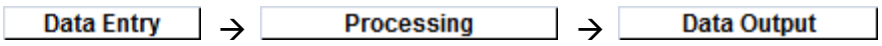
```
4 6 1 | 3 7 2 | 8 5 9
9 3 5 | 4 8 6 | 1 7 2
2 7 8 | 9 1 5 | 3 6 4
-----------------------
7 9 4 | 2 3 1 | 5 8 6
5 1 2 | 8 6 9 | 4 3 7
6 8 3 | 5 4 7 | 9 2 1
-----------------------
8 4 6 | 7 9 3 | 2 1 5
1 2 9 | 6 5 8 | 7 4 3
3 5 7 | 1 2 4 | 6 9 8
```

Given a partially empty grid, the puzzle consists in finding the missing numbers.
The sudoku above is the solution of the problem below, where the empty cells are replaced by zeros:

```
0 0 0 | 3 0 0 | 0 5 0
0 0 5 | 4 0 6 | 0 0 2
2 7 0 | 0 1 0 | 3 6 0
-----------------------
7 0 4 | 2 3 0 | 0 0 0
5 1 0 | 0 0 0 | 0 3 7
0 0 0 | 0 4 7 | 9 0 1
-----------------------
0 4 6 | 0 9 0 | 0 1 5
1 0 0 | 6 0 8 | 7 0 0
0 5 0 | 0 0 4 | 0 0 0
```

This M-Code routine **SDK** uses a similar scheme to solve a Sudoku seen in the FOCAL routine, but it is almost 200 times as fast as the focal program. Therefore, many more puzzles can be solved in a "reasonable" time. "SDK" solves a sudoku by backtracking. Though it could theoretically solve any - solvable - sudoku, only a subset can be practically solved, due to very long execution times involved in some instances.

A FOCAL driver program "**SUDOKU**" acts as master of ceremonies, arranging the data input, processing by SDK, and output of the results - represented by the block diagram below:



Data entry in turn also uses its own FOCAL driver, "SUD" – managing function ^SROW.

Grid data entry

One of the nice aspects of the implementation is the fast and convenient way to enter the Sudoku grid data. The traditional approach would require prompting for each individual element, for a total of 81 – clearly a tiring and inefficient system.

Considering that the Sudoku elements are single digits (0 to 9), there must be a better way to go about the data entry process – and there is: meet the **^SROW** function, which uses Alpha as vehicle for the digit input *in blocks of multiple elements at once*, (therefore arranged in rows) all with a special keyboard enabled for the task, as follows:

- *Numeric keypad, for 0-9 as element value*
- *Back arrow to delete previous entry or cancel out*
- *R/S, to terminate the entry sequence*
- *ON turns the calculator off*

The figures below show entry of the elements in rows #1 and #3 mid-way. Note how digits are separated by a colon, delimiting each individual digit. The left of the display has an input arrow plus a number, signaling the "row" being edited.

The editing process may be terminated at any time. Elements are being stored in Alpha, from where they'll be retrieved by the data input routine in a loop using function ANUMDL – converting the alpha string into a valid number and storing it in the appropriate data register.

Solving the puzzle with SDK.

At the core of this Sudoku implementation is the number-crunching engine, SDK, the real heart which actually resolve the puzzles and write the results for the data output routines to pick-up. SDK was written by Jean-Marc Baillard; see the web pages on the URL above.

Execution times can be very long, therefore it's most recommended to use TURBO50 on the 41CL – or a PC-emulator (like V41 running in turbo mode). Note also that some grids won't have a valid solution, which will be displayed as "DATA ERROR" or 'NO SOLUTION"- both really meaning: "sorry, no cigar".

The best way to test the functionality is by solving the canned examples **"SDK0"**, **"SDK1"**, and **"SDK2"**. The first one is a trivial all-zero (blank) grid – not a valid Sudoku but interesting nonetheless. The second is a simple easy case, which is resolved quickly. The third however will require a much longer execution time – and all the three of them can be used to check that the programs are working fine. Refer to JM's pages for the grid definition and solutions of these examples.

Example1: Solve the following sudoku:

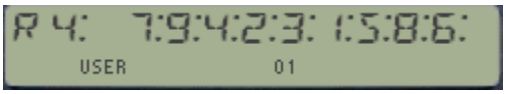
```
0 0 0 | 3 0 0 | 0 5 0
0 0 5 | 4 0 6 | 0 0 2
2 7 0 | 0 1 0 | 3 6 0
-----------------------
7 0 4 | 2 3 0 | 0 0 0
5 1 0 | 0 0 0 | 0 3 7
0 0 0 | 0 4 7 | 9 0 1
-----------------------
0 4 6 | 0 9 0 | 0 1 5
1 0 0 | 6 0 8 | 7 0 0
0 5 0 | 0 0 4 | 0 0 0
```

A more difficult example: With the grid:

```
0 9 0 | 0 4 2 | 0 1 0
0 0 5 | 0 0 0 | 0 0 0
3 0 0 | 0 0 0 | 9 0 4
-----------------------
0 0 0 | 0 0 0 | 1 9 3
5 2 0 | 7 0 0 | 0 0 6
0 0 0 | 0 0 1 | 0 0 0
-----------------------
9 0 0 | 0 5 0 | 0 6 0
0 0 0 | 2 0 4 | 0 0 7
0 0 0 | 0 1 6 | 8 0 0
```

Outputting the results.

Data output is presented in the same compact mode way in all cases – regardless of the program used. There is one prompt per row, repeated until the complete grid is shown. This facilitates reading the solution as it avoids multiple prompts to see the elements of a single row. Below are some examples taken from the solution of the "SDK1" puzzle.



The complete solution to the difficult example is provided below:

```
7 9 8 | 6 4 2 | 3 1 5
4 1 5 | 9 7 3 | 6 2 8
3 6 2 | 1 8 5 | 9 7 4
------------------------------
6 7 4 | 5 2 8 | 1 9 3
5 2 1 | 7 3 9 | 4 8 6
8 3 9 | 4 6 1 | 7 5 2
------------------------------
9 4 3 | 8 5 7 | 2 6 1
1 8 6 | 2 9 4 | 5 3 7
2 5 7 | 3 1 6 | 8 4 9
```

Data Registers used:

- R00: scratch
- R01 & R09 hold the row values.
- R10 to R18 hold the elements of the sudoku grid, in column order (or row order) with 0 in the empty cells.

FOCAL listing:

First the main driver programs, followed by the example loaders:

```
01*LBL "SUDOKU"
 02 SIZE?
 03 20
 04 X>Y?
 05 PSIZE
 06 9
 07 E3/E+
 08 CLRGX
 09*LBL 01
 10  E
 11 STO IND Y
 12 CLX
 13 9
 14 E3/E+
 15 ^SROW
 16 CF 22
 17 -SUDOKU 1C
 18*LBL 00
 19 ANUMDL
 20 FC?C 22
 21 GTO 02
 22 X=0?
 23 GTO 05
 24 RCL Y
 25 INT
 26 10^X
 27 /
 28 ST+ IND Z
 29*LBL 05
 30 RDN
 31 ISG X
 32 GTO 00
 33*LBL 02
 34 RDN
 35 ISG X
 36 GTO 01
37*LBL "SUD"
 38 9
 39 E3/E+
 40 LASTX
 41 +
 42 E3/E+
 43 REGMOVE
 44 SDK
 45 RASP
 46 " ** DONE **"
 47 AVIEW
 48 PSE
49*LBL "SUDVIEW"
 50 9
 51 E3/E+
 52*LBL 03
 53 "R"
 54 AINT
 55 "`: "
 56 9
 57 E3/E+
 58 RCL IND Y
 59*LBL 04
 60 FRC
 61  E1
 62 *
 63 AINT
 64 "`:"
 65 ISG Y
 66 GTO 04
 67 AVIEW
 68 RDN
 69 RDN
 70 ISG X
 71 GTO 03
 72 END
```

```
01*LBL "SDK1"
 02 -SUDOKU 1C
 03 1,00030005
 04 STO 01
 05 1,005406002
 06 STO 02
 07 1,27001036
 08 STO 03
 09 1,70423
 10 STO 04
 11 1,510000037
 12 STO 05
 13 1,000047901
 14 STO 06
 15 1,046090015
 16 STO 07
 17 1,1006087
 18 STO 08
 19 1,050004
 20 STO 09
 21 XROM "SUD"
 22 RTN
23*LBL "SDK0"
 24 -SUDOKU 1C
 25 9
 26 E3/E+
 27 ENTER^
 28  E
 29*LBL 05
 30 STO IND Y
 31 ISG Y
 32 GTO 05
 33 XROM "SUD"
 34 END
```

MCODE listing:

Here's the code for the Data Entry routine, ^SROW:

```
Header A164   097   "W"
Header A165   00F   "O"
Header A166   012   "R"          prompts SDK Row
Header A167   013   "S"
Header A168   01E   "^"          Ángel Martin
^SROW A169    0B8   READ 2(Y)
      A16A    070   N=C ALL
      A16B    345   ?NC XQ       Clears Alpha
      A16C    040   ->10D1       [CLA]
      A16D    3C1   ?NCXQ        Enable & Clear LCD
      A16E    0B0   ->2CF0       [CLLCDE]
      A16F    3BD   ?NC XQ
      A170    01C   ->07EF       [MESSL]
      A171    21E   "^"
      A172    0B0   C=N ALL      row #
      A173    37C   RCR 12
      A174    21C   PT= 2
      A175    010   LD@PT- 0
      A176    2D0   LD@PT- B
      A177    3E8   WRIT 15(e)   write it in display (9-bit)
      A178    130   LDI S&X
      A179    020   "  "
      A17A    3E8   WRIT 15(e)
DECNTRY       115   ?NC XQ       Partial Data Entry!
      A17C    038   ->0E45       [NEXT1]
BCKARW        19B   JNC  +51d
      A17E    00C   ?FSET 3      numeric input?
      A17F    0E3   JNC  +28d    NO, KEEP LOOKING
      A180    0BE   A<>C MS      recall LS digit from A[13]
      A181    2FC   RCR 13       move it over digit 0
      A182    21C   PT= 2        ensures no lower-case bits!
      A183    010   LD@PT- 0     from angle chr = 10D
      A184    0D0   LD@PT- 3     add a 3 on digit 1
      A185    070   N=C ALL
      A186    3D8   C<>ST        add a colon as separator
      A187    288   SETF 7
      A188    3D8   C<>ST
      A189    3E8   WRIT 15(e)   write it in display (9-bit)
      A18A    149   ?NC XQ       Disable PER, enable RAM
      A18B    024   ->0952       [ENCP00]
```

```
        A18C  0B0   C=N ALL
        A18D  39C   PT= 0
        A18E  058   G=C @PT,+     reset PTEMP bits
        A18F  051   ?NC XQ
        A190  0B4   ->2D14        [APNDNW]
        A191  130   LDI S&X
        A192  03A   ":"           appends ":"  [03A]
        A193  3D5   ?NC XQ
        A194  07C    ->1FF5       [APND10]
        A195  39C   PT= 0
        A196  042   C=0 @PT
        A197  058   G=C @PT,+     reset PTEMP bits
        A198  3D9   ?NC XQ        Enable Display (not cleared)
        A199  01C   ->07F6        [ENLCD]
        A19A  30B   JNC -31d      ONE PROMPT
        A19B  0B0   C=N ALL       PRESSED KEY CODE
        A19C  106   A=C S&X
        A19D  130   LDI S&X
        A19E  370   CON:          R/S keycode [370]
        A19F  366   ?A#C S&X      terminate digit entry
        A1A0  033   JNC +06
        A1A1  265   ?NC XQ        Blink Display - pass #1
        A1A2  020    ->0899       [BLINK1]
        A1A3  265   ?NC XQ        Blink Display - pass #2
        A1A4  020    ->0899       [BLINK1]
        A1A5  3AB   JNC -11d      ONE PROMPT
WAYOUT  3D9   ?NC XQ        Clear LCD
        A1A7  0B0   ->2CF6        [CLRLCD]
        A1A8  261   ?NC XQ        Reset keyboard
        A1A9  000   ->0098        [RSTKB]
        A1AA  149   ?NC XQ        Disable PER, enable RAM
        A1AB  024   ->0952        [ENCP00]
        A1AC  215   ?NC XQ        Reset BIT sequence
        A1AD  00C   ->0385        [RSTSQ]
        A1AE  3C1   ?NC GO
        A1AF  002   ->00F0        [NFRPU]
DELCHAR 3B8   READ 14(d)  to delete rightmost chr
        A1B1  149   ?NC XQ        Disable PER, enable RAM
        A1B2  024   ->0952        [ENCP00]
        A1B3  178   READ 5(M)
        A1B4  2EE   ?C#0 ALL      anything in Alpha?
        A1B5  037   JC  +06       yes, go on
        A1B6  104   CLRF 8        no, abort if empty
        A1B7  1B1   ?NC XQ        Mainframe Message
        A1B8  070    ->1C6C       [MSGA]
```

```
          A1B9  03C  "NULL"        from table
          A1BA  363  JNC -20d
          A1BB  36D  PORT DEP:     remove Alpha's last chr
          A1BC  08C  XQ            Ken Emery's book
          A1BD  07D   ->A47D       [ADEL]
          A1BE  3D9  ?NC XQ        Enable Display (not cleared)
          A1BF  01C  ->07F6        [ENLCD]
          A1C0  369  PORT DEP:     display ONE prompt
          A1C1  03C  GO            (too far for jumps)
          A1C2  17B   ->A17B       [DECNTRY]
```

The code for the SDK Solver is shown below:

```
Header A078  08B  "K"
Header A079  004  "D"             MCODE Solver
Header A07A  013  "S"             Expects data in R10-R19
SDK    A07B  379  PORT DEP:       give feedback
          A07C  03C  XQ
          A07D  064  ->A064        [SHOWUP]
          A07E  3C8  CLRKEY
          A07F  378  READ 13( c)
          A080  03C  RCR 3
          A081  106  A=C S&X
          A082  130  LDI S&X
          A083  012  CON:          needs 11 registers
          A084  146  A=A+C S&X
          A085  130  LDI S&X
          A086  200  CON:    512
          A087  306  ?A<C S&X
          A088  381  ?NC GO        Displays"NonExistent"
          A089  00A  ->02E0        [ERRNE]
          A08A  378  READ 13(c)
          A08B  0A6  A<>C S&X      save it in A
          A08C  106  A=C S&X       keep it in C
          A08D  1BC  RCR 11
          A08E  130  LDI S&X
          A08F  009  CON:
          A090  246  C=A-C S&X
          A091  106  A=C S&X
          A092  27C  RCR 9
          A093  0A6  A<>C S&X
          A094  0BC  RCR 5
          A095  070  N=C ALL
          A096  04E  C=0 ALL
          A097  19C  PT=11
```

```
        A098  050   LD@PT- 1      C = 111111111
        A099  214   ?PT= 2        in nybbles  11 to 3
        A09A  3F3   JNC -02
        A09B  000
        A09C  000
        A09D  000
        A09E  000
        A09F  000
        A0A0  000
        A0A1  268   WRIT 9(Q)
        A0A2  10E   A=C ALL
        A0A3  1EE   C=C+C ALL
        A0A4  1EE   C=C+C ALL
        A0A5  1EE   C=C+C  ALL
        A0A6  20E   C=A+C ALL
        A0A7  228   WRIT 8(P)     P = 999999999   in nybbles  11 to 3
        A0A8  0A0   SLCT P
LOOP0   A0A9  21C   PT=2
LOOP1   A0AA  3DC   PT=PT+1
        A0AB  0B0   C= N ALL
        A0AC  354   ?PT=12
        A0AD  063   JNC +12d
        A0AE  266   C=C-1 S&X
        A0AF  27A   C=C-1 M
        A0B0  070   N=C ALL
        A0B1  106   A=C S&X
        A0B2  17C   RCR 6
        A0B3  366   ?A#C S&X
        A0B4  3AF   JC  -11d      [LOOP0]
        A0B5  04E   C=0 ALL
        A0B6  270   RAMSLCT
        A0B7  228   WRIT 8(P)
        A0B8  3E0   RTN           the routine stops here if a solution is found
        A0B9  270   RAMSLCT
        A0BA  038   READATA
        A0BB  2E2   ?C#0 @PT
        A0BC  377   JC  -18d      [LOOP1]
        A0BD  10E   A=C ALL
        A0BE  046   C=0 S&X
        A0BF  270   RAMSLCT
        A0C0  238   READ 8(P)
LOOP2   A0C1  158   M=C ALL
        A0C2  0E0   SLCT Q
        A0C3  01C   PT=3
        A0C4  362   ?A#C@PT       we test if the digit is different from all the other digits in
```

			the same column
A0C5	07B	JNC +15d	
A0C6	3DC	PT=PT+1	
A0C7	354	?PT=12	
A0C8	3E3	JNC -04	
A0C9	0A0	SLCT P	
A0CA	130	LDI S&X	
A0CB	008	CON:	
A0CC	10E	A=C ALL	
A0CD	0B0	C=N ALL	
A0CE	17C	RCR 6	
A0CF	226	C=C+1 S&X	
A0D0	270	RAMSLCT	
A0D1	0E6	B<>C S&X	
A0D2	038	READATA	
A0D3	362	?A#C@PT	we test if the digit is different from all the other digits in the same row
A0D4	1C3	JNC +56d	
A0D5	0E6	B<>C S&X	
A0D6	1A6	A=A-1 S&X	
A0D7	3C3	JNC -08	
A0D8	0B0	C=N ALL	
A0D9	10E	A=C ALL	
A0DA	1A6	A=A-1 S&X	
A0DB	17C	RCR 6	
A0DC	226	C=C+1 S&X	
A0DD	226	C=C+1 S&X	
A0DE	226	C=C+1 S&X	
A0DF	306	?A<C S&X	
A0E0	03F	JC +07	
A0E1	226	C=C+1 S&X	
A0E2	226	C=C+1 S&X	
A0E3	226	C=C+1 S&X	
A0E4	306	?A<C S&X	
A0E5	017	JC +02	
A0E6	03C	RCR 3	
A0E7	0E6	B<>C S&X	B.X contains the address of the register in the right lower corner of the 3x3 region (R09 or R06 or R03)
A0E8	013	JNC +02	
A0E9	20B	JNC -63d	[LOOP1]
A0EA	0E0	SLCT Q	
A0EB	01C	PT=3	
A0EC	0A0	SLCT P	
A0ED	014	?PT=3	
A0EE	087	JC +16d	

```
A0EF  054  ?PT=4
A0F0  077  JC  +14d
A0F1  094  ?PT=5
A0F2  067  JC  +12d
A0F3  0E0  SLCT Q
A0F4  15C  PT=6
A0F5  0A0  SLCT P
A0F6  154  ?PT=6
A0F7  03F  JC  +07
A0F8  294  ?PT=7
A0F9  02F  JC  +05
A0FA  114  ?PT=8
A0FB  01F  JC  +03
A0FC  0E0  SLCT Q
A0FD  25C  PT= 9
A0FE  0E0  SLCT Q      now, pointer Q points to the right lower corner of
                       the 3x3 region ( 9 or 6 or 3 )
A0FF  013  JNC +02
A100  20B  JNC -63d    [LOOP2]
A101  198  C=M ALL
A102  130  LDI S&X     the 4 instructions on the left prepare 2 loops that
                       may be executed 3 times
A103  002  CON:
A104  23E  C=C+1 MS
A105  23E  C=C+1 MS
A106  10E  A=C ALL
A107  0E6  B<>C S&X
A108  270  RAMSLCT
A109  0E6  B<>C S&X
A10A  038  READATA
A10B  362  ?A#C @PT    Test if the digit is different from all the other digits
                       In the same 3x3 region
A10C  0B3  JNC +22d
A10D  3DC  PT=PT+1
A10E  1A6  A=A-1 S&X
A10F  3E3  JNC -04
A110  166  A=A+1 S&X
A111  3D4  PT=PT-1
A112  166  A=A+1 S&X
A113  3D4  PT=PT-1
A114  166  A=A+1 S&X
A115  3D4  PT=PT-1
A116  0E6  B<>C S&X
A117  266  C=C-1 S&X
A118  0E6  B<>C S&X
```

```
A119  1BE   A=A-1 MS
A11A  36B   JNC -19
A11B  0A0   SELCT P
A11C  0B0   C=N ALL      if the candidate number has successfully passed
                         all the tests, it replaces the zero in the empty cell
A11D  270   RAMSLCT
A11E  038   READATA
A11F  0A2   A<>C@PT
A120  2F0   WRITDATA
A121  243   JNC -56d     [LOOP1]
A122  0A0   SLCT P       the execution jumps here if the digit has been rejected
A123  198   C=M ALL
A124  10E   A=C ALL
A125  046   C=0 S&X
A126  270   RAMSLCT
A127  278   C=Q
A128  1CE   A=A-C ALL    we started with 999999999 in M, then we try
                         888888888 in M , ...etc...
A129  0B0   C=N ALL
A12A  270   RAMSLCT
A12B  038   READATA
A12C  0AE   A<>C ALL
A12D  2EE   ?C#0 ALL     ... until we arrive at  000000000
A12E  013   JNC +02
A12F  28B   JNC -47d     [LOOP2]
A130  3D4   PT=PT-1      if all the digits are rejected for this cell, we go to the
                         previous cell ( backtracking )
A131  214   ?PT=12
A132  107   JC +32d      we must also move to the previous register if we were
                         at the left of a register
A133  0B0   C=N ALL
A134  03C   RCR 3
A135  270   RAMSLCT     otherwise, we check in a register between R10 and R18
                         if the cell was empty or not
A136  038   READATA
A137  2E2   ?C#0 @PT
A138  3C7   JC  -08      If the cell was not empty, go to the previous cell again
A139  0B0   C=N ALL
A13A  270   RAMSLCT
A13B  038   READATA
A13C  10E   A=C ALL
A13D  04E   C=0 ALL
A13E  0A2   A<>C @PT
A13F  0AE   A<>C ALL
A140  2F0   WRITDATA     the number in the non-fixed cell is replaced by 0
```

A141	1A2	A=A-1 @PT	
A142	342	?A#0 @PT	
A143	36B	JNC -19d	if the last tested digit was 1, we again go to the previous non-fixed cell
A144	046	C=0 S&X	
A145	270	RAMSLCT	
A146	278	READ 9(Q)	
A147	08E	B=A ALL	
A148	10E	A=C ALL	
A149	322	?A<B @PT	
A14A	01B	JNC +03	if the digit in the previous cell was, say 8, we must recreate 777777777 which will be stored in CPU register M (loop2)
A14B	14E	A=A+C ALL	
A14C	3EB	JNC -03	
A14D	0B0	C=N ALL	
A14E	270	RAMSLCT	
A14F	038	READATA	
A150	0AE	A<>C ALL	
A151	2F3	JNC -34d	[LOOP2]
A152	265	?NCXQ	
A153	020	->0899	[BLINK1]
A154	35C	PT=12	we get here if we must go to the "previous" register (R01->R02->R03 ...)
A155	0B0	C=N ALL	
A156	226	C=C+1 S&X	
A157	23A	C=C+1 M	
A158	070	N=C ALL	
A159	27C	RCR 9	
A15A	106	A=C S&X	
A15B	0BC	RCR 5	
A15C	160	?LOWBAT	the 4 instructions written in yellow on the left
A15D	360	?C RTN	will stop the routine if the batteries are low
A15E	3CC	?KEY	or if you press any key
A15F	360	?CRTN	They may be deleted if you have a "newest" HP-41: simply press ENTER^ ON to stop the program
A160	306	?A<C S&X	
A161	27B	JNC -49d	Replace this line by 2A3 JNC-44d if you don't key in the yellow instructions
A162	0B5	?NC GO	shows "DataError" msg
A163	0A2	->282D	[ERRDE]

Roman Numerals

Martin-Baillard,

This implementation uses Jean-Marc's FOCAL routines as the basis of the Arabic<>Roman conversions "N>R" and "R>N" - but adds a nice twist by providing a MCODE data entry for Roman numbers. (**PMTR**, "prompt Roman").

The data entry is therefore simplified, as only the valid roman letters (I, V, X, C, L, D, and M) are allowed by the function. You can delete entries using the back arrow, or proceed using R/S – which will leave the roman string in ALPHA and transfer the execution to the Roman to Arabic conversion program (R>A).

In fact this auxiliary function is very similar to the sudoku row value entering described n the previous section – both use the same techniques and share many characteristics.

MCODE listing:

```
BCKARW          369   PORT DEP      DEL char from LCD & Alpha
        A505    03C   GO
        A506    162    ->A562       [DELCHAR]
Header  A507    092   "R
Header  A508    014   "T"           Roman Prompt
Header  A509    00D   "M"
Header  A50A    010   "P"           Ángel Martin
PMTR    A50B    345   ?NC XQ        Clears Alpha
        A50C    040   ->10D1        [CLA]
        A50D    3C1   ?NC XQ        Enable & Clear Disp
        A50E    0B0   ->2CF0        [CLLCDE]
        A50F    3BD   ?NC XQ        Message Line
        A510    01C   ->07EF        [MESSL]
        A511    092   "R:"          "R:" roman clue
        A512    220   "  "
RENTRY          115   ?NC XQ        Partial Data Entry!
        A514    038   ->0E45        [NEXT1]
        A515    37B   JNC -17d      back arrow pressed
        A516    0B0   C=N ALL       PRESSED KEY CODE
        A517    106   A=C S&X
        A518    130   LDI S&X
        A519    370   CON:          R/S keycode
        A51A    366   ?A#C S&X
        A51B    02B   JNC +05       terminate digit entry
        A51C    130   LDI S&X
        A51D    030   CON:          ENTER^ keycode
        A51E    366   ?A#C S&X
```

```
A51F  027  JC +04          terminate digit entry
A520  369  PORT DEP:
A521  03C  GO
A522  186  ->A586 [        EXIT]
A523  21C  PT= 2
A524  130  LDI S&X
A525  200  CON:            SQRT keycode [200]
A526  366  ?A#C S&X
A527  027  JC +04          NO, KEEP LOOKING
A528  130  LDI S&X
A529  003  "C"             100
A52A  033  JNC +06         way out
A52B  222  C=C+1 @PT       LOG keycode [300]
A52C  366  ?A#C S&X
A52D  027  JC +04          NO, KEEP LOOKING
A52E  130  LDI S&X
A52F  004  "D"             500
A530  03B  JNC +07         way out
A531  130  LDI S&X
A532  220  CON:            STO keycode [220]
A533  366  ?A#C S&X
A534  027  JC +04          NO, KEEP LOOKING
A535  130  LDI S&X
A536  00C  "L"             50
A537  033  JNC +06         way out
A538  222  C=C+1 @PT       RCL keycode [320]
A539  366  ?A#C S&X
A53A  027  JC +04          NO, KEEP LOOKING
A53B  130  LDI S&X
A53C  00D  "M"             1000
A53D  03B  JNC +07         way out
A53E  130  LDI S&X
A53F  310  CON:            COS keycode [310]
A540  366  ?A#C S&X
A541  027  JC +04          NO, KEEP LOOKING
A542  130  LDI S&X
A543  009  "I"             1
A544  03B  JNC +07         way out
A545  130  LDI S&X
A546  350  CON:            "6" keycode [310]
A547  366  ?A#C S&X
A548  027  JC +04          NO, KEEP LOOKING
A549  130  LDI S&X
A54A  018  "X"             10
A54B  03B  JNC +07         way out
```

```
        A54C  130  LDI S&X
        A54D  150  CON:       "4" keycode [310]
        A54E  366  ?A#C S&X
        A54F  097  JC +18     One Prompt
        A550  130  LDI S&X
        A551  016  "V"        5
        A552  3E8  WRIT 15(e) write CHR  in display
        A553  106  A=C S&X
        A554  130  LDI S&X
        A555  040  CON:
        A556  206  C=C+A S&X  add 40 for Alpha code
        A557  39C  PT= 0
        A558  058  G=C @PT,+
        A559  149  ?NC XQ     Disable PER, enable RAM
        A55A  024  ->0952     [ENCP00]
        A55B  051  ?NC XQ
        A55C  0B4  ->2D14     [APNDNW]
        A55D  042  C=0 @PT
        A55E  058  G=C @PT,+  reset PTEMP bits
        A55F  3D9  ?NC XQ     Enable Display (not cleared)
        A560  01C  ->07F6     [ENLCD]
        A561  113  JNC +34    One Prompt
DELCHAR 3B8  READ 14(d)       to delete rightmost chr
        A563  149  ?NC XQ     Disable PER, enable RAM
        A564  024  ->0952     [ENCP00]
        A565  178  READ 5(M)
        A566  2EE  ?C#0 ALL   abort if empty
        A567  037  JC  +06
        A568  104  CLRF 8
        A569  1B1  ?NCXQ      Mainframe Message
        A56A  070   ->1C6C    [MSGA]
        A56B  03C  "NULL"     from table
        A56C  0D3  JNC +26d
DCHR    A56D  238  READ 8(P)
        A56E  10E  A=C ALL
        A56F  1F8  READ 7(O)
        A570  0AA  A<>C PT<-
        A571  23C  RCR 2
        A572  2F0  WRIT DATA
        A573  1B8  READ 6(N)
        A574  0AA  A<>C PT<-
        A575  23C  RCR 2      Delete Alpha last chr
        A576  2F0  WRIT DATA  (from Ken Emery's book)
        A577  178  READ 5(M)
        A578  04A  C=0 PT<-
```

```
      A579  0AA  A<>C PT<-
      A57A  23C  RCR 2
      A57B  2F0  WRIT DATA
      A57C  0AE  A<>C ALL
      A57D  23C  RCR 2
      A57E  228  WRIT 8(P)
      A57F  042  C=0 @PT
      A580  058  G=C @PT,+     reset PTEMP bits
      A581  3D9  ?NC XQ        Enable Display (not cleared)
      A582  01C  ->07F6        [ENLCD]
      A583  369  PORT DEP:     display ONE prompt
      A584  03C  GO
      A585  113   ->A513       [RENTRY]
EXIT  A586  3D9  ?NC XQ        Clear LCD
      A587  0B0  ->2CF6        [CLRLCD]
      A588  149  ?NC XQ        Disable PER, enable RAM
      A589  024  ->0952        [ENCP00]
      A58A  261  ?NC XQ        Reset keyboard
      A58B  000  ->0098        [RSTKB]
      A58C  215  ?NC XQ        Reset BIT sequence
      A58D  00C  ->0385        [RSTSQ]
      A58E  178  READ 5(M)
      A58F  2EE  ?C#0 ALL
      A590  3A0  ?NC RTN       abort if empty
      A591  191  ?NC XQ
      A592  00C  ->0364        [XAVIEW]
      A593  35D  ?NC XQ        get this address
      A594  000  ->00D7        [PCTOC]
      A595  03C  RCR 3         page number to C<3>
      A596  10E  A=C ALL
      A597  130  LDI S&X
      A598  010  CON: 17
      A599  146  A=A+C S&X     A[(3-0] = addr of first user code word
      A59A  2F9  ?NC GO
      A59B  0BE   ->2FBE       [XRM20]
```

Note the direct transfer from the PMTR to the FOCAL routine, using a call to the OS routine [XRM20], assumeing that the first FOCAL instruction on "R>N" is located 17 bytes below the point of call.

FOCAL drivers:

```
00 LBL "R>N"
01 CLST
02*LBL 01
03 ATOX
04 X=0?
05 GTO 00
06 RDN
07 XEQ IND T
08 X<>Y
09 X<Y?
10 CHS
11 ST+ Z
12 RDN
13 GTO 01
14*LBL 77
15 RTN
16*LBL 68
17 5 E2
18 RTN
19*LBL 67
20 RTN
21*LBL 76
22 50
23 RTN
24*LBL 88
25 RTN
26*LBL 86
27 5
28 RTN
29*LBL 73
30 RTN
31*LBL 00
32 +
33 +
34 CLD
35 END
```

```
00 LBL "N>R"
01 CLA
02*LBL 01
03  E3
04 X>Y?
05 GTO 00
06 -
07 "`M"
08 GTO 01
09*LBL 00
10 CLX
11 9 E2
12 X<=Y?
13 "`CM"
14 X>Y?
15 CLX
16 -
17 5 E2
18 X<=Y?
19 "`D"
20 X>Y?
21 CLX
22 -
23 4 E2
24 X<=Y?
25 "`CD"
26 X>Y?
27 CLX
28 -
29*LBL 02
30  E2
31 X>Y?
32 GTO 00
33 -
34 "`C"
35 GTO 02
36*LBL 00
37 CLX
38 90
39 X<=Y?
40 "`XC"
41 X>Y?
42 CLX
43 -
44 50
45 X<=Y?
46 "`L"
47 X>Y?
48 CLX
49 -
50 40
51 X<=Y?
52 "`XL"
53 X>Y?
54 CLX
55 -
56*LBL 03
57  E1
58 X>Y?
59 GTO 00
60 -
61 "`X"
62 GTO 03
63*LBL 00
64 DSE X
65 X<=Y?
66 "`IX"
67 X>Y?
68 CLX
69 -
70 5
71 X<=Y?
72 "`V"
73 X>Y?
74 CLX
75 -
76 4
77 X<=Y?
78 "`IV"
79 X>Y?
80 CLX
81 -
82*LBL 04
83  E
84 X>Y?
85 GTO 00
86 -
87 "`I"
88 GTO 04
89*LBL 00
90 AVIEW
91 END
```

Splash Screen (Scrolling Message)

Nelson F. Crowle

Those of you with MCODE experience know how idiosyncratic the LCD display is, and if you don't have the personal experience you can take my word for it. It's impressive to imagine how Nelson came up with this jewel of a routine, but we're glad he wrote it! *Note that V41 emulator has a bug that prevents it from running properly*, and it will hung up the program.

The listing below uses the text "LIBRARY#4" for the scrolling message – you can replace it with your own text as appropriate. Also note that provision is made for the TURBO settings on the CL to allow to the necessary time for the displaying action to show.

```
Header 4705   093   "S"
Header 4706   001   "A"          SPLASH
Header 4707   00C   "L"
Header 4708   010   "P"
Header 4709   093   "S"
Header 470A   02D   "-"          Nelson C. Crowle
SPLASH 4710   063   JNC +12d
MSGTXT        1E2   "**"         1C7
       470D   005   "E"          "M"
       470E   00E   "N"          " "
       470F   009   "I"          "V"
       4710   00C   "L"          "E"
       4711   02D   "-"          "R"
       4712   00E   "N"          "-"
       4713   00F   "O"          "4"
       4714   022   "'"          "#"
       4715   034   "4"          "B"
       4716   023   "#"          "L"
SPLASH 4717   35D   ?NC XQ
       4718   000   ->00D7       [PCTOC]
       4719   27A   C=C-1  M     backup two bytes
       471A   27A   C=C-1  M     to beginning of string
       471B   0EE   B<>C  ALL    save it in B[M]
SPLSH4 471C   37D   ?NC XQ       Cancels TURBO mode
       471D   13C   ->4FDF       [TURBO0]
       471E   3C1   ?NC XQ       Enable and Clear Display
       471F   0B0   ->2CF0 [     CLLCDE]
       4720   130   LDI S&X
       4721   107   "**"         little "T"
       4722   31C   PT=  1
       4723   3A8   WRIT 14(d)   Places it (Long) into the LEFT
       4724   3B8   READ 14(d)   Fetch Right Long: moves right to left
LB_A09D       0CE   C=B  ALL
       4726   27A   C=C-1  M     previous address
       4727   0EE   B<>C  ALL    update repository
       4728   0CE   C=B ALL      keep it in C
```

```
        4729  330   FETCH S&X     read byte value
        472A  358   ST=C  XP      place it in ST
        472B  28C   ?FSET 7       is it > "0FF"?
        472C  023   JNC  +04      no, skip to A0A8
        472D  284   CLRF  7       clear it
        472E  398   C=ST  XP      restore byte to C[S&X]
        472F  288   SETF 7        flag this fact
[LB_A0A8        3E8   WRIT 15(e)  write it to RIGHT end
        4731  28C   ?FSET 7       was it last one?
        4732  10F   JC   +33      yes, we're done -> A0CB
LB_A0AB         130   LDI S&X
        4734  100   CON:
        4735  266   C=C-1  S&X    count until 100(hex)
        4736  3FB   JNC  -01      [A0AD]
        4737  130   LDI S&X
        4738  020   " "           blank space
        4739  106   A=C  S&X      store in A[S&X]
LB_A0B2         3B8   READ  14(d)  read right chr and move it to left
        473B  366   ?A#C  S&X     is it a space?
        473C  3F3   JNC  -02      yes, read next chr.  -> A0B2
        473D  158   M=C  ALL      no, save chr1 in M
        473E  3B8   READ 14(d)    read chr2 and move to left
        473F  366   ?A#C  S&X     is it a space?
        4740  05F   JC   +11      yes, jump over to A0C3
        4741  198   C=M ALL       no, recall chr1
        4742  3E8   WRIT 15(e)    write it to RIGHT end
        4743  130   LDI S&X
        4744  020   " "           blank space
        4745  3E8   WRIT 15(e)    write it to RIGHT end
LB_A0BE         3F8   READ 15(e)  Fetch Left Long
        4747  2E2   ?C#0 @PT
        4748  3F7   JC   -02      [A0BE]
        4749  3A8   WRIT 14(d)
        474A  34B   JNC  -23 d    [A0AB]
LB_A0C3         3E8   WRIT 15(e)  write it to RIGHT end
        474C  198   C=M  ALL      recall chr1 for real
        474D  3E8   WRIT 15(e)    write it to RIGHT end
LB_A0C6         3F8   READ 15(e)  Fetch Left Long
        474F  366   ?A#C  S&X
        4750  3F3   JNC  -02      [A0C6]
        4751  3A8   WRIT 14(d)
        4752  29B   JNC  -45d     next character, A09D
LB_A0CB         38D   ?NC XQ      Sets TURBO mode
        4754  13C   ->4FE3       [TURB50]
STMSG4          149   ?NC XQ      Enables Chip0
        4756  024   ->0952       [ENCP00]
        4757  1F9   ?NC GO       Set MSG Flag
        4758  00E   ->-037E      [STMSGF]
```